Soybeans *with Vitazyme application—A Silicon Additive Study*

Researcher: Lance Taylor
Research organization: Crossroads Ag Research, Denver, Iowa
Field location: Dunkerton, Black Hawk County, Iowa
Variety: LG Seed 55C32 STX PRO
Planting date: May 14, 2025
Planting depth: 1.5 inches
Row spacing: 30 inches
Seeding rate: 140,000 seeds/acre
Tillage: conventional
Soil type: Maxfield silty clay
Fertility level: good
Soil drainage: excellent
Soil analysis: pH = 5.8, organic matter = 7.5%, cation exchange capacity = 26.9 meq/100 g, Bray P1 = 13 ppm, Bray P2 = 27 ppm, K = 106 ppm, Mg = 545 ppm, Ca = 3390 ppm (at 6 inches, Midwest Labs)

The soybean plants treated with Vitazyme plus the Si product show the greatest plant size, pod set, and root mass of the three treatments .

Experimental design: A small-plot randomized complete block design with four replications was established, using plots that were 15 x 30 feet. There were six rows per plot, with the middle two rows harvested. The purpose of the trial was to evaluate the effectiveness of Vitazyme and a silicon additive to increase soybean yield.

❶ *Control* ❷ *Vitazyme* ❸ *Vitazyme + Nano Yield*

Fertilization: none
Vitazyme applications: 13 oz/acre (1 liter/ha) in-furrow at planting; 13 oz/acre (1 liter/ha) sprayed on the leaves and soil at early bloom on July 9
Nano Yield application: The Nano Yield solution was mixed with Vitazyme for both applications to obtain a 1 oz/acre (0.08 liter/ha) application rate. Nano Yield is a silicic acid aluminum sodium salt designed to improve the uptake of active agents.
Herbicide applications: May 14 – Zidua Pro; June 14 – Outlook, Liberty Ultra, Round Up, Power Max, and AMS; July 1 – Outlook, Liberty Ultra, Round Up Power Max, Vaquero, and AMS.
Growing season weather: average precipitation and temperature
Harvest date: October 11, 2025
Leaf chlorophyll results: Chlorophyll determinations made on July 27 did not reveal any significant differences among the three treatments.
Bean moisture results: There were no significant differences in soybean moisture content for the three treatments.

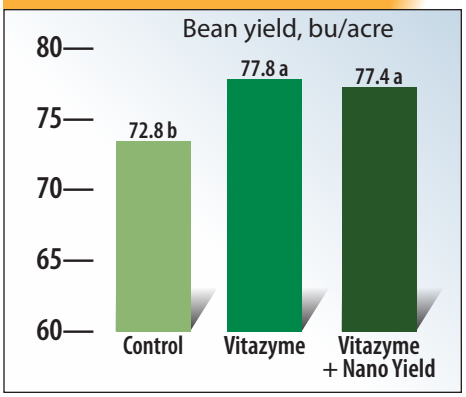
Bean yield results:

Treatment	Bean yield[1]	Yield change
	bu/acre	bu/acre
1. Control	72.8 b	—
2. Vitazyme	77.8 a	+5.0 (+7%)
3. Vitazyme + Nano	77.4 a	+4.6 (+6%)
LSD (P=0.15)	3.5	—
CV	3.97	—
Replicate probability (F)	0.1595	—
Treatmen probability (F)	0.1079	—

[1]Means followed by the same letter are not significantly different at P = 0.15, according to the Student-Newman-Keuls Test.

The silicon additive to Vitazyme made a significant contribution to the growth and yield of the soybeans in this east central Iowa study.

Bean Yield Results



Soybean Yield Increase

Vitazyme 7%
Vitazyme + Nano Yield... 6%

Conclusions: A small-plot replicated soybean trial, completed in east-central Iowa, comparing an untreated control with Vitazyme (in-furrow and early bloom foiliar) and Vitazyme + Nano Yield (1 oz/acre or 0.08 liter/ha with Vitazyme) treatments revealed that both treatments significantly increased bean yield by 6 to 7%. There was no difference between the increase for the two treatments, showing that either of them is sufficient to improve soybean yield and profits. For soybeans selling at $11.00/bu and Vitazyme costing $12.00 for two applications, the 5.0 bu/acre yield increase produced a $43.00/acre increase in income, or a 4.6:1 return on investment.

Soybeans *with Vitazyme application*

Researcher: Jonathan Jaschen
Research organization: Heritage Ag Research, Fairbank, Iowa
Field location: Readlyn, Iowa
Variety: P22A67E
Planting date: June 2, 2024
Planting rate: 140,000 seeds/acre
Planting depth: 1.5 inches
Row spacing: 30 inches
Soil type: Readlyn silty clay loam (4.5% organic matter, 7.4 pH, 22 meq/100g cation exchange capacity)
Soil analysis: P_1 very high (about 55 ppm); K very high (about 290 ppm); Ca high (about 3,200 ppm); Mg very high (about 430 ppm); percent base saturations: 75% Ca, 18% Mg, 3.8% K); results from Midwest Laboratories, Omaha, Nebraska
Experimental design: A small plot soybean experiment (plots 15 x 30 ft), using five replications in a randomized complete block design, with six rows per plot, was established to evaluate the effect of Vitazyme — in seven different treatment patterns — on the yield and test weight of the crop as compared to the untreated control.

Note the superior podding and leaf canopy for the Vitazyme treated plants in this Iowa study. Leaf chlorophyll is also greater for the treated plants.

Treatment	Application			
	Seed[1]	In-furrow	Foliar V3	Foliar R1[2]
1	o	o	o	o
2	x	o	o	o
3	o	x	o	o
4	o	o	x	o
5	o	o	o	x
6	x	o	o	x
7	o	x	o	x
8	o	x	x	x

[1]5% Vitazyme on the seeds before planting.
[2]Early R1

The pods stripped from ten plants for the control and Vitazyme seed-treated plants show a distinct increase for the treated plants.

Fertilization: none
Vitazyme applications: See the table above
Growing season weather: Adequate to excessive rainfall until August; then very dry into September. A very heavy rainfall after planting affected germination. Temperatures were above normal in the midsummer.
Harvest date: October 7, 2024, using a TR88 Split Plot #3 on two rows (5 X 30 ft)
Bean test weight results: The control treatment had a test weight of 57.9 lb/bu, a bit less than the Vitazyme treatments, which registered 58.0 to 58.1 lb/bu. These differences were not significant.

Bean yield results:

Treatment	Bean yield[1]	Yield change
	bu/acre	bu/acre
1. Control	65.36 b	—
2. Seeds only	67.42 ab	2.06 (+3%)
3. In-furrow	64.90 b	-0.46 (-1%)
4. Foliar at V3	67.99 ab	2.63 (+4%)
5. Foliar at early R1	67.12 ab	1.76 (+3%)
6. Seeds + R1	68.47 ab	3.11 (+5%)
7. In-furrow + at R1	68.74 a	3.38 (+5%)
8. In-furrow + V3 +R1	67.79 ab	2.43 (+4%)
LSD (0.10)	3.147	—
CV	4.35	—
Treatment	0.716	—
Replicate	8.299	—

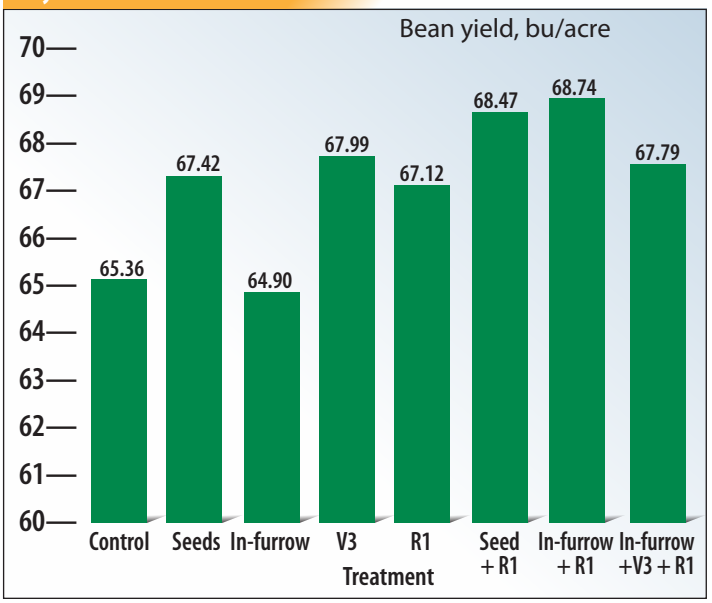
*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls Test.

Soybean yield increase with Vitazyme

Seed only 3%
Foliar at V3 .....4%
Foliar at R1.....3%
Seeds at R1.....5%
In-furrow + R1 .....5%
In-furrow + V1 +R1.....4%

All but Treatment 3 showed a yield increase with Vitazyme, of from 3 to 5%, the greatest increase being with Treatment 7: in-furrow + R1.

Soybean Yield



Conclusions: This small-plot, randomized and replicated soybean trial in east-central Iowa, using various combinations of Vitazyme applications, revealed a consistent yield increase with Vitazyme of from 3 to 5% (2.06 to 3.38 bu/acre), except for the in-furrow treatment. It is not known why this treatment did not perform similarly to the other Vitazyme treatments. The best results were for Treatment 7, the in-furrow + foliar R1 application, which gave a 3.38 bu/ace increase above the control. At current soybean prices (December, 2024) of $9.95/bu, this yield increase is worth $33.63. With two 13 oz/acre (1 liter/ha) applications at a cost of $12.00/acre, the return on investment is $2.80 per dollar invested for this application regimen.

Soybeans *with Vitazyme application*

Researcher: Greig Reicks, Ph.D.
Research institution: Department of Plant Sciences, South Dakota State University, Brookings, South Dakota
Location: South Dakota State University Experimental Farm, Aurora, South Dakota
Variety: Dekalb AG!4XF4 (1.4 maturity rating) ***Planting date:*** June 3, 2024
Seeding rate: 160,000 seeds/acre ***Soil type:*** Brandt silty clay loam ***Row spacing:*** 30 inches
Planting depth: 2 inches
Experimental design: A small-plot soybean research trial was initiated on the SDSU experimental farm using plots that were four rows wide and 20 feet long. The purpose of the study was to evaluate the effect of Vitazyme biostimulant on the yield of the soybeans, from harvesting the middle two rows of each plot. Four replications were used. Both irrigated and non-irrigated areas were used.

1 ***Control*** **2** ***Vitazyme***

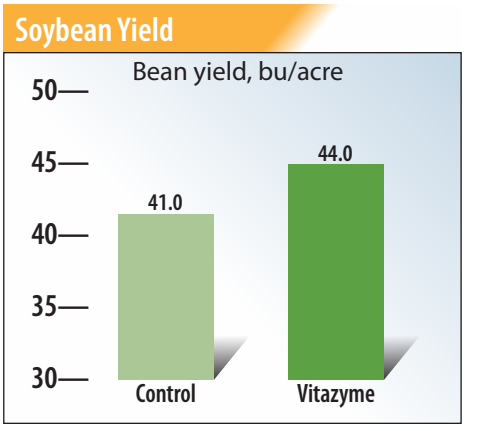
Fertilization: none
Vitazyme application: 13 oz/acre (1 liter/ha) as a foliar spray at V5, on July 18
Irrigation: as needed during the summer
Growing season weather: hot and dry the latter half of the summer

Yield results:

Treatment	BeanYield[1]	Yield change
	bu/acre	bu/acre
1. Control	41.0 b	—
2. Vitazyme	44.0 a	3.0 (+7%)

[1]Means followed by the same letter are not significantly different at P=0.09.

Increase in soybean yield with Vitazyme: 7%



Conclusions: This small-plot replicated soybean study in eastern South Dakota, which compared an untreated control with Vitazyme applied at 13 oz/acre (1 liter/ha), revealed a 3.0 bu/acre yield increase (7%) with Vitazyme. This increase for the irrigated plots was significant at P = 0.09. The non-irrigated soybeans showed a 2.1 bu/acre increase (5%) with Vitazyme (41.0 vs. 38.9 bu/acre); this increase was significant at P = 0.25. The reason for the yields being quite low is likely due to a late planting date. The fact that a 5 to 7% yield increase was realized from a single application at V5 indicates that a seed or in-furrow treatment would very likely have improved the yield increase substantially more; the recommended program for Vitazyme with soybeans is an in-furrow or seed treatment plus a foliar treatment at early bloom.

Soybeans *with Vitazyme application*

Researcher: V. V. Plotnikov
Research organization: Agro Expert International, Kaharlyk, Ukraine; Plant Designs International, Rochester, New York; National Academy of Agrarian Sciences of Ukraine, Institute of Feed and Agriculture of Podillia, Ukraine
Location: Vinnytsia District, Vinnytsia Region, Agronomichne Village, Ukraine
Variety: Titan Elite
Planting date: May 13, 2024
Seeding rate: 0.81 million seeds/ha
Previous crop: perennial ryegrass
Soil type: gray podzolic (1.8% organic matter)
Soil preparation: plowing to 20-22 cm, harrowing, disking in two tracks to 8-10 cm
Experimental design: A soybean field was divided into an untreated control area and a Vitazyme treated area, to evaluate the effects of this biostimulant on soybean growth and yield.

1 ***Control*** **2** ***Vitazyme***

Fertilization: none
Bacteria inoculation: Rhizobium inoculant on the seeds at planting
Vitazyme application: 1 liter/ton of seed at planting
Herbicide application: Ogorodnik (Metribuzin at 700g/kg) at 0.65 kg/ha
Plant growth parameter results: Selected plants were dug, measured, and the data were averaged.

(1) Results at the fourth trifolicate (BBCH 15) on June 21, 2024

The seed treated soybeans on the right are much leafier and taller than the untreated control plants on the left.

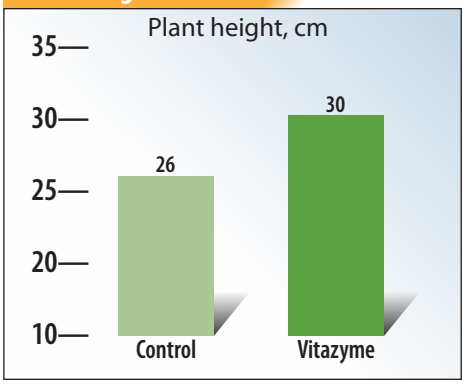
At harvest the Vitazyme treated soybeans yielded an amazing 34% more beans than the untreated control, besides being heavier and higher in protein.

Leaf Color

Control plants: light green
Vitazyme plants: rich, dark green

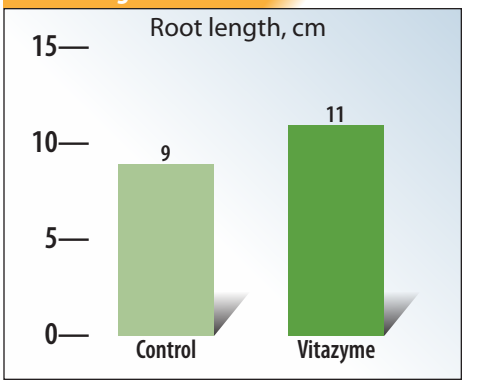
The herbicide had hampered chlorophyll development in the plants, but Vitazyme overcame the problem in the treated area.

Plant Height



Increase in plant height with Vitazyme: 15%

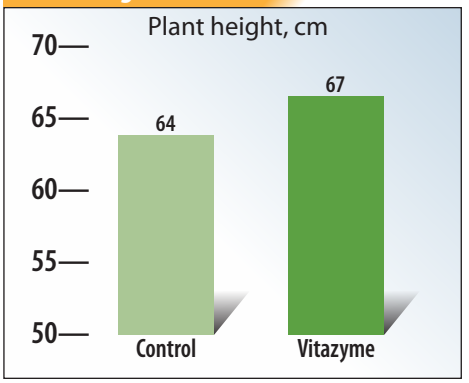
Root Length



Increase in root length with Vitazyme: 22%

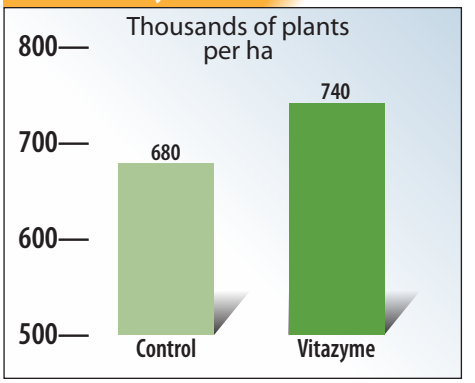
(2) Results at crop maturity (BBCH 95) on September 23, 2024

Plant Height



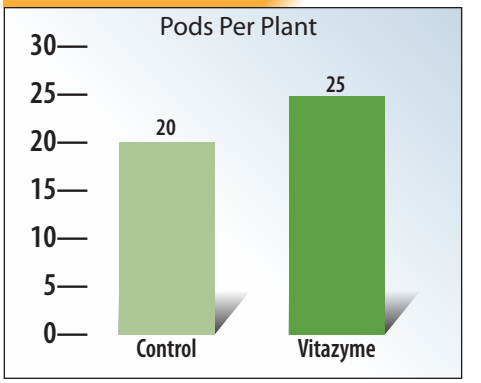
Increase in plant height with Vitazyme: 5%

Plant Density



Increase in plant density with Vitazyme: 9%

Pods Per Plant

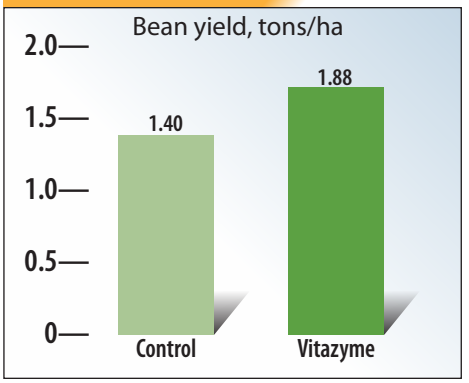


Increase pods/plant with Vitazyme: 25%

All plant growth parameters — height, density, roots, and pods/plant were increased with the Vitazyme seed treatment, especially root length (22%) and pods/plant (25%).

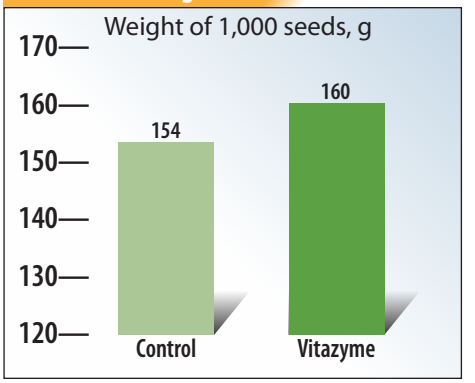
Yield and quality results: Besides bean yield, 1000 seed weight and crude protein content were measured.

Bean Yield



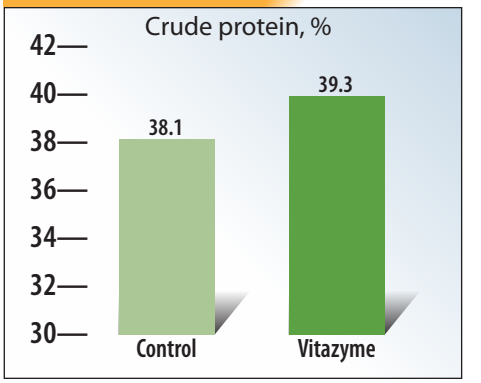
Increase in soybean yield with Vitazyme: 34%

1000 Seed Weight



Increase in 1,000 seed weight with Vitazyme: 4%

Bean Crude Protein



Increase in bean crude protein with Vitazyme: 1.2 percentage points

Income results: The income for the farmer with Vitazyme was increased by $203/ha, from an extra 0.48 ton/ha of yield.

Conclusions: A field-scale soybean trial in Ukraine, using Vitazyme applied to the seeds before planting at 1 liter/ton of seed, resulted in substantial improvements in plant growth at the fourth trifoliate and full maturity stages. Plant height was increased by 15% and 5% at the two analysis times, respectively, while root length, plant density, and pods/plant were all improved; pods/plant increased by 25% above the control. At harvest, the yield was improved by 34%, while bean quality in terms of 1000 seed weight and crude protein increased by 4% and 1.2 percentage points, respectively. This yield improvement netted the farmer an extra $203/ha. This trial emphasizes the great efficacy of the Vitazyme program for soybean growers in Ukraine.

Soybeans *with Vitazyme application*

Researcher: V. V. Plotnikov
Research organization: Cherkasy Experimental Station of Bioresources, Ukraine, and Plant Designs International, Rochester, New York
Location: Zolotonyskyi District, Cherkasy Region, Village of Drabovo – Baryatynske, Ukraine
Variety: Favor, F2
Planting date: May 12, 2024
Seeding rate: 700,000 seeds/ha
Previous crop: corn
Soil type: chernozem (Mollisol; 3.9% organic matter)
Soil preparation: plowing to 20-25 cm, harrowing, cultivation to 4-5 cm
Experimental design: A soybean field was divided into a Vitazyme treated portion, and the rest of the field served as an untreated control. The purpose of the trial was to evaluate the effect of the biostimulant on relieving herbicide stress and improving bean yield.

This field of cv. Favor soybeans shows excellent growth in response to Vitazyme applied twice, at 0.5 liter/ha at the second trifoliate and at early bloom.

At harvest the Vitazyme treated soybeans, shown here, are growthy and well podded. The yield of the Vitazyme treated field secion yielded 20% more than the untreated control

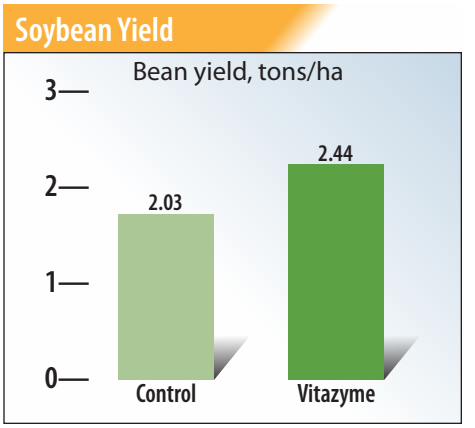
❶ *Control* ❷ *Vitazyme*

Fertilization: 8-24-24 kg/ha of N-P_2O_5-K_2O as a preplant amendment
Vitazyme application: 0.5 liter/ha sprayed on the leaves and soil at the second trifoliate state (BBCH 13) on June 5, tank mixed with the herbicide below; 0.5 liter/ha sprayed on the leaves and soil at early bloom (BBCH 55) on June 26
Herbicide application: Korum (bentazone at 480 g/liter) plus Imazamax (22.4 g/liter) at 2 liters/ha sprayed on the soil

Yield results:

Treatment	Bean yield	Yield change
	tons/ha	tons/ha
1. Control	2.03	—
2. Vitazyme	2.44	0.41 (+20%)

Increase in soybean yield with Vitazyme: 20%



Income results: By applying two 0.5 liter/ha sprays of Vitazyme on the soybean crop, the additional 0.41 ton/ha yield netted the farmer $152 more per ha.

Conclusions: A Ukrainian soybean trial on a chernozem soil in the Cherkasy Region proved that Vitazyme biostimulant could overcome the effects of herbicide stress, when tank-mixed with the herbicide, to give a substantial 0.41 ton/ha (20%) yield increase. These results show that Vitazyme, incorporated into soybean management programs, is a highly effective adjunct for soybean growers in Ukraine, especially when a negative effect of a herbicide is anticipated.

Soybeans *with Vitazyme application*

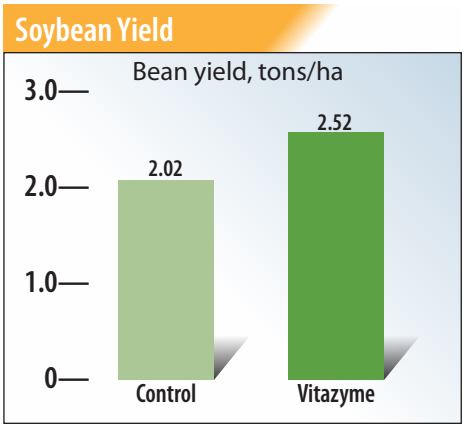
Researcher: V. V. Plotnikov
Research organization: Agro Expert International, Kaharlyk, Ukraine, and Plant Designs International, Rochester, New York
Location: LLC "PK Zorya Podillia," Haysyn District, Vinnytsia Region, Rozivka Village, Ukraine
Variety: Medoc, F2
Planting date: May 7, 2024
Seeding rate: 500,000 seeds/ha
Previous crop: corn
Soil type: dark gray podzolic (2.7% organic matter)
Soil preparation: mulching (crushing plant residue), deep cultivation to 20-22 cm, harrowing, cultivation to 4-5 cm
Experimental design: A soybean field was divided into Vitazyme treated and untreated areas, with the objective of evaluating the effect of this biostimulant on the yield and quality of the beans at harvest.

1 ***Control*** **2** ***Vitazyme***

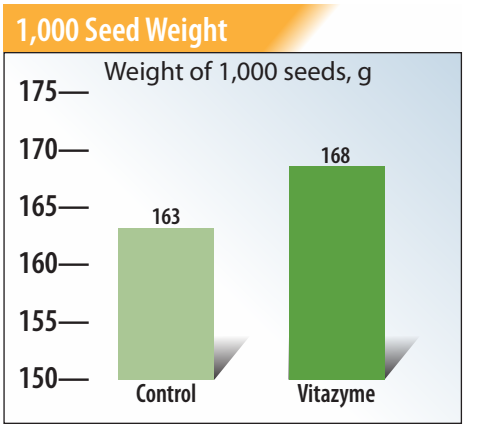
Fertilization: none
Vitazyme application: 1 liter/ton of seeds applied before planting
Yield and quality results:

The Vitazyme seed treated soybeans show much better plant development at this mid-season period, and yielded 25% more than the untreated control plants, besides being heavier in weight and containing more protein.

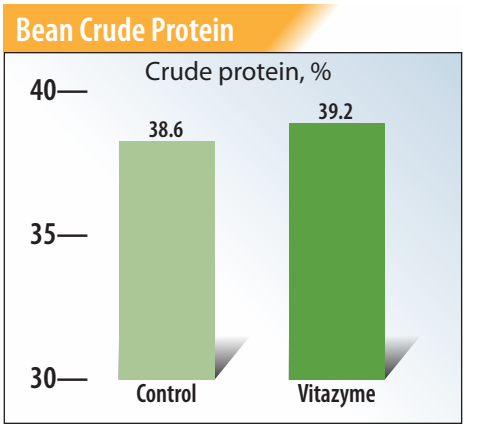
The planting machinery and personnel are shown getting ready to install the soybean trial at Rozivka Village



Increase in soybean yield with Vitazyme: 25%



Increase in 1,000 seed weight with Vitazyme: 3%



Increase in bean crude protein with Vitazyme: 0.6 percentage point

Income results: A 1 liter/ton of seed treatment with Vitazyme increased the net income to the farmer by $211/ha.

Conclusions: This Ukrainian field-scale soybean trial, using 1 liter/ton of Vitazyme applied to the seeds before planting, revealed an excellent response to the biostimulant. The yield was increased by 0.50 ton/ha (25%), while at the same time the quality of the yield was improved: the 1000 seed weight increased by 3%, and the bean crude protein by 0.6 percentage point. At the same time, farm income was increased by $211/ha. These responses reveal how effective this simple and non-toxic biostimulant treatment can be for soybean growers.

Soybeans *with Vitazyme application*

Researcher: Jonathan Jaschen ***Research organization:*** Heritage Ag Research, Fairbank, Iowa
Trial location: Fairbank, Iowa ***Variety:*** P25A16E ***Planting date:*** May 13, 2023
Planting depth: 1.25 inches ***Row spacing:*** 30 inches ***Rows per plot:*** 6
Planting rate: 1,400,000 seeds/acre ***Soil type:*** unknown ***Tillage:*** conventional ***Previous crop:*** corn
Experimental design: A soybean field was divided into plots of 15 x 30 feet (450 ft^2/plot). Five replications of eight treatments using Vitazyme biostimulant were arranged to determine the effect of various timings to effect the greatest yield enhancement of the product.

Treatment	Seed treatment	In-furrow	Foliar, V3	Foliar, R1
	5% v/v	oz /acre	oz /acre	oz /acre
1. Control	o	o	o	o
2.Vitazyme 1x	x	o	o	o
3. Vitazyme 1x	o	13	o	o
4. Vitazyme 1x	o	o	13	o
5. Vitazyme 1x	o	o	o	13
6. Vitazyme 2x	x	o	o	13
7. Vitazyme 2x	o	13	o	13
8. Vitazyme 3x	o	13	13	13

Fertilization: none
Vitazyme applications:
Seed treatment: A 5% Vitazyme solution was applied to the seeds before planting, making sure that the seeds were well-coated.
In-furrow treatment: A 13 oz/acre application was made in-row during planting, on May 13.
Foliar V 3 treatment: A 13 oz/acre spray was applied at the V 3 stage.
Foliar R 1 treatment: A 13 oz/acre spray was applied at the R 1 stage.
Weed control: herbicides for broadleaf and grass weed control
Growing season: warmer and dryer than normal
Plant growth results: Yield results were unable to be collected, but plant growth parameters were evaluated: plant vigor, plant height, and plant weight.
Harvest date: October 3, 2023, using an Almaco plot combine. Two rows in the center of each plot were harvested, for 30 feet (150 ft^2, or 0.00344 acre).
Crop vigor results: Crop vigor was evaluated on June 8, 2023, using a scale of 0 to 10. All plots received a score of 9, so there were no significant differences among the eight treatments.

Plant size, chlorophyll development, pod number, and root growth were visibly enhanced with Vitazyme applied to the soybeans on the right. The V3 application yielded 6.13 bu/acre more than the control.

Notice the superior size of the soybean plants on the right, indicative of the significantly greater yield harvested from Vitazyme applied at 13 oz/acre to the plants at V3.

Pods removed from the plants in the accompanying photo show the remarkable enhancement of crop yield potential with Vitazyme applied to the leaves in this study. The greatest yield increase was with application at the V3 stage.

Bean test weight results:

Treatment	Bean test weight*	Weight change
	lb/bu	lb/bu
1. Control	58.22 b	—
2. Vita on seeds	58.26 b	+0.04
3. Vita in-furrow	58.14 b	-0.08
4. Vita foliar early	57.84 b	-0.38
5. Vita foliar late	59.04 a	+0.82
6. Vita seeds + late	58.20 b	-0.02
7. Vita in-furrow + early	58.12 b	-0.10
8. Vita in-furrow + early + late	58.22 b	0
LSD (P = 0.10)	0.72	—
CV	1.16	—
Replicate (F) probability	0.856	—
Treatment (F) probability	0.287	—

*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman -Keuls Test.

All of the eight treatments did not differ significantly in bushel weight, except for Treatment 5, when Vitazyme was applied late, at the R 1 stage. That weight was 0.82 lb/bu heavier than the control weight, or 1.4% heavier.

Bean yield:

Treatment	Soybean moisture*	Yield change
	bu/acre	bu/acre
1. Control	52.81 b	—
2. Vita on seeds	52.30 b	-0.51 (-1%)
3. Vita in-furrow	53.73b	+0.92 (+2%)
4. Vita foliar early	58.94 a	+6.13 (+12%)
5. Vita foliar late	52. 27 b	-0.54 (-1%)
6. Vita seeds + late	51.37 b	-1.44 (-3%)
7. Vita in-furrow + early	53.28 b	+0.47 (+1%)
8. Vita in-furrow + early + late	53.11 b	+0.30 (+1%)
LSD (P = 0.10)	4.26	—
CV	7.41	—
Replicate (F) probability	0.0016	—
Treatment (F) probability	0.1451	—

*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls Test.

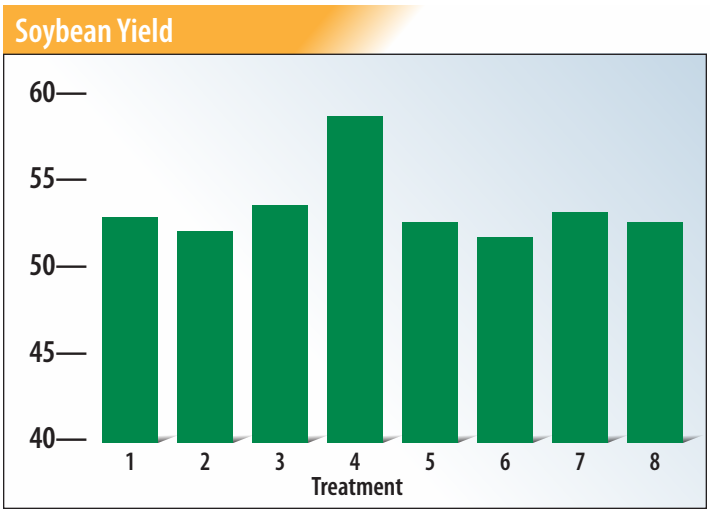
Bean moisture results: Though the bean moisture varied little among the eight treatments, there were some minor differences.

Treatment	Bean moisture*	Moisture change
	%	%
1. Control	8.35 abc	—
2. Vita on seeds	8.40 ab	+0.05
3. Vita in-furrow	8.29 bcd	-0.06
4. Vita foliar early	8.07 d	-0.28
5. Vita foliar late	8.51 a	+0.16
6. Vita seeds + late	8.18 bcd	-0.17
7. Vita in-furrow + early	8.16 bcd	-0.19
8. Vita in-furrow + early + late	8.36 abc	+0.01
LSD (P = 0.10)	0.26	—
CV	2.9	—
Replicate (F) probability	0.451	—
Treatment (F) probability	0.125	—

*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman- Keuls Test.

The highest moisture content soybeans at harvest were those of Treatment 5, (Vitazyme applied to the leaves at R 1), while the lowest moisture was for Treatment 4 (Vitazyme applied to the leaves at V 3).

Increase in soybean yield with Vitazyme applied foliar at V3: 12%



Seven of the treatments gave statistically equal yield, but Treatment 4 — Vitazyme applied at V 3 — gave a major 6.13 bu/acre yield increase, 12% above the control and 10% above any other Vitazyme treatment.

Conclusions: A replicated small-plot soybean trial in east-central Iowa, using seven different Vitazyme application regimes, showed that there were some significant effects. The bean test weight was significantly improved above all other treatments when Vitazyme at 13 oz/acre was sprayed foliar at R 1 (late). This weight was 0.82 lb/bu more than the untreated control. Vitazyme sprayed on the leaves at V 3 (early), however, gave the driest beans at harvest, being 0.28 percentage-point less than the untreated control. These more mature soybeans of the early (V3) foliar application also gave the highest yield — 58.94 bu/acre — which was 6.13 bu/acre greater than the control yield. The other Vitazyme treatments were statistically less than this V 3 application. The reason for this excellent response with the V 3 application is not known, for the other two treatments that received V 3 applications did not respond as much; these two had at least one more 13 oz/acre treatment besides the V 3 spray. The complex interplay of internal growth regulars tied to timely summer rains during a dry year may have influenced the responses noted. In any case, a foliar application at 13 oz/acre at V 3 is shown to be a highly effective treatment in this east-central Iowa study.

Soybeans *with Vitazyme application*

Researcher: V. V. Plotnikov
Research organization: Agro Expert International, Kaharlyk, Ukraine, and Plant Designs International, Rochester, New York
Location: PE Meleshkin, Kozyatyn District, Vinnytsia Region, Zhurbyntsi Village, Ukraine; central Ukraine (440-590 mm of rain per year)
Variety: Kansas, F 2 ***Planting date:*** May 11, 2023
Planting rate: 550,000 seeds/ha ***Previous crop:*** winter wheat
Tillage: disking to 8-10 cm, plowing to 23-25 cm, harrowing, cultivation to 4-5 cm
Soil type: podzolic black soil (3.9% organic matter)
Experimental design: A soybean field was selected for the evaluation of the effectiveness of Vitazyme biostimulant on this legume crop. The field was divided into an untreated control and a treated area to evaluate the bean yield differences.

❶ ***Control*** ❷ ***Vitazyme***

Fertilization: none
Vitazyme application: 1 liter/ha sprayed on the leaves and soil at the fifth trifoliate leaf stage, on June 23, 2023

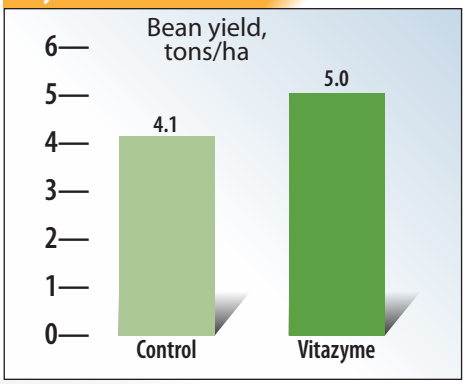
Income results: The 0.9 ton/ha soybean yield increase resulted in a net income increase of $292/ha.

Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
1. Control	4.1	—
2. Vitazyme	5.0	0.9 (+22%)

Yield increase in bean yield with Vitazyme: 22%

Soybean Yield



The Vitazyme treated soybeans show considerably greater biomass at this stage of development, leading to a 22% yield increase at harvest.

Conclusions: This field-scale Ukraine soybean trial, comparing an untreated control with a 1 liter/ha Vitazyme application at the fifth trifoliate stage, revealed a major yield increase of 0.9 ton/ha (+22%) with this biostimulant. This result proves the substantial effectiveness of the product when used on soybeans in central Ukraine. A net income increase of $292/ha was also achieved in this study.

Soybeans *with Vitazyme application*

Researcher: Graig Reicks
Research organization: South Dakota Soybean Association, Brookings, South Dakota
Farm cooperator: Luke Holzwarth, Hazel, South Dakota
Location: Hazel, South Dakota
Variety: unknown
Experimental design: A soybean field was treated with Vitazyme in three alternate strips, with the intervening strips serving as untreated controls. The purpose of the trial was to evaluate the effect of this product on soybean yield.

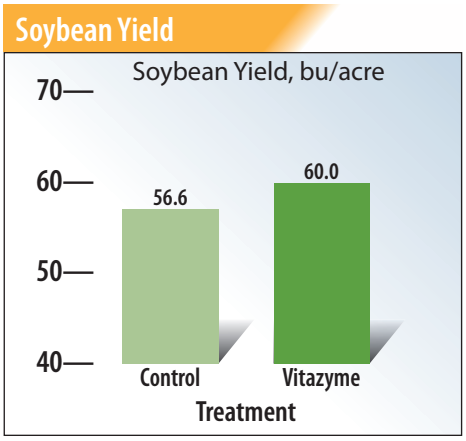
1 *Control* 2 *Vitazyme*

Vitazyme application: 13 oz/acre (1 liter/ha) at planting in the starter fertilizer

Yield results:

Field Strip	Bean yield		Yield change
	Control	Vitazyme	
	bu/acre	bu/acre	lb/acre
1	55.3	58.5	3.2 (+6%)
2	56.1	59.5	3.4 (+6%)
3	58.4	61.9	3.5 (+6%)
Average	56.6	60.0	3.4* (+6%)

*Significantly greater than the control at P=0.05.



Increase in bean yield with Vitazyme: 6%

The Vitazyme treated soybeans on the right in this photo reveal enhanced maturity right to the dividing line.

Soybean pods stripped from 10 representative plants from each treatment revealed not only a greater number of pods with Vitazyme, but enhanced maturity, as seen in the field photo above.

The Vitazyme treated soybean plants were taller, had more leaf area, and contained more pods, as can be clearly seen in this photo.

Conclusions: This South Dakota field-strip soybean trial, utilizing Vitazyme in alternating strips, resulted in a 3.4 lb/acre (6%) yield increase, revealing the efficacy of this simple program to boost soybean yields.

Soybeans *with Vitazyme Bio (Organic Vitazyme) application after hail damage*

Researchers: Vadim V. Plotnikov
Research organization: Agro Expert International, Kaharlyk, Ukraine, and Plant Designs International, Rochester, New York
Location: PE "Meleshkin," Kuzyatyn District, Vinnytsia Region, Zhurbyntsi Village, Ukraine; central Ukraine (440-590 mm of rain per year)
Variety: Kansas, F3 ***Planting date:*** May 21, 2022
Planting rate: 0.55 million seeds/ha
Previous crop: winter wheat
Tillage: disking to 8-10 cm, plowing to 23-25 cm, harrowing, cultivation to 4-5 cm
Soil type: podzolized chernozem (3.9% organic matter)
Experimental design: A soybean field that had been hail damaged on June 30, with 50% leaf loss, was divided into a Vitazyme Bio treated portion, while the remainder of the field was left untreated. The purpose of the trial was to evaluate the effect of Vitazyme Bio on soybeans to bring recovery from the hail damage and produce a good yield.

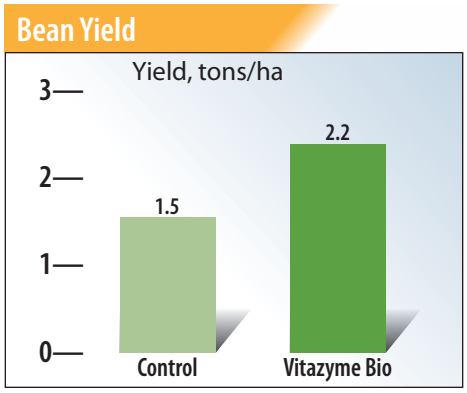
A hailstorm devastated this soybean test field on June 30, and was treated with Vitazyme Bio to help rejuvenate the crop.

❶ *Control* ❷ *Vitazyme Bio foliar*

Fertilization: 35 kg/ha of N broadcast and harrowed in before planting
Vitazyme Bio application: 1 liter/ha sprayed over the leaves, which had lost 50% of the leaf canopy, at the third trifoliate stage on July 30.
Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
1. Control	1.5	—
2. Vitazyme Bio	2.2	0.7 (+47%)

Yield increase with Vitazyme Bio: 47%



Income results: A great yield increase of 47% above the control treatment gave an income increase of $180/ha.
Conclusions: A soybean trial in Ukraine was initiated on a field which had been severely damaged by a hail storm (50% leaf loss) on June 30, 2022. A portion of the field was treated at the third trifoliate stage 30 days after the storm, with 1 liter/ha, which substantially aided crop recovery to produce a 47% yield increase. This increase translated to an income improvement of $180/ha, showing the great value of Vitazyme to aid in crop recovery after damage from hail.

The superiority of the soybeans that were treated with Vitazyme Bio after severe hail damage is clear in this photo, where the treated soybeans yielded 47% more than the control, a great recovery of yield

Soybeans *with Vitazyme application*

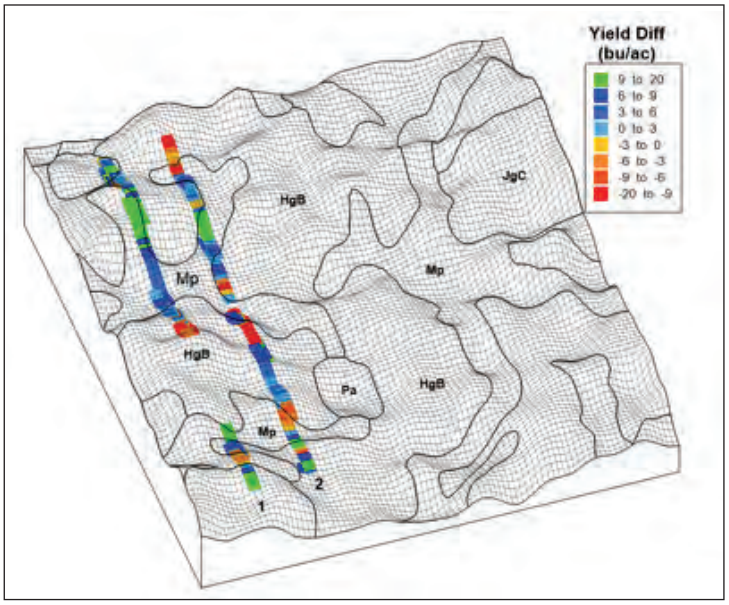
Note the greater biomass, greater pod number, and greener pods of the Vitazyme treated soybean plants, and the considerably better root system versus the untreated control.

Pods removed from two typical plants from each treatment show the greater number of pods and more four-bean pods with Vitazyme treatment.

Researchers: Graig Reicks and Cory Strom
Research organization: South Dakota Soybean Association and South Dakota State University, Brookings, South Dakota
Location: Kimball, South Dakota
Variety: 16 x 628 Mustang
Plant population: 138, 507 seeds/acre
Planting date: May 16, 2021
Row spacing: 30 inches
Soil type: Chernozem (Mollisol); Plankinton silt loam, Mobridge—Plankintion silt loams, Highmore-Java Complex, and Java-Glenham loams (6-9% slopes)
Experimental design: A soybean field was treated in one portion with Vitazyme applied in-furrow to evaluate the effect of this biostimulant on the yield of soybeans.

1 ***Control*** **2** ***Vitazyme***

Fertilization: (1) broadcast pre-plant, 100 lb/acre of 11-52-0 % N-P_2O_5-K_2O + 20 lb/acre AMS; (2) in-furrow, 2.5 gal/acre of 7-23-0-1.5-0.5% N-P_2O_5-K_2O-S-Zn
Vitazyme application: 13 oz/acre (1 liter/ha) mixed with the starter fertilizer, in-furrow at planting
Growing season weather: dry and hot; 10.9 inches of rain all year vs. 17.4 inches average for 10 years.
Harvest date: September 22 and 23, 2021
Yield results:

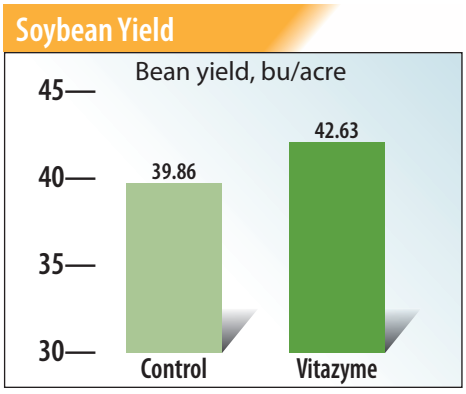


Yields were determined for a comparison of the two treatments using combine monitor data in adjacent strips.

Treatment	Yield	Yield change
	bu/acre	bu/acre
Control	39.86	—
Vitazyme + Others	42.63	2.77 (+7%)
Treatment F*	0.11	

*Two-tailed paired t-test.

Increase in bean yield with Vitazyme: 7%



Conclusions: A split-field soybean trial in central South Dakota, using Vitazyme as an in-furrow treatment along with liquid starter fertilizer, produced a 2.77 bu/acre (7%) yield increase. This increase occurred in spite of extremely hot and dry conditions throughout the summer.

Soybeans *with Vitazyme application*

Chris Fischbach stands in the Vitazyme treated section of the trial field of soybeans.

The pods removed from three average plants for each treatment show a considerable advantage for the Vitazyme treated plants.

Researchers: Graig Reicks and Chris Fischbach
Research organization: South Dakota Soybean Association and South Dakota State University, Brookings, South Dakota
Location: Mansfield, South Dakota
Variety: REA RX1529
Seeding rate: 150,000 seeds/acre
Planting date: May 17, 2021 ***Row spacing:*** 30 inches
Soil type: silt loam, Chernozem (Mollisol)
Experimental design: A soybean field was selected to receive Vitazyme applied in-furrow in strips, alongside untreated areas, to determine the effect of this biostimulant on the yield of soybeans.

1 ***Control*** **2** ***Vitazyme***

Fertilization: none
Vitazyme application: 13 oz/acre (1 liter/ha) in-furrow at planting on May 17
Growing season weather: sparse but timely rains, and very warm June to August
Harvest date: September 23, 2021
Yield results: A field combine with a yield monitor was used. Three replications as strips were used for a statistical analysis.

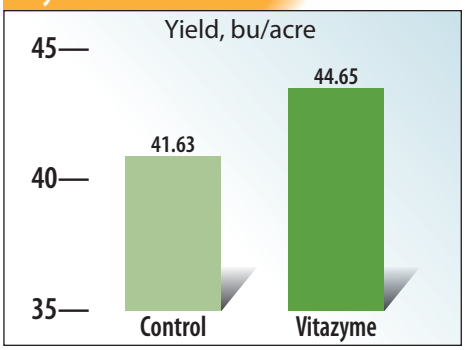
The Vitazyme treated plants show greater mass in both the roots and the tops, as well as a greater stem diameter and pod number. Note the greener leaves at this late stage of development.

Note how the pods are filled to the tips of the treated plants in the Fischbach soybean trial.

Treatment	Rep 1	Rep 2	Rep 3	Average*	Yield change
	bu/acre	bu/acre	bu/acre	bu/acre	bu/acre
Control	37.55	41.69	45.64	41.63 b	—
Vitazyme	41.90	43.71	48.33	44.65 a	3.02 (+7%)

*The yield difference was significant at P=0.02 using a one-tailed paired t-test.

Soybean Yield



Increase in bean yield with Vitazyme: 7%

Conclusions: In this South Dakota soybean trial, where Vitazyme was applied in-furrow at 13 oz/acre (1 liter/ha) at planting, the yield was increased significantly (P=0.02) by 3.02 bu/acre during a year having very warm temperatures. This represented a 7% yield increase, showing the highly profitable value of this simple application for soybean production in South Dakota.

Soybeans *with Organic Vitazyme application*

Researchers: Graig Reicks and B.J. McNeil
Research organization: South Dakota Soybean Association and South Dakota State University, Brookings, South Dakota
Location: Siegling South field, Miller, South Dakota ***Variety:*** LS 1380HP
Planting date: June 7, 2021 ***Row spacing:*** 30 inches
Soil type: Chernozem (Mollisol); Tetonka silt loam (0-2 % slopes), Houdek-Prosper loams (0-2% slopes), Houdek-Prosper loams (1-6% slopes), Dudley silt loam, nearly level
Experimental design: An organic soybean field was divided into Organic Vitazyme and untreated areas, in an effort to determine the effect of this biostimulant on soybean yield.

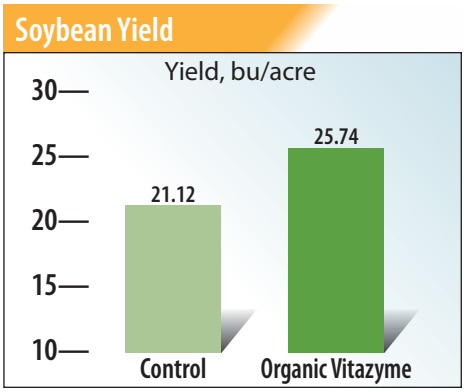
1 ***Control*** **2** ***Organic Vitazyme***

Fertilization: unknown
Vitazyme application: 13 oz/acre applied by air on July 16, 2021, at 9:30 a.m., using a spray rate of 5 gal/acre on 12 acres
Growing season weather: very hot and dry; 16.5 inches of precipitation to December of 2021. This caused slow germination.
Harvest date: October 7, 2021

Note the greater abundance of pods and superior rooting and nodulation of the Vitazyme treated plants from the McNeil farm on the right.

Yield results:

Treatment	Yield	Yield change
	bu/ha	bu/ha
1. Control	21.12	—
2. Organic Vitazyme	25.74	4.62 (+22%)



Increased bean yield with Organic Vitazyme: 22%


The soybeans on the Siegling farm were well-filled to the top of the plants, giving good yields in spite of the heat and drought.

The Vitazyme treated soybeans at the McNeil farm displayed greater overall plant growth and root development, leading to more pods and a higher final yield.

Conclusions: A field-scale soybean trial in central South Dakota proved that Organic Vitazyme, at 13 oz/acre (1 liter/ha) applied in-furrow at planting, increased soybean yield by 4.62 bu/acre, a 22% increase. These results show the potential for Organic Vitazyme to be a major contributor to soybean production in South Dakota, especially with organic production programs.

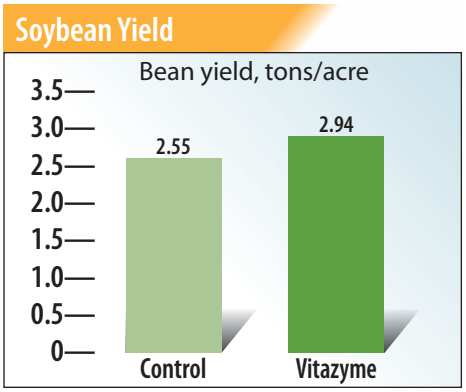
Soybeans *with Vitazyme application*

Researcher: V.V. Plotnikov
Research organization: Agro Expert International, Kaharlyk, Ukraine, and Plant Designs International, Rochester, New York
Location: Cherkasy Research Station of Bioresources, Zolotonosha District, Cherkasy Region, Draboro-Bariatynske Village, Ukraine; central Ukraine (440-590 mm of rain per year:
Variety: Aurelina, F1 ***Planting date:*** May 11, 2021 ***Planting rate:*** 0.55 million seeds/ha ***Previous crop:*** winter wheat
Tillage: disking to 8-10 cm, deep loosening to 28-30 cm, cultivations to 8-10 cm, harrowing to 4-5 cm
Soil type: Chernozem (3.9% organic matter)
Experimental design: A soybean field was divided into a Vitazyme treated portion, with an untreated portion left as a control, to evaluate the effect of this product on bean yield. The first application was made at the time of herbicide application to minimize herbicide stress.

1 ***Control*** **2** ***Vitazyme***

Fertilization: 8-24-24 kg/ha of N- P_2O_5-K_2O before planting
Vitazyme application: 0.5 liter/ha sprayed on the leaves and soil at the 5th trifoliate on June 25, 2021; 0.5 liter/ha foliar at early bloom
Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
Control	2.55	—
Vitazyme	2.94	0.39 (+15%)



Increase in bean yield with Vitazyme: 15%

Income results: An additional 0.39 ton/ha with Vitazyme produced $237/ha more income versus the untreated control.
Conclusions: This soybean field-scale trial in Ukraine, using Vitazyme sprayed at 0.5 liter/ha at the 5th trifoliate to reduce herbicide stress, and 0.5 liter/ha at early bloom, resulted in a 0.39 ton/ha (15%) yield increase. This increase netted the farmer $237/ha more income versus the untreated control, showing the value of this program for soybean growers in Ukraine.

Soybeans *with Vitazyme application*

Researchers: Graig Reicks and Chris Fischbach
Research organization: South Dakota Soybean Association, Siouz Falls, South Dakota
Location: Fischbach Farms, Mansfield, South Dakota
Variety: unknown ***Planting date:*** unknown
Soil type: Harmony-Beotia silty clay loams, 0-2% slopes, Great Bend-Beotia silt loams, 0-2% slopes, and Harmony-Aberdeen silty clay loams, 0-2% slopes
Experimental design: A soybean field was treated with Vitazyme in 90-foot sprayer strips, and compared with untreated control strips between them to evaluate the effect of the biostimulant on soybean yield. Four replicated strips were used.

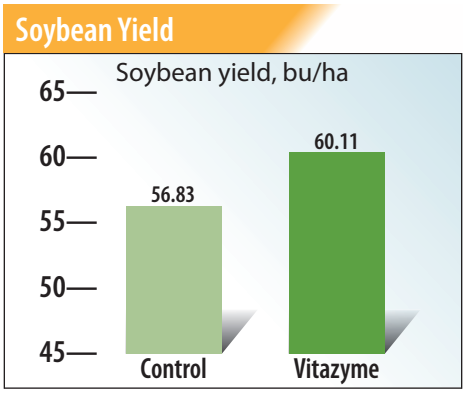
1 ***Control*** **2** ***Vitazyme***

Fertilization: unknown
Vitazyme application: (1) 13 oz/acre in-furrow at planting; (2) 13 oz/acre sprayed on the plants and soil at early bloom
Yield results: Several strips were harvested using a combine-mounted yield monitor, with treated and untreated adjoining strips compared.

These soybeans from northeastern South Dakota show excellent growth and maturity with Vitazyme use.

Replicate	Control	Vitazyme	Yield change
	bu/acre	bu/acre	bu/acre
1	57.50	61.40	3.90
2	57.29	60.71	3.42
3	55.20	58.95	3.75
4	57.34	59.39	2.05
Mean	56.83	60.11*	3.28 (+6%)

*Significantly greater than the control at P = 0.05.



Note the excellent pod formation along the entire stems of these Vitazyme treated soybeans, giving an excellent 60.1 bu/acre yield.

Increase in soybean yield with Vitazyme: 6%

Conclusions: This northeastern South Dakota field scale soybean trial, where Vitazyme applications was compared to an untreated control, revealed that the product significantly increased bean yield by 3.28 bu/acre, or 6%. This increase shows the efficacy of Vitazyme for soybean production in South Dakota.

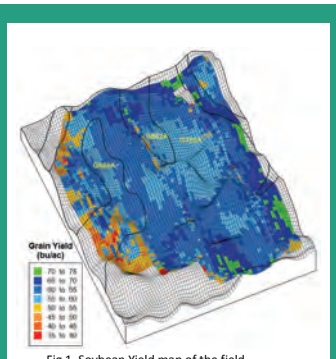


Fig 1. Soybean Yield map of the field

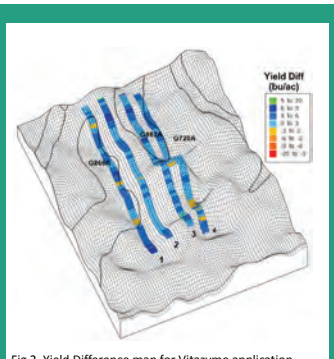


Fig 2. Yield Difference map for Vitazyme application

Compared to the control plants, the Vitazyme treated plants display greater height, leaf area, root growth, srem diameter, pod number, and leaf chlorophyll content.

Soybeans *with Vitazyme application*

Researcher: Dr. Bruce Kirksey ***Research organization:*** Agricenter International, Memphis, Tennessee
Location: Memphis, Tennessee ***Variety:*** GoSoy 4912LL ***Planting date:*** June 17, 2020 ***Planting depth:*** 1 inch
Seeding rate: 140,000 seeds/acre ***Row width:*** 30 inches ***Rows per plot:*** 4
Soil: Falaya and Waverly soil series; silt loam; organic matter = 1.8%, pH = 6.5, cation exchange capacity = 7.8% meq/100g of soil
Fertility level: excellent ***Soil drainage:*** good ***Soil moisture at planting:*** excellent

Experimental design: A small-plot soybean trial, arranged in a randomized complete block design with four replications, the plots being 10 x 30 feet (300 ft^2), was established in order to evaluate the effects of Vitazyme, a silicon product, and OCC emulsion on the yield of soybeans. Vitazyme and silicon were applied alone and in combination, while OCC was applied in combination with Vitazyme.

Treatment	Vitazyme	Silicon	OCC
1	o	o	o
2	x	o	o
3	x	o	x
4	o	x	o
5	x	x	o

Fertilization: unknown

Vitazyme application: (1) 13 oz/acre in-furrow at planting on June 17; (2) 13 oz/acre sprayed on the soil and leaves on July 24 at early bloom. Vitazyme was mixed with silicon for Treatment 5.

Silicon application: (1) 6 oz/acre in-furrow at planting on July 17; (2) 6 oz/acre sprayed on the soil and leaves on July 24 at early bloom. Silicon was mixed with Vitazyme for Treatment 5.

OCC application: OCC is a plant-based emulsion that can be applied alone, or along with nutrients or biostimulants to encourage better growth, higher nutrient efficiency, better crop quality, and reduced pesticide appllications. It was applied at 0.0125% v/v of the sprayer capacity at early bloom, over the leaves and soil, on July 24 mixed with Vitayme.

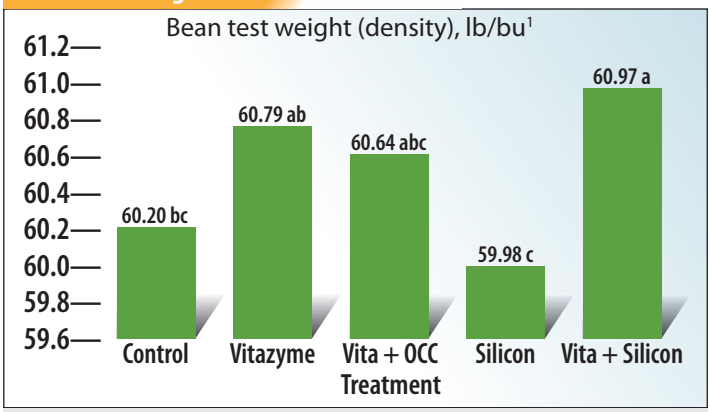
Growing season conditions: good

Harvest date: December 1, 2020. An Almaco plot combine harvested an area of 5 x 30 feet (150 ft^2) from each plot; this area encompassed the middle two rows of each plot.

Bean moisture results: The soybean moisture levels varied from 13.00 to 13.19 % among the five treatments, and were not significantly different.

Bean test weight results: Soybean test weight varied within a narrow range for the five treatment—59.98 to 60.97 lb/bu—and was significant at P = 0.070.

Bean Test Weight



[1]Means followed by the same letter are not significantly different at P = 0.05.

LSD (P = 0.05)	0.75
CV	0.81
Replicate F	0.299
Treatment F	0.070

Bean yield results:

Treatment	Yield[1]	Yield change
	bu/acre	bu/acre
1. Control	63.1 b	—
2. Vitazyme	66.9 a	3.8 (+6%)
3. Vitazyme + OCC	66.1 a	3.0 (+5%)
4. Silicon	63.3 b	0.2 (<1%)
5. Vitazyme + Silicon	65.8 a	2.7 (+4%)
LSD (P = 0.05)	2.2	
CV	2.17	
Replicate F	0.657	
Treatment F	0.007	

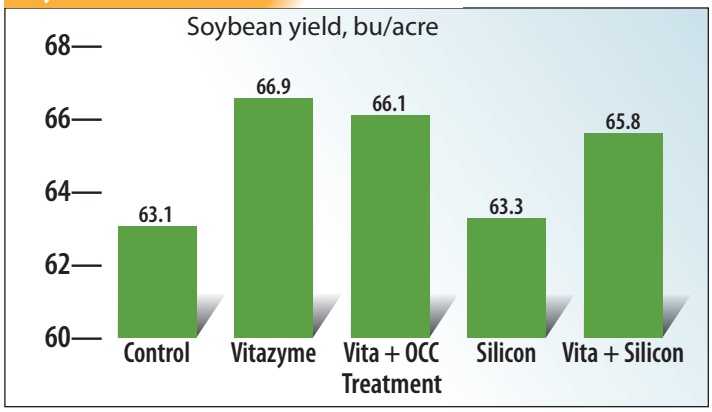
[1]Means followed by the same letter are not significantly different at P = 0.05.

Increase in test weight

Vitazyme alone..... 0.59 lb/bu
Vitazyme + OCC ..... 0.44 lb/bu
Vitazyme+ Silicon... 0.77 lb/bu*

*This increase is significantly greater than the control at P = 0.07.

Soybean Yield



Conclusions: This small-plot soybean trial in western Tennessee revealed a number of conclusions.

- Vitazyme applied in-furrow and at early bloom at 13 oz/acre each application, in all cases significantly increased the soybean yield by from 4 to 6%. The greatest increase was with Vitazyme alone.
- Silicon applied alone did not increase soybean yield, nor did it improve yield when combined with Vitazyme.
- OCC did not improve soybean yield compared to Vitazyme applied by itself.
- Vitazyme, alone or mixed with silicon or OCC, increased the bushel weight of the soybeans, and significantly above the control for Vitazyme plus silicon.

Increase in bean yield	
Vitazyme alone	*6%*
Vitazyme + OCC	*5%*
Vitazyme+ Silicon	*4%*

These results indicate that the significant yield increases of this study were obtained with Vitazyme alone, while neither silicon nor OCC caused any yield enhancement. Vitazyme also increased bushel weight, and silicon along with Vitazyme improved that weight significantly above the control. Vitazyme is shown in this study to be an excellent yield and bean density enhancer for soybean growers in the mid-South of the United States.

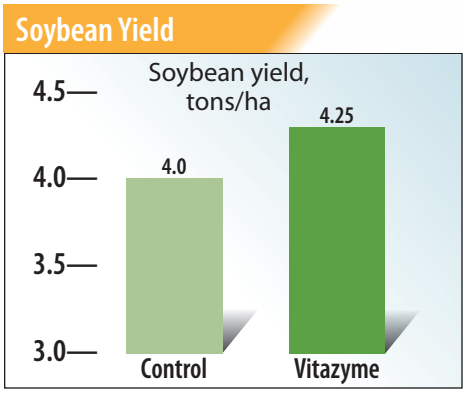
Soybeans *with Vitazyme application*

Researcher: V. V. Plotnikov
Research organizations: Plant Designs International, Rochester, New York, and Agro Expert International, Kaharlyk, Ukraine
Location: PE AF "Dzvony", Peremyshl District, Lviv Region, Bolotnya Village, Ukraine; western Ukraine (550-750 mm of rain per year)
Variety: Kuban, F1 ***Planting date:*** May 1, 2019 ***Planting rate:*** 0.8 million seeds/ha ***Previous crop:*** winter wheat
Previous crop: winter wheat ***Tillage:*** disking to 6-8, heavy cultivation to 30 cm, cultivation to 4-5 cm
Soil type: dark-gray podzolic (2.2% organic matter)
Experimental design: A soybean field was partitioned to an untreated control area and a Vitazyme treated area, using a seed treatment, to evaluate the effect of this product on soybean yield.

1 ***Control*** **2** ***Vitazyme***

Fertilization: 100kg/ha of K_20 in the fall of 2018; 16-27-7 kg/ha of N-P_20_5-K_20 in-furrow at planting
Vitazyme application: 1.0 liter/ton of soybean seeds before planting
Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
1. Control	4.0	—
2. Vitazyme	4.25	0.25 (+6%)



Increase in soybean yield with Vitazyme: 6%

Income results: The yield increase of 6 % (0.25 ton/ha) resulted in an income increase of $137/ha.
Conclusions: A soybean trial of field scale was conducted in western Ukraine in 2019, using a Vitazyme seed treatment of 1 liter/ton to compare the yield of soybeans to the adjoining untreated control. The yield increase was 6% (0.25 ton/ha) with Vitazyme, resulting in greater net income of $137/ha, showing this program to be a very good management practice for soybean growers in western Ukraine.

Soybean *with Vitazyme application*

Researchers: E. Bruce Kirksey, Ph.D.
Research organization: Agricenter International, Memphis, Tennessee
Location: Memphis, Tennessee ***Variety:*** P4255RR2X ***Planting date:*** July 12, 2019 ***Planting rate:*** 140,000 seeds/acre
Planting depth: 1.0 inch ***Row spacing:*** 30 inches
Soil type: Falaya silt loam, pH = 6.3, organic matter = 2.4%, fertility level = good, drainage = good
Experimental design: A small-plot soybean trial was established, using 10 x 30-foot plots (300 ft.^{2}) and five treatments with four replications in a randomized complete block design.

Treatment	Bio Seed application		Vitazyme applicaton[1]	
	On seed	In-furrow	In-furrow	foliar
1. Control	0	0	0	0
2. Bio Seed	136 g/cwt	0	0	0
3. Bio Seed	0	50 g/acre	0	0
4. Bio Seed + Vitazyme in-furrow	0	50 g/acre	13 oz/acre	0
5. Bio Seed + Vitazyme in-furrow and foliar	0	50 g/acre	13 oz/acre	13 oz/acre

[1]13 oz./acre = 1 liter/ha

Bean pods removed from three plants of both the Vitazyme and Bio Seed treatment and the control reveal more pods and potential yield for the treated plants...up to 40% more yield for Treatment 5.

Fertilization: none
Vitazyme application: 13 oz/acre (1 liter/ha) in-furrow at planting for treatments 4 and 5; 13 oz/acre (1 liter/ha) sprayed foliar 30 days after planting at early bloom.
Bio Seed application: Bio Seed is a formulation of bacteria and fungi that stimulates rhizosphere microbial populations. 136 g/100 lb of seed applied before planting for Treatment 2; 50 g/acre in-furrow at planting for Treatments 3, 4, and 5.
Harvest date: November 5, 2019, of the middle two rows of each plot with an Almaco plot combine
See moisture: There were no significant differences in seed moisture content (8.13 to 8.48%).
Seed Test weight: There were no significant differences among treatments for test weight (55.98 to 58.32 lb/bu).

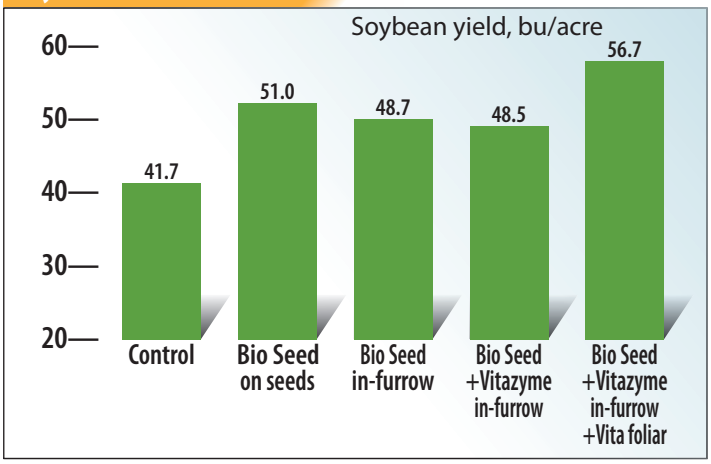
This soybean trial with Vitazyme and Bio Seed produced excellent and highly significant responses in a small plot setting.

Yield results:

Treatment	Yield	Yield change
	bu/acre	bu/acre
1. Control	41.7 c	—
2. Bio Seed on seeds	51.0 b	9.3 (+22%)
3. Bio Seed in-furrow	48.7 b	7.0 (+17%)
4. Bio Seed in-furrow +Vitazyme in-furrow	48.5 b	6.8 (+ 16%)
5. Bio Seed in-furrow +Vitazyme in-furrow +Vitazyme foliar	56.7 a	15.0 (+40%)
LSD (P=0.05)	3.68	
CV	4.85	
Treatment F -value	0.0001	

Notice the taller, stronger soybean plants on the right that have received Vitazyme and Bio Seed. Their leaf area is greater, root development is more extensive, and leaf chlorophyll level is better than for the untreated control.

Soybean Yield



Income results: Income increase data is given for Treatments 1, 4, and 5.

Treatment	Extra income	Extra costs	Net increase
	----------U.S. $/acre----------		
1. Control	—	—	—
4. Bio Seed in-furrow +Vitazyme in-furrow	63.72	21.13	42.58
5. Bio Seed in-furrow +Vitazyme in-furrow +Vitazyme foliar	140.55	29.77	110.78

Increase in soybean yield

Bio Seed on seeds 22%
Bio Seed in-furrow..... 17%
Bio Seed + Vitazyme in-furrow 16%
Bio Seed + Vitazyme in-furrow + Vitazyme foliar..... 40%

Conclusion: A small-plot soybean study conducted with Bio Seed and Vitazyme in Memphis, Tennessee, revealed that, while test weight and seed moisture at harvest were not significantly affected, Bio Seed seed pre-treatment and in-furrow treatment increased the yield by 22 and 17%, respectively. When Vitazyme was applied together with Bio Seed in-furrow, the yield improved by 16%, which was statistically the same as the Bio Seed treatments alone at P=0.05. However when a foliar Vitazyme treatment was added to the in-furrow Bio Seed and in-furrow Vitazyme treatment, the yield shot up to 40% greater than the control. These results show the great efficacy of Bio Seed alone either pre-treated on the seeds or in-furrow, but epecially Vitazyme applied foliar along with Bio Seed and Vitazyme added in-furrow. Income was increased by up to $110.78/acre with Bio Seed and Vitazyme.This experiment reveals the great value of the products for soybean growers.

Corn and Soybeans *with Vitazyme application*

A Summary of Research at the University of Missouri: From a paper presented at the Fourth International Congress on Biostimulants—Barcelona, Spain, November, 2019

Vitazyme Improves Plant Growth, Soil Health, & Tolerance to Glyphosate Stress

Authors: Manjula V. Nathan, Robert J. Kremer, Paul W. Syltie, Timothy M. Reinbott, Kelly A. Nelson, and Xiaowei Pan
Research organization: Division of Plant Sciences, University of Missouri, Columbia, Missouri, USA

Objectives:

- Determine effects of Vitzazyme on selected soil health indicators
- Determine effects of Vitazyme on rhizosphere biology in transgenic soybean and maize treated with glyphosate

Experimental Methods:

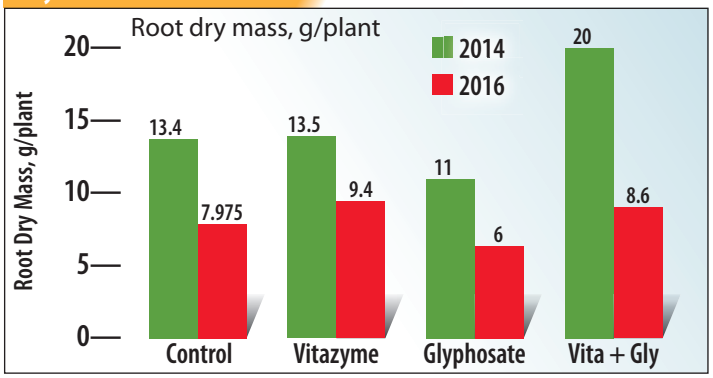
- Field trials conducted at Columbia (2014) and Novelty (2016-17) Missouri on Mexico silt soil (fine, smectitic, mesic Vertic Epiaqualfs)
- Maize and soybean planted conventionally using minimum tillage; plants and soils collected at R2 soybean & V10 maize growth stage
- Root-colonizing *Fusarium* assessed by selective culture technique (Levesque et al. 1993)
- Rhizosphere pseudomonads determined using S1 agar medium (Gould et al. 1985)
- Indoleacetic acid-producing (IAA) bacteria detected on nitrocellulose membranes reacted with Salkowski reagent for color development (Bric et al. 1991)
- Mn-transforming bacteria detected on Gerretsen's medium (Huber & Graham 1992)
- Glucosidase activity detected using enzyme assay of Eivazi & Tabatabai (1988)
- Soil microbial components and biomass determined using phospholipid fatty acid (PLFA) analysis (Buyer & Sasser 2012; Pritchett et al. 2011)

Root growth results: Vitazyme improved soil health indicators and overcame glyphosate effects on maize and soybean

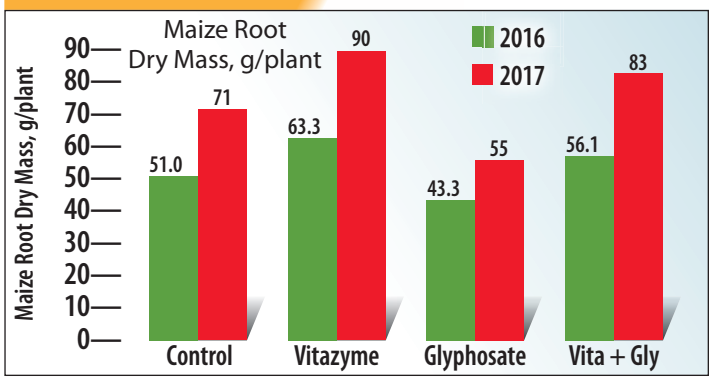
Soybean root biomass enhanced by Vitazyme

Maize root biomass enhanced by Vitazyme

Soybean Root Biomass



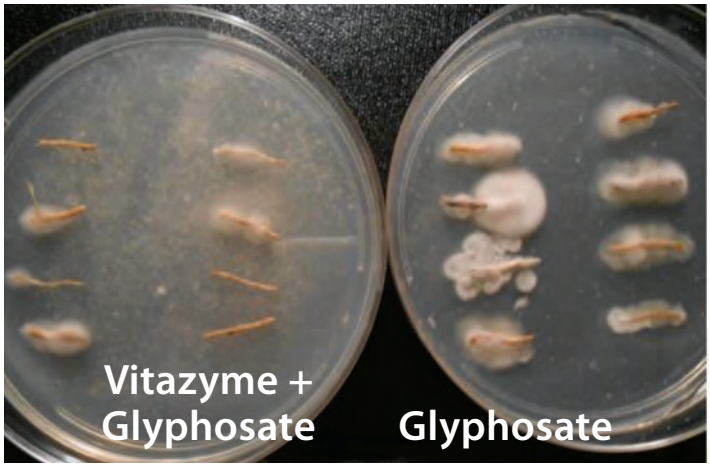
Maize Root Biomass



Biostimulant improved root biomass in both soybean and maize each year relative to no treatment. Biostimulant overcame detrimental effects of glyphosate on root growth in both crops.

Root Fusarium colonization results: Vitazyme significantly reduced colonization of roots by potentially pathogenic *Fusarium* fungal species.

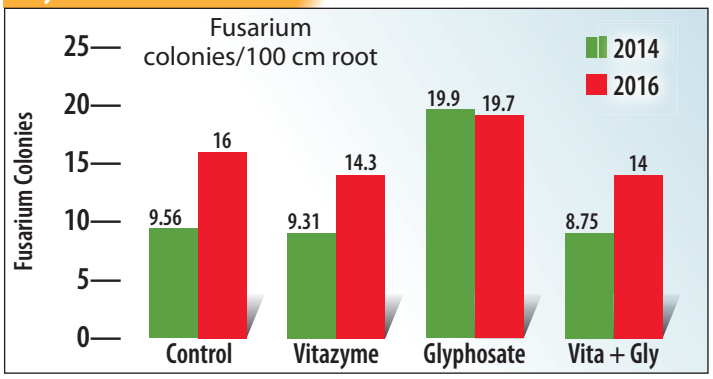
Soybean root colonization by Fusarium spp.



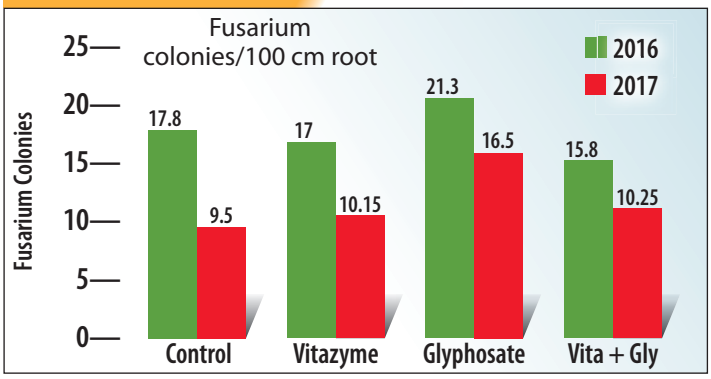
Maize root colonization by Fusarium spp.

Note reduced fungal growth density on field-collected root by Vitazyme treatment compared with roots from plants receiving glyphosate herbicide. Glyphosate induces colonization and infection of roots of both transgenic and non-transgenic crops by soilborne pathogenic fungi (Johal & Huber 2009; Kremer & Means 2009)

Soybean Fusarium



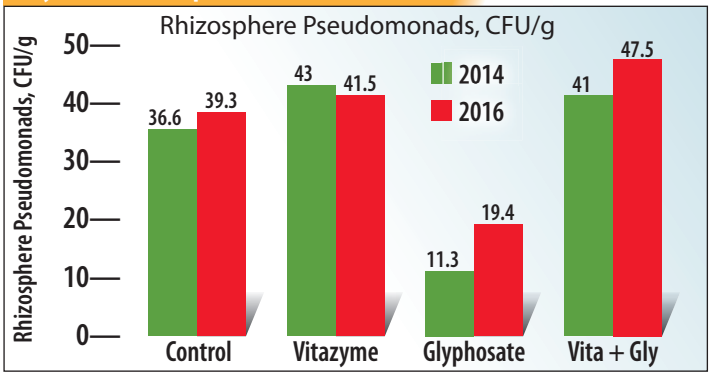
Maize Fusarium



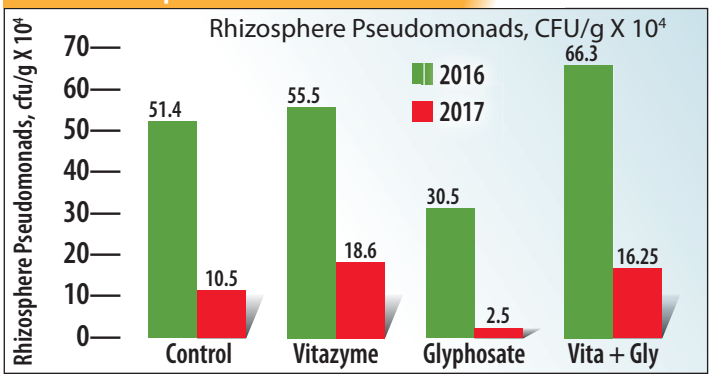
Vitazyme reduced *Fusarium* colonization of roots on both soybean and maize each year relative to no treatment. Vitazyme overcame detrimental effects of glyphosate in reducing root *Fusarium* in both crops. Values above bars are colonization density per 100 cm root or % colonization.

Rhizosphere Fluorescent Pseudomonad results: Vitazyme improved rhizosphere fluorescent pseudomonads, which are soil bacteria that contribute beneficial plant growth-promoting functions, and were significantly increased in both glyphosate-treated crops

Soybean Rhizosphere Pseudomonads

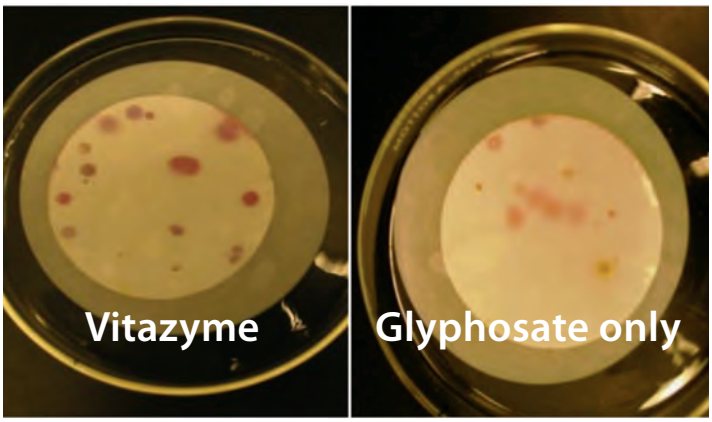


Maize Rhizosphere Pseudomonads



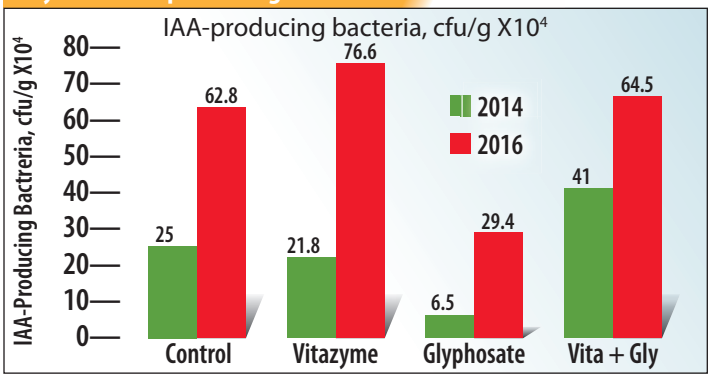
Vitazyme improved rhizosphere pseudomonads. Vitazyme was very effective in overcoming detrimental effects of glyphosate on pseudomonad abundance.

Rhizosphere IAA-producing bacteria results: Vitazyme improved rhizosphere indole-acetic acid producing (IAA) rhizobacteria, which are soil bacteria that provide IAA for various plant functions including root growth stimulation.

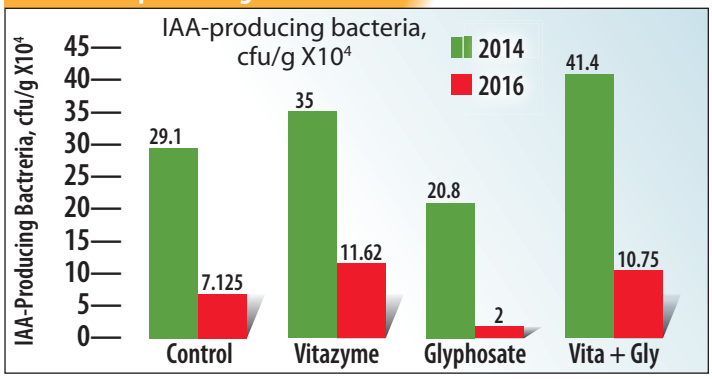


Bacterial colonies attached to membrane show IAA production detected via pink color reaction with Salkowski reagent saturated in the membrane. Instensity of color also indicates IAA concentration.

Soybean IAA-producing Bacteria



Maize IAA-producing Bacteria

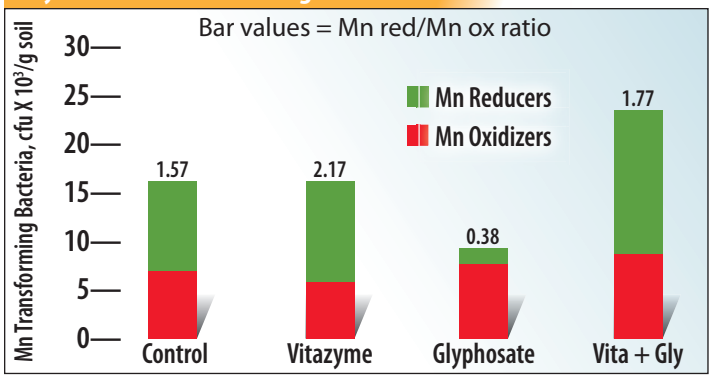


Vitazyme enhanced rhizosphere IAA bacteria abundance on both soybean and maize. Vitazyme was very effective in overcoming detrimental effects of glyphosate on IAA-producing rhizobacteria.

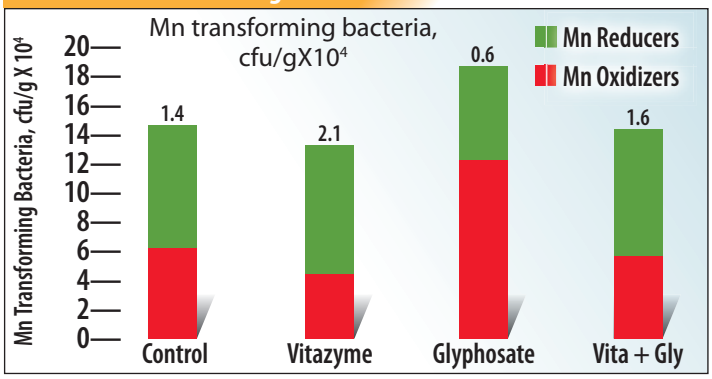
Rhizosphere Mn-transforming bacteria results: Mn-reducing microorganisms provide available Mn (reduced) for plant and microbial uptake. Glyphosate increases Mn-oxidizing microorganisms and limits Mn availability in the rhizosphere.

Mn-transforming bacteria on selective medium; Mn oxidizers appear black; Mn reducers are white and form halos.

Soybean Mn Transforming Bacteria



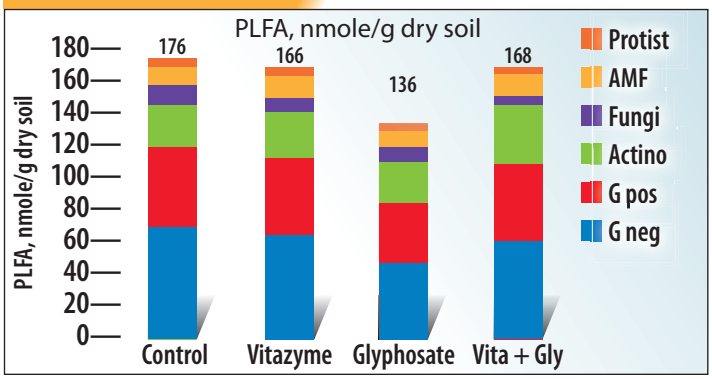
Maize Mn Transforming Bacteria



For soybean and maize, Mn reducers and Mn-reducer: Mn-oxidizer ration increased with Vitazyme; Mn-reducers significantly decreased by glyphosate; Vitazyme overcame glyphosate effects—increasing Mn-reducers and the ratio.

Soil microbial community results: Vitazyme maintained soil microbial community composition (phospholipid fatty acid [PLFA] groups) and total microbial biomass in glyphosate-treated crops.

Maize PLFA Nmole 2016

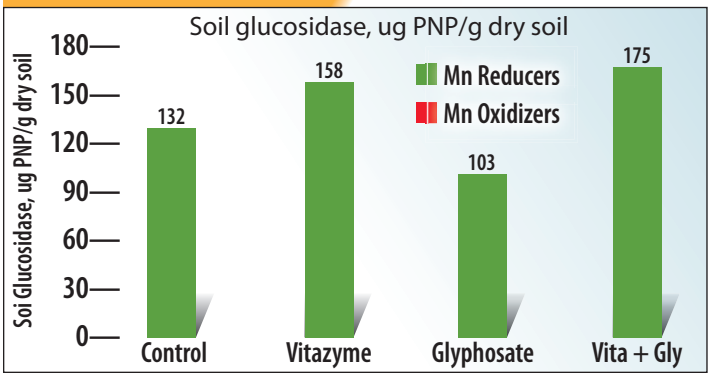


Key:
Protist—protozoa
AMF—arbiscular mycorrhizal fungi
Fungi—non-mycorrhizal fungi
Actino—actinobacterial or actinomycetes
G pos—Gram-positive bacteria
G neg—Gram-negative bacteria

Maize rhizosphere soil microbial diversity. Vitazyme significantly increased diversity of microbial groups and total microbial biomass in the glyphosate treatment. Abundance of mycorrhizae, the symbiotic fungi involved in P and water translocation, was improved with Vitazyme. NOTE: Values above each bar = Total PLFA (representative of microbial biomass)

Soil glucosidase activity results: Vitazyme enhanced glucosidase activity, a bioindicator of soil health and soil biological activity, in both control and glyphosate treatments.

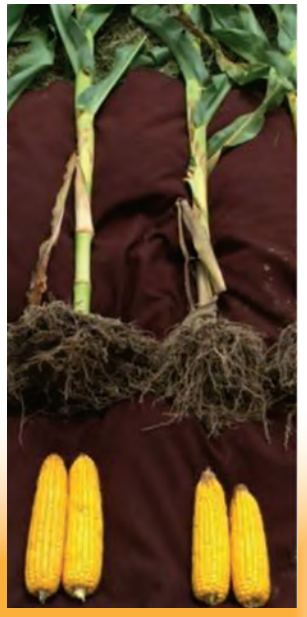
Maize Soil Glucosidase 2016



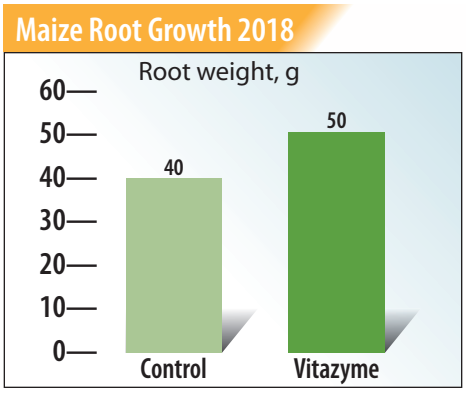
Soybean rhizosphere soil microbial activity indicated by soil glucosidase, a carbon -cycling enzyme.

Conclusions: Vitazyme supplements soil health function and plant growth.

Control Vitazyme



Vitazyme Control



Root mass of Pioneer hybrid: 25% Increase with biostimulant (2018)

- Multiple assessments of sensitive biological indicators of soil health successfully evaluated Vitazyme as a factor in suppressing effects of glyphosate on root growth and rhizosphere biology in transgenic cropping systems and improving soil health.
- Soil microbial diversity (PLFA groups) was restored by Vitazyme in soils planted to maize and soybean treated with glyphosate. High soil microbial diversity is essential to maintain a stable ecosystem and crop productivity.
- Vitazyme use can be a major mangement factor for addressing productivity problems and declining soil health associated with transgenic crops in current crop production systems.

References:

Bric, J.M. Bostock, R.M., Silverstone, S.E., 1991. Rapid in situ assay for indoleacetic acid production by bacteria immobilized on a nitrocellulose membrane. Applied & Environmental Microbiology 57:535-538.

Buyer, J.S., Sasser, M., 2012. High throughput phospholipid fatty acid analysis of soils. Applied Soil Ecology 61:127-130.

Eivazi, F., Tabatabai, M.A., 1988. Glucosidases and galactosidases in soils. Soil Biology & Biochemistry 20:601-606.

Gould, W.D., Hagedorn, C., Bardinelli, T.R., Zablotowicz, R.M., 1985. New selective medium for enumeration and recovery of fluorescent pseudomonads from various habitats. Applied & Environmental Microbiology 49:29-32.

Huber, D.M., Graham, R.D., 1992. Techniques for studying nutrient-disease interactions. In Singleton, L.L. et al. (eds.), Methods for Research on Soilborne Phytopathogens, APS Press, St. Paul, MN. pp. 204-214.

Kremer, R.J., Means, N.E. 2009. Glyphosate and glyphosate-resistant crop interactions with rhizosphere microorganisms. European Journal of Agronomy 31;153-161.

Levesque, C.A., Rahe, J.E., Eaves, D.M., 1993. Fungal colonization of glyphosate-treated seedlings using a new root-plating technique. Mycological Research 97:299-306.

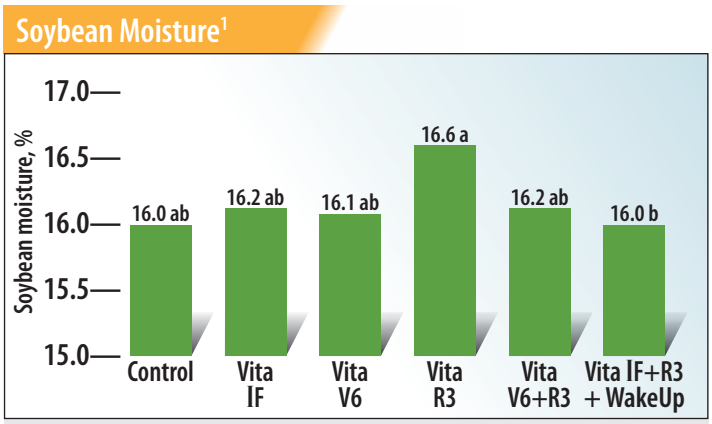
Pritchett, K.A., Kennedy, A.C., Cogger, C.G., 2011. Management effects on soil quality in organic vegetable systems in western Washington. Soil Science Society of America Journal 75:605-615.

Soybeans *with Vitazyme application—A Study on Synergism with WakeUp*

Researchers: Steve Schmidt
Research organization: ACRES Research, Cedar Falls, Iowa
Location: Denver, Iowa ***Variety:*** Emerge 1993 ***Planting date:*** May 22, 2018
Planting rate: 130,000 seeds/acre ***Planting depth:*** 1.5 inches
Row spacing: 30 inches ***Plot size(harvested area):*** 7.5 x 60 feet ***Tillage:*** strip-till
Soil type: Sparta loamy fine sand (1.5% organic matter, 6.2 pH, 6.5 meq/100 grams cation exchange capacity.
Experimental design: A small-plot soybean trial, using four replications and six treatments, was prepared in east-central Iowa in order to evaluate the effect of Vitazyme, applied at different times, on the yield of soybeans. In addition, a treatment utilizing WakeUp adjuvant was added to investigate possible synergisms with Vitazyme.

Treatment	Vitazmye			WakeUp	
	In-furrow	V6	R3	Spring	Summer
	oz/acre	oz/acre	oz/acre	oz/acre	oz/acre
1. Control	0	0	0	0	0
2. Vitazyme in-furrow	13	0	0	0	0
3. Vitazyme foliar/soil V6	0	13	0	0	0
4. Vitazyme foliar R3	0	0	13	0	0
5. Vitazyme foliar/soil V6 + R3	0	13	13	0	0
6. Vitazyme + WakeUp Spring in furrow + Vitazyme + Wake Up Summer R3	13	0	13	4	4

Fertilization: starter mix of 3 gal/acre MPK (0-52-34% N-P_2O_5-K_20), 1 quart/acre humate, and 4 oz/acre Super Trace
Vitazyme application: (1) 13 oz/acre in-furrow (Treatments 2 and 6); (2) 13 oz/acre to the leaves and soil at V6 June 28 (Treatments 3 and 5), and 13/oz/acre to the leaves at R3 (Treatments 4, 5, and 6).
WakeUp Spring application: 4 oz/acre in-furrow (Treatment 6)
WakeUp Summer application: 4 oz/acre to the leaves at R3 (Treatment 6)
Herbicide application: Pre-emergence: 6 oz/acre Zidua Pro, 24 oz/acre Roundup, 16 oz/acre 2, 4-D, 2 lb/acre AMS. Postemergence (first): 10 oz/acre Outlook, 10 oz/acre Arrow, 2.5 lb/acre AMS. Postemergence (second): 16 oz/acre Flexstar, 8 oz/acre Select Max, 4 oz/acre MSO, 3 oz/acre Fultec
Soybean moisture results:



[1]Means followed by the same letter are not significantly different at P=0.05.

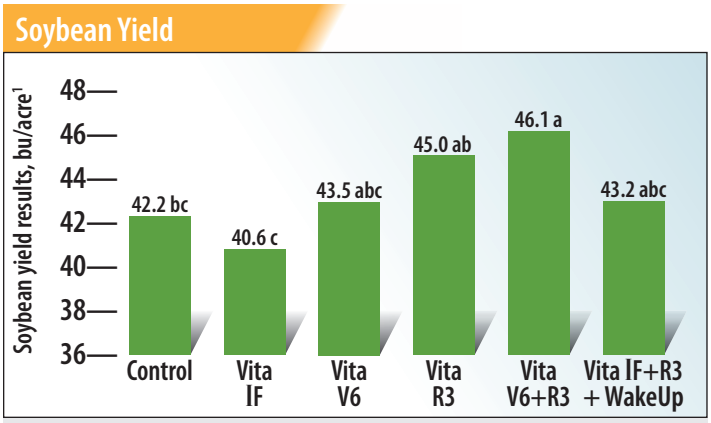
Only the Vitazyme application at R3 caused a significantly higher bean moisture content at harvest than the control.

Vitazyme applied foliar at V6 and R3 gave a significant yield response of 9% in this Iowa replicated study.

Statistics

LSD (P=0.05) 0.6%
Standard deviation 0.1%
CV..... 0.93
Replicate F 0.569
Treatment F 0.434

Soybean yield results:



Means followed by the same letter are not significantly different at P=0.05 .

Statistics	
LSD (P=0.05)	3.7 bu/acre
Standard deviation	2.9 bu/acre
CV	6.4
Replicate F	0.044
Treatment F	0.065

Increase in yield	
Vitazyme at V6	(+3%)
Vitazyme at R3	(+7%)
Vitazyme at V6 + R3	(+9%)
Vitazyme in-furrow + R3 +WakeUp in-furrow + R3	(+2%)

Conclusion: A small-plot soybean trial in east-central Iowa, using three application times for Vitazyme and WakeUp adjuvant, revealed that soybean moisture at harvest varied little, but soybean yield was improved significantly (9%) with Vitazyme applied at the V6 and R3 stages. In addition, the R3 application alone increased yield by 7%, and V6 application by 3%. The in-furrow application did not produce a yield increase, which is contrary to most soybean studies in past years. WakeUp did not produce a significant interaction with Vitazyme when both were applied in-furrow and at the R3 stage. This trial reveals the potential great efficacy of Vitazyme application at the R3 (early pod) stage of plant development.

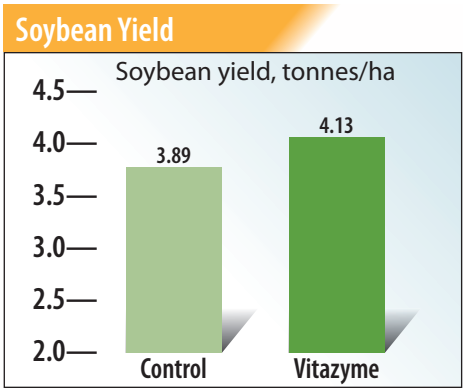
Soybeans *with Vitazyme application*

Researcher: V.V. Plotnikov
Research organization: Plant Designs, Inc., Rochester, New York, and Agro Expert International, Kaharlyk, Ukraine
Location: Gorohiv District, Volyn Region, Ugryniv Village, LTD Shevchenko, Ukraine
Variety: Cassidi, first generation
Planting date: May 1, 2018
Previous crop: winter wheat
Soil type: soddy podzolic (humus = 1.5%)
Planting rate: 500,000 seeds/ha
Field preparation: disking to 6-8 cm, plowing to 20-22 cm, cultivation to 4-5 cm
Experimental design: A soybean field in western Ukraine was treated in part with one application of Vitazyme, while the rest of the field was left untreated to serve as a control. The purpose of the trial was to determine the effectiveness of this product on soybean yield and income.

1 ***Control*** **2** ***Vitazyme***

Fertilization: none
Vitazyme application: 1 liter/ha sprayed on the soil before planting, on April 30, 2018

Yield results:



Yield increase with Vitazyme: 6%

Income results: This soybean yield increase of 0.24 tonne/ha gave an increased income of $86/ha.
Conclusions: A single 1liter/ha Vitazyme application for this western Ukraine soybean trial resulted in a respectable income increase of $86/ha. The yield increase was 6% (0.24 tonne/ha), showing the benefit of this program for soybean growers in Ukraine.

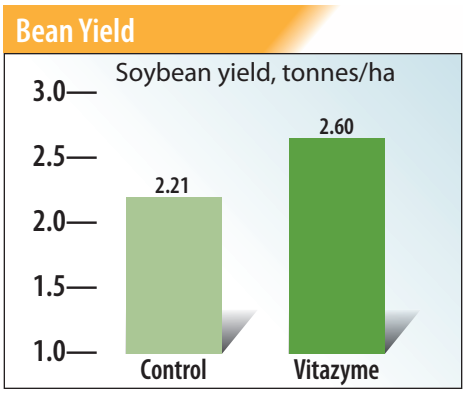
Soybeans *with Vitazyme application*

Researcher: V.V. Plotnikov
Research organization: State Enterprise "Scientific Innovation Center of the Institute of Feeding and Agriculture of Podillia of the National Academy of Agrarian Sciences of Ukraine"
Location: Vinnytsia District, Vinnytsia Region, Agronomichne Village, Ukraine
Variety: Diadema, elite
Planting date: May 5, 2018
Previous crop: spring wheat
Soil type: dark-brown podzolic (humus = 2.2%)
Planting rate: 0.75 million seeds/ha
Field preparation: disking 6-8 cm, plowing to 20-24 cm, cultivation to 4-5 cm
Experimental design: A soybean field was divided into a Vitazyme treated and untreated area to determine the effects of this product on crop yield and income.

V.V. Plotnikov writes field notes for a soybean trial. The program has revealed excellent yield improvements with Vitazyme consistently over the years.

❶ *Control* ❷ *Vitazyme*

Fertilization: none
Vitazyme application: (1) 0.5 liter/ha foliar spray on July 10, at bud formation, and (2) 0.5 liter/ha on August 4 at "green beans" stage
Yield results: (See bar graph to the right)
Income results: The increased yield of 0.39 tonne/ha provided $140/ha more income.
Conclusions: A soybean trial in Ukraine, using Vitazyme at 0.5 liter/ha at bud formation and when the beans had developed significantly, revealed a 17% yield improvement, plus $140/ha greater profitability, showing the great efficacy of this program for soybean growers in Ukraine.



Increase in soybean yield with Vitazyme: 17%

Soybeans *with Vitazyme application—A Greenhouse Study*

Researcher: Robert Kloepper, Ph.D.
Research organization: Plant Science Research Center, Auburn University, Auburn, Alabama
Location: Auburn, Alabama
Soil type: field soil
Experimental design & results: Two experiments were conducted in the greenhouse to discover the effects of Vitazyme on plant height, dry shoot weight, dry root weight, and mineral and nitrogen content.

Experiment 1. Early growth promotion and root morphology over two weeks. Containers, 2.5 inches in diameter and 10 inches deep, were filled with the same weight of field soil to 0.5 inch from the rim.

- **Treatments:** (1) Control, (2) 0.1% Vitazyme, (3) 0.01% Vitazyme (4) 0.001% Vitazyme.
- **Vitazyme application:** 30 ml of each solution were applied at planting.
  Data collection: At two weeks after planting, shoots were cut at the base, and the roots were carefully washed with tap water. Plant height, dry shoot weight, and dry root weights were recorded, and root morphology was evaluated using an Epson WinRhizo XL 10000 scanner.
- **Data analyses:** All data were analyzed using ANOVA and Tukey's HSD in RStudio.
- **Results:** No significant differences were detected in early growth parameters, nor were there any significant differences in root morphology (total length, surface area, and average root diameter).

Experiment 2. Growth promotion and root morphology over five weeks.Containers, 7.75 inches in diameter and 7 inches deep (c400), were filled with the same weight of field soil, to 0.5 inch from the rim. No fertilizer was added.

- **Treatments:** (1) Control, (2) 0.1% Vitazyme, (3) 0.01% Vitazyme, (4) 0.001% Vitazyme
- **Vitazyme application:** 100 ml of each treatment were applied at planting.
- **Data collection:** At five weeks after planting, shoots were cut off at the base, and roots were carefully washed with tap water. Plant height, dry shoot weight, and dry root weight were recorded, and root morphology was evaluated using an Epson WinRhizo XL 10000 scanner. Nutrient analyses were made by Waters Agricultural Lab in Georgia.
- **Data analyses:** All data were analyzed using ANOVA and Tukey's HSD on RStudio.
- **Results:** The 0.1% Vitazyme showed a significant increase in height compared to all other treatments.

Note the greater height of the Vitazyme treated soybeans with a 0.1% application rate (30 ml/pot) in this Auburn University soybean greenhouse study.

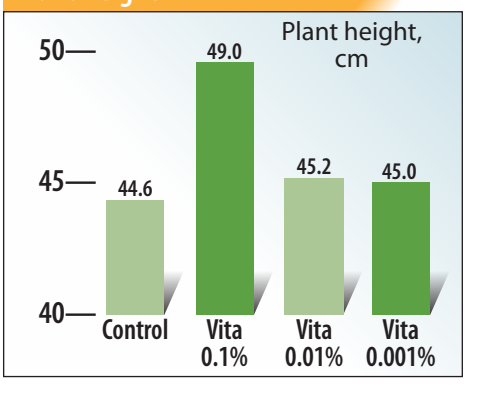
Treatment	Plant height[1]	Yield change
	cm	cm
1. Control	44.6 b	—
2. Vitazyme, 0.1%	49.0 a	44 (+10%)
3. Vitazyme, 0.01%	45.2 b	6 (+1%)
4. Vitazyme, 0.001%	45.0 b	4 (+1%)

[1]Means followed by the same letter are not significantly different at P=0.01, according to Tukey's HSD.

Increase in plant height with 0.1% Vitazyme: 10%

Conclusions: A greenhouse pot trial at Auburn University, using field soil and Vitazyme applications of 0.1, 0.01, and 0.001%, resulted in no significant growth effects in a 2-week study, but highly significant increases in height at the 0.1% application rate for the 5-week study. These results illustrate the ability of Vitazyme, at very lower application levels, to improve plant phenotypic expression for soybeans. These effects normally will translate into higher crop yields in field situations.

Plant Height



Soybeans *with Vitazyme application*

Researcher: Graig Reicks
Research organization: South Dakota Soybean Association
Location: Brookings County, South Dakota
Variety: unknown
Relative maturity: 1.9
Row spacing: 30 inches
Planting rate: 140,000 seeds/acre
Tillage: strip tilled after corn harvest in 2015, and field cultivated in the spring
Soil type: silty clay loam to sandy loam complexes of 1-6%
Seed treatment: fungicide and insecticide
Previous crop: corn
Experimental design: A soybean field received three alternate strips of Vitazyme treatment in-furrow, with the associated strips serving as controls. The purpose of the study was to evaluate the effects of the product on soybean yield.

1 ***Control*** **2** ***Vitazyme***

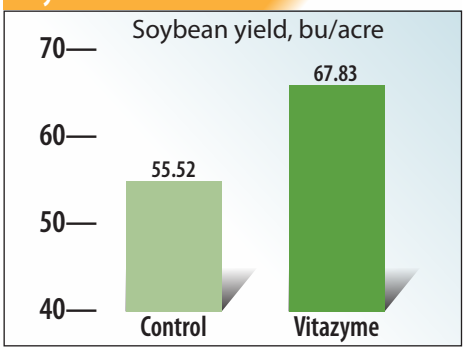
Fertilization: 3 gal/ha of 10-34-0% $N\text{-}P_2O_5\text{-}K_2O$ in-furrow at planting
Vitazyme application: 13 oz/acre (1 liter/ha) in-furrow at planting
Growing season weather: favorable: 9.36 inches of rain, and 1,844 growing degree days from June 1 through August 31 (average is 10.6 inches of rain and 1,668 growing degree days)

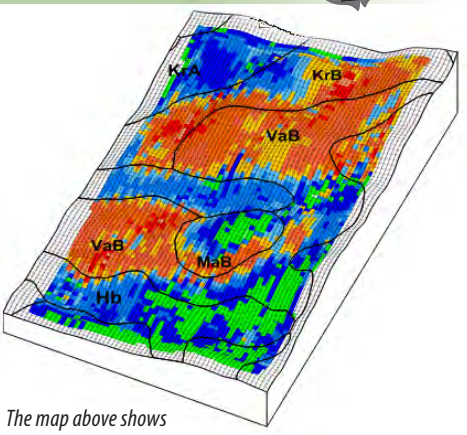
Yield results:

Treatment	Bean yield	Yield change
	bu/acre	bu/acre
1. Control	55.52	—
2. Vitazyme	67.83*	12.31 (+22%)

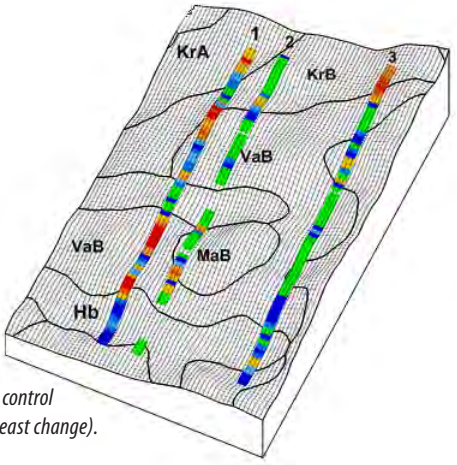
*Significantly greater than the control at P=0.05.

Increase in soybean yield with Vitazyme: 22%





The map above shows the soybean yield (green=highest, red=lowest).



This map shows yield change from the adjacent control (green=greatest change, red=least change).

Conclusions: This soybean trial in eastern South Dakota showed that a single 13 oz/acre (1 liter/ha) in-furrow application of Vitazyme can increase yield by 22%, a great and highly profitable increase. The field had substantial white mold and brown stem rot, so the active agents in the product apparently helped the plants overcome growth stresses. These results show the program's ability to significantly boost soybean yields with little added cost in South Dakota.

Soybeans *with Vitazyme application*

Researcher: Graig Reicks
Research organization: South Dakota Soybean Association
Location: Brookings County, South Dakota
Variety: unknown
Relative maturity: 1.9
Row spacing: 30 inches
Planting rate: 140,000 seeds/acre
Tillage: strip tillage after corn harvest in 2015, and field cultivation
Previous crop: corn
Planting date: May 19, 2016
Soil type: silty clay loam, loam, and sandy loam complexes of 0-6% slope
Seed treatment: fungicide, insecticide, and *Bacillus japonicum*
Experimental design: A soybean field was planted with three alternating strips of Vitazyme treatment in-furrow, with adjacent and intervening strips serving as controls. The objective of the study was to determine the effect of Vitazyme on soybean yield.

1 ***Control*** **2** ***Vitazyme***

Fertilization: 3 gal/ha of 10-34-0% $N\text{-}P_20_5\text{-}K_20$ in-furrow at planting
Vitazyme application: 13 oz/acre (1 liter/ha) in-furrow at planting
Growing season weather: favorable: 9.36 inches of rain, and 1,844 growing degree days from June 1 through August 31 (average is 10.6 inches of rain and 1,668 growing degree days)

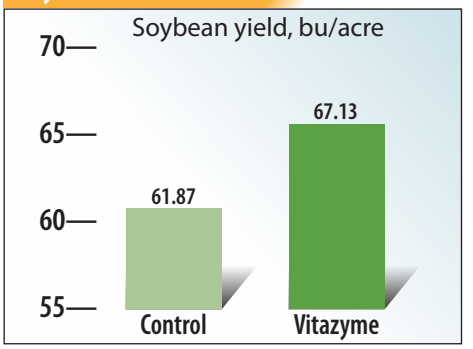
Yield results:

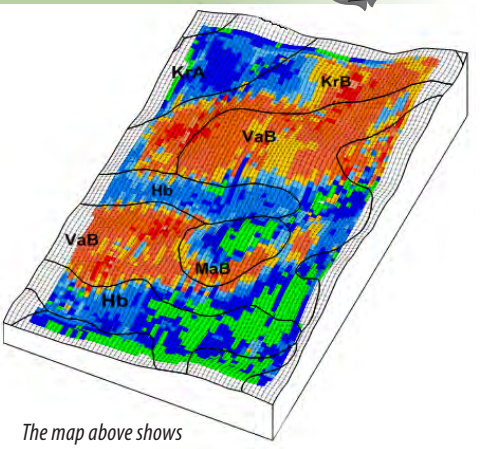
Treatment	Bean yield	Yield change
	bu/acre	bu/acre
1. Control	61.87	—
2. Vitazyme	67.13*	5.26 (+9%)

*Significantly greater than the control at P=0.05.

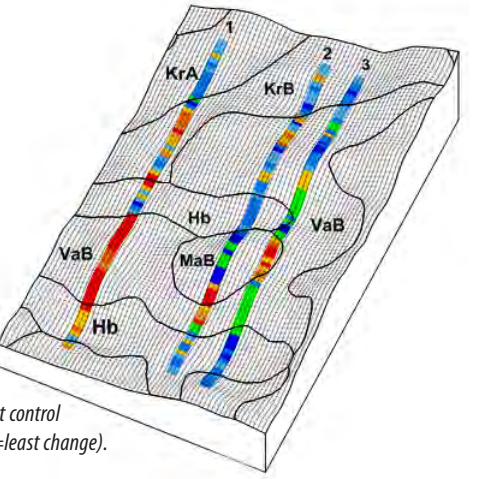
Increase in soybean yield with Vitazyme: 9%

Soybean Yield





The map above shows the soybean yield (green=highest, red=lowest).



This map shows yield change from the adjacent control (green=greatest change, red=least change).

Conclusions: A soybean strip study in Brookings, using three repetitions in a normal field setting, resulted in a 9% (5.26 bu/acre) yield increase with Vitazyme applied in-furrow at planting at 13 oz/acre (1 liter/ha). This result shows the great utility of this program for soybean production in eastern South Dakota.

Soybeans *with Vitazyme application*

Researcher: Graig Reicks
Research organization: South Dakota Soybean Association
Location: Kingsbury County, South Dakota
Variety: AG 1935
Relative maturity: 1.8
Row spacing: 30 inches
Planting rate: 150,000 seeds/acre
Tillage: conventional
Previous crop: soybeans
Planting date: May 9, 2015
Soil type: Poinsett-Buse Complex, 2-6% slopes; Poinsett-Waubay silty loams, 1-6% slope; Poinsett-Buse-Forman, 5-9% slope
Seed treatment: fungicide, insecticide
Experimental design: A soybean field was planted in three alternating strips of in-furrow Vitazyme applications, the intervening strips serving as controls. The objective of the study was to discover if Vitazyme would increase soybean yield.

1 ***Control*** **2** ***Vitazyme***

Fertilization: none
Vitazyme application: 13 oz/acre (1 liter/ha) in-furrow at planting
Growing season weather: favorable: 16.3 inches of rain, and 1,698 growing degree days from June 1 through August 31

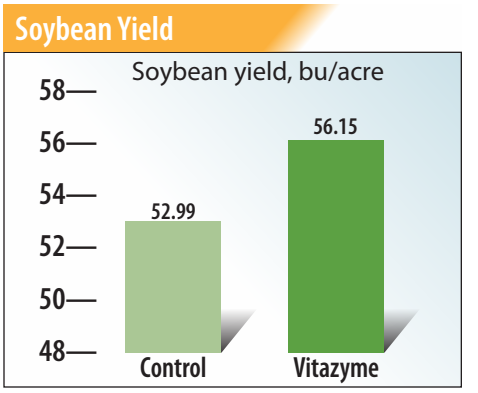
Note the thicker stems and greater leaf canopy of the Vitazyme treated soybeans in this South Dakota Soybean Association replicated field trial. The yield improvement was substantial.

Yield results:

Treatment	Bean yield	Yield change
	bu/acre	bu/acre
1. Control	52.99	—
2. Vitazyme	56.15*	3.16 (+6%)

*Significantly greater than the control at P=0.05.

Yield increase in soybean yield with Vitazyme: 6%



Conclusions: This soybean trial in South Dakota produced a 3.16 (6%) yield increase with Vitazyme, displaying the product's ability to stimulate highly profitable yield increases with a single in-furrow application of 13 oz/ha (1 liter/ha).

Soybeans *with Vitazyme application*

Researcher: Vadim Plotnikov
Research organization: LLC "Zlagoda", Ukraine
Location: Onufryevsky District, Kirovograd Region, Vishnivtsi Village, Ukraine
Variety: EU Mentor (generation 1)
Seeding rate: 600,000 seeds/ha
Planting date: May 5, 2017
Previous crop: winter wheat
Soil type: dark gray, humus=2.6%
Seedbed preparation: disking to 6-8 cm, plowing to 22-24 cm, harrowing, and cultivation to 4-5 cm
Experimental design: A field of soybeans was partitioned into an untreated control area and a Vitazyme treated area to evaluate the effect of Vitazyme on soybean yield and growth.

1 ***Control*** **2** ***Vitazyme***

Fertilization: Preplant, 21 kg/ha of N ; starter in-row at planting, 8-21-21 kg/ha N-P_2O_5-K_2O.
Vitazyme application: (1) 0.5 liter/ha at the first flower pod stage on July 5, 2017; (2) 0.5 liter/ha at the mid-pod stage on July 31, 2017. Both treatments were broadcast sprayed.
Growing season weather: dry

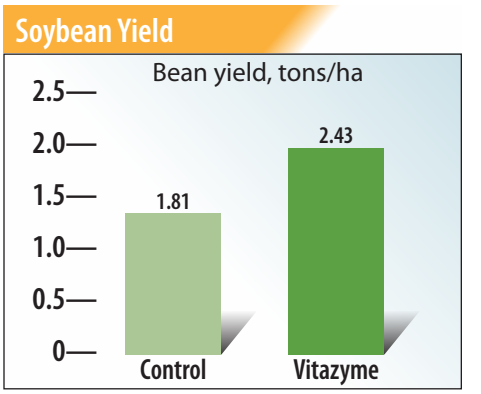
Note the improved plant size, superior root development, and increased pod set with the Vitazyme treated plants, leading to an impressive 34% yield increase.

Vadim Plotnikov displaying some of the excellent response obtained from Vitazyme applied to soybeans in Ukraine. Two foliar applications were used.

Yield results:

Treatment	Bean yield	Yield change
	tons/ha	ton/ha
1. Control	1.81	—
2. Vitazyme	2.43	0.62 (+34%)

Yield increase in soybean yield with Vitazyme: 34%



Income increase: The extra yield of soybeans gave an increased income of $250/ha.
Conclusions: This Ukrainian soybean study revealed that only two 0.5 liter/ha Vitazyme applications, one at flower pod formation and another at mid-pod filling, gave an excellent bean yield increase of 34%. This yield enhancement translated to an income increase of $250/ha, revealing the great efficacy of this product for soybean culture in Ukraine.

Soybeans *with Vitazyme application*

Researcher: Vadim Plotnikov
Research organization: PJSC "Zlagoda", Ukraine, Plant Designs, New York, USA, and Agro Expert International, Ukraine
Location: Onufriivka District, Kirovograd Region, Vyshnivtsi Village, Ukraine
Variety: ES Mentor (generation 1)
Seeding rate: 0.6 million seeds/ha
Planting date: May 5, 2017
Previous crop: wheat
Soil type: dark-brown podzolic; humus=2.6%
Soil preparation: disking to 6-8 cm, plowing to 22-24 cm, harrowing to 4-5 cm
Experimental design: A soybean field was divided into Vitazyme treated and untreated control areas to determine the efficacy of this product in promoting yield increases.

1 ***Control*** **2** ***Vitazyme***

Fertilization: 21 kg/ha of nitrogen broadcast before planting, and 8-21-21 kg/ha of N-P_2O_5-K_2O in-furrow starter at planting
Vitazyme application: 0.5 liter/ha sprayed on the leaves and soil at flower bud formation (July 5), and 0.5 liter/ha sprayed on the leaves at mid-pod development (July 31)
Growing season weather: dry

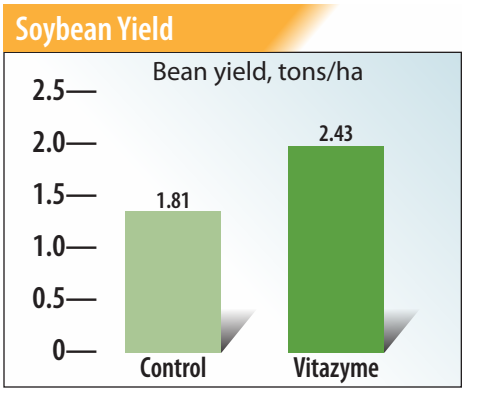
A Ukrainian soybean field displays excellent growth and yield potential after Vitazyme application.

These Ukrainian soybean Rhizobium nodules reveal excellent nodulation, as indicated by the red color (leghemoglobin). Vitazyme assists nodule development and N-fixation.

Yield results:

Treatment	Bean yield	Yield change
	tons/ha	ton/ha
1. Control	1.81	—
2. Vitazyme	2.43	0.62 (+34%)

Yield increase in soybean yield with Vitazyme: 34%



Income results: At a price of $403.23/ton of soybeans, the added 0.62 ton/ha gave an additional $250/ha income.
Conclusions: This soybean field-scale experiment in central Ukraine, during a dry year, using two 0.5 liter/ha foliar applications, revealed an excellent 34% yield increase of 0.62 ton/ha. With this increase bringing the farmer $250/ha more income, the considerable value of the program is readily apparent.

Corn and Soybeans *with Vitazyme application*

Research organization: University of Missouri, School of Natural Resources and Division of Plant Sciences, Columbia, Missouri, USA

Researchers: Robert J. Kremer, Manjula V. Nathan, Paul W. Syltie, Tim Reinbott, Kelly Nelson, and Xiaowei Pan

Introduction: Biostimulants enhance nutrient uptake and crop quality; however, knowledge of effects on soil health is limited (Kremer 2017a). The biostimulant Vitazyme provides several modes of action mediated by multiple active brassinosteroids. Attributes of brassinosteroid-based biostimulants include enhanced root development, improved nutrient uptake efficiency, disease suppression, and environmental stress tolerance (Hayat & Ahmad 2011). Limited research has shown that brassinosteroids may regulate pesticide metabolism in plants (Zhou et al. 2015); however, no information is available on the potential for overcoming stress of the herbicide glyphosate on rhizosphere biology in transgenic (genetically-modified, [GM]) cropping systems. Glyphosate affects rhizosphere microbial diversity and activity, increased fungal root conlonization, decreased beneficial bacterial components, and detrimental effects on crop root growth (Kremer & Means 2009; Wagner et al. 2003). Vitazyme was applied in soybean and maize field trials in Missouri USA during 2014-2017, with and without glyphosate application.

Objectives:

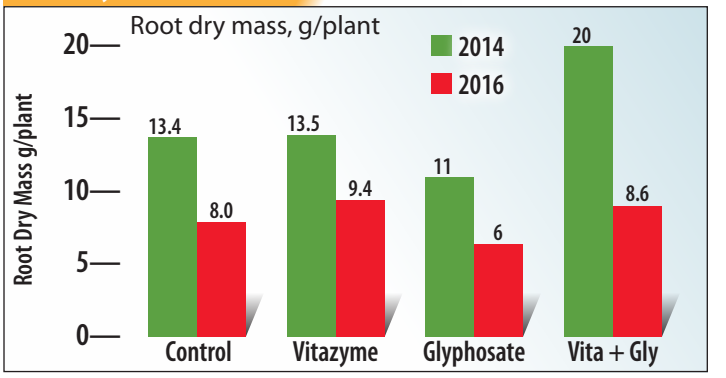
- Determine effects of Vitazyme on selected soil health indicators
- Determine effects of Vitazyme on rhizosphere biology in transgenic soybean and maize receiving glyphosate in field trials
- Determine potential effects of Vitazyme on crop growth in soils with residual glyphosate contents

Experimental design:

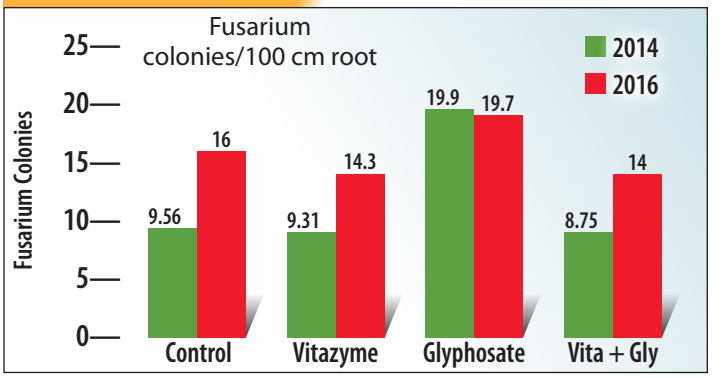
- Field trials conducted at Columbia (2014) and Novelty (2016-17), Missouri, on Mexico sil soil (fine, smectitic, sesic Vertic Epiaqualfs), maize and soybean planted conventionally using minimum tillage; plants and soils collected at R2 soybean and V10 maize growth stage
- Root-colonizing Fusarium assessed by selective culture technique (Levesque et al. 1993)
- Rhizosphere pseudomonads determined using S1 agar medium (Gould et al. 1985)
- Indoleacetic acid-producing (IAA) bacteria detected on nitrocellulose membranes reacted with Salkowski reagent for color development (Bric et al. 1991)
- Mn-transforming bacteria detected on Gerretsen's medium (Huber & Graham 1992)
- Glucosidase activity detected using enzyme assay of Eivazi & Tabatabai (1988)
- Soil microbial components and biomass determined using phospholipid fatty acid (PLFA) analysis (Buyer & Sasser 2012; Pritchett et al. 2011)

Soybean Results:

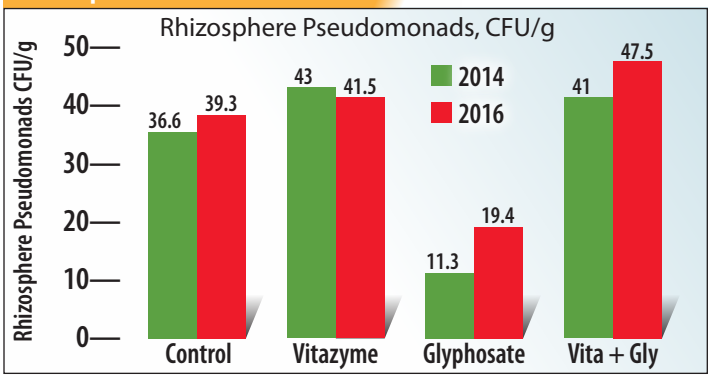
Root Dry Mass



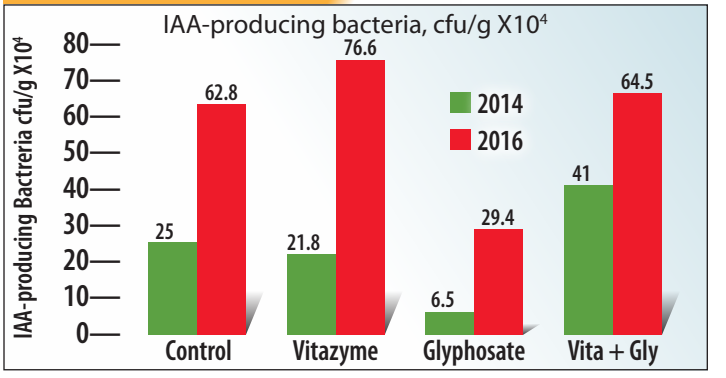
Fusarium

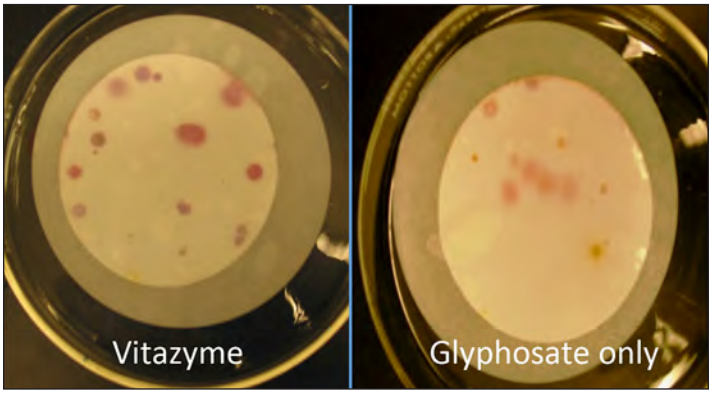


Rhizosphere Pseudomonads



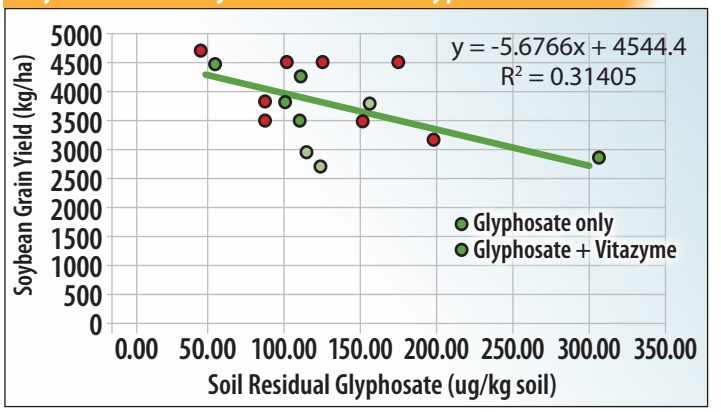
IAA-producing Bacteria





Note how indole acetic acid bacteria, which are detected in the petri dishes by the pink halos they form around the bacteria, are much more numerous in the Vitazyme treated soybean soil inoculum. The bacteria are very beneficial to plant growth.

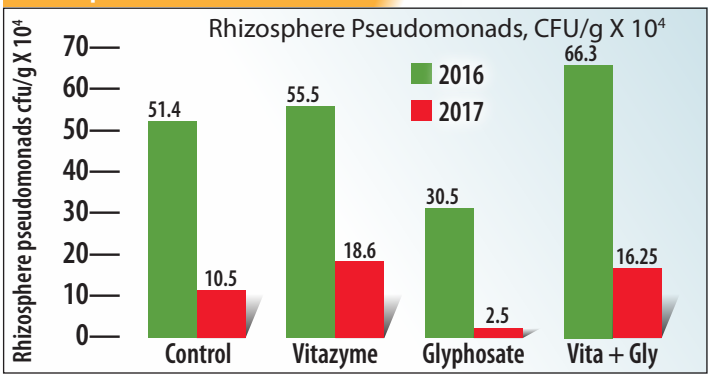
Soybean Yield Projection With Soil Glyphosate



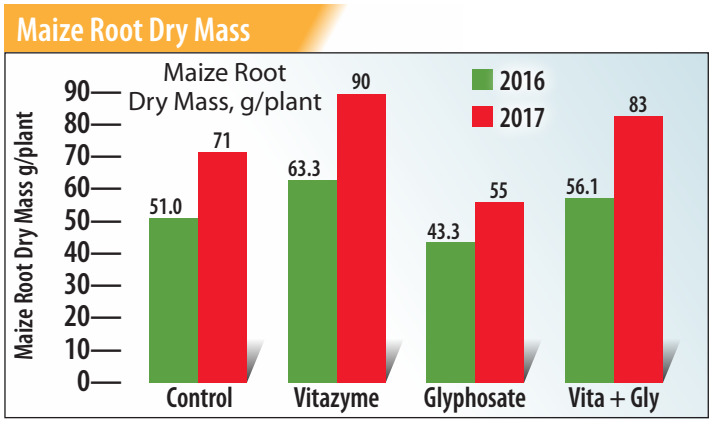
Corn Results:

Note the highly beneficial effect of Vitzyme in enhancing root growth and ear development in this University of Missouri trial..

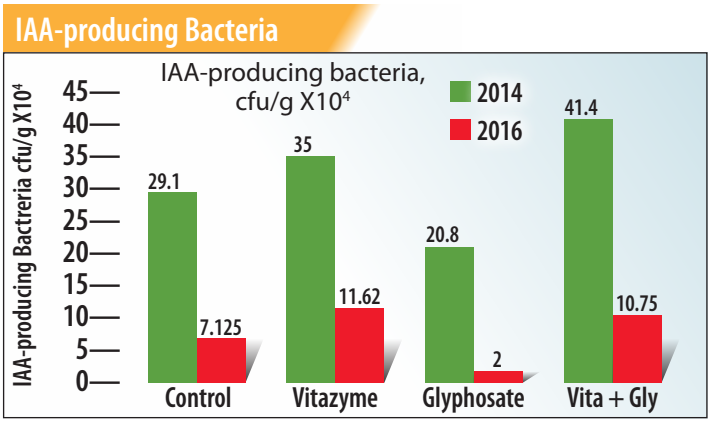
Rhizosphere Pseudomonads



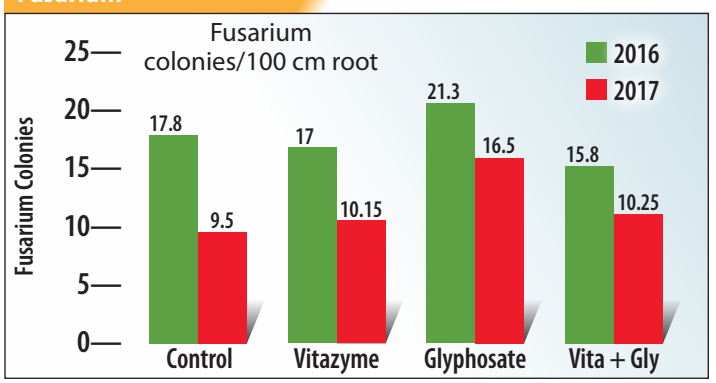
Maize Root Dry Mass



IAA-producing Bacteria

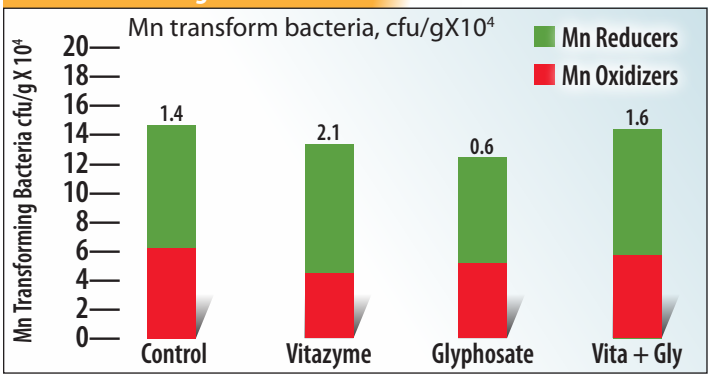


Fusarium

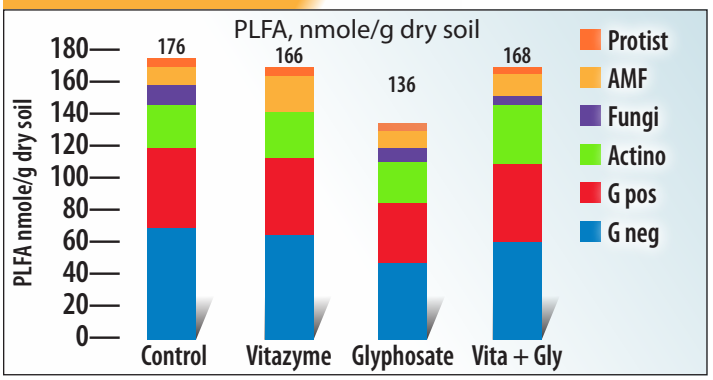


With corn rhizosphere soil samples, the prevalence of Fusarium fungi is much higher when glyphosate is applied to the leaves, but when Vitazyme is added with the glyphosate these fungi are held in check. The same occurs with soybeans.

Mn Transforming Bacteria



PLFA Nmole 2016



Overall results:

Vitazyme-improved soil health indicator and overcame glyphosate effects on maize and soybean at all sites across years:

- Root growth (dry biomass) improved while colonization by potentially pathogenic Fusarium fungi was significantly ($p<0.05$) reduced, root nodulation on soybean improved or did not decrease with glyphosate + Vitazyme.
- Rhizosphere fluorescent pseudomonads, which contribute to beneficial plant growth-promoting funtions, and IAA-producing bacteria, significantly increased in both Vitazyme-treated crops.
- Maintained high Mn reducers to Mn oxidizers ratio, notably in presence of glyphosate, suggesting adequate available Mn (reduced) for plant and microbial uptake and metabolism, and limiting unavailable, immobilized Mn (oxidized) associated with glyphosate and oxidizing bacteria
- Maintained soil microbial community composition (PLFA groups) and total microbial biomass in glyphosate treated crops at similar levels of control, non-glyphosate soils, which tended to improve mycorrhizal component
- Enhanced glucosidase activity, indicator of soil microbial function, in both control and glyphosate treatments

Glyphosate Soil Residues and Grain Yields:

- Residual glyphosate contents in soil ranged from 0 to >1000 ug/kg (ppb) of soil, which was randomly distributed among plots at field sites, regardless of glyphosate application timing
- Soybean grain yields increased 1 to 4% (data not shown)
- No relationship between yields of individual plots with soil glyphosate content was found for maize (2016)
- Apparent relationship between soybean yield in individual plots with soil glyphosate-tendency for lower yield with higher soil glyphosate; Vitazyme may offset potential yield decline due to glyphosate buildup in Mexico silt loam (6 of 8 plots)

Conclusions:

- A polyphasic microbial analysis multiple assesments of sensitive soil health indicators, previously used to evaluate GM crop effects on soil biology and ecology (Kremer & Means 2009), was successfully adapted for evaluating the biostimulant Vitazyme as a means of suppressing effects of glyphosate on root growth and rhizosphere biology in (GM) cropping systems and maintaining or improving soil health.
- Soil microbial diversity based on PLFA analyses was restored by Vitazyme in soils planted to maize and soybean treated with glyphosate; a high microbial diversity is essential to maintain a stable ecosystem and crop productivity (Grayston et al. 1998).
- Glyphosate residue buildup in soils under GM crops is a reality (Kremer 2017b) and may affect crop growth and yields in future seasons. Biostimulants such as Vitazyme might offset effects of residual glyphosate, however more evaluation under rigorous experimental conditions is required to confirm effect.
- Results from this project demonstrate that biostimulants can be a major management factor for addressing recurrent productivity problems and declining soil health associated with GM crops in current crop production systems.

References:

Bric, J.M. Bostock, R.M., Silverstone, S.E., 1991. Rapid in situ assay for indoleacetic acid production by bacteria immobilized on a nitrocellulose membrane. Applied & Environmental Microbiology 57:535-538.

Buyer, J.S., Sasser, M., 2012. High throughput phospholipid fatty acid analysis of soils. Applied Soil Ecology 61:127-130.

Eivazi, F., Tabatabai, M.A., 1988. Glucosidases and galactosidases in soils. Soil Biology & Biochemistry 20:601-606.

Gould, W.D., Hagedorn, C., Bardinelli, T.R., Zablotowicz, R.M., 1985. New selective medium for enumeration and recovery of fluorescent pseudomonads from various habitats. Applied & Environmental Microbiology 49:29-32.

Grayston, S.J., Wang, S.Q., Campell, C.D., Edwards, A.C., 1998. Selective influence of plant species on microbial diversity in the rhizosphere. Soil Biology & Biochemistry 30:369-378.

Hayat, S., Ahmad, A. (eds.), 2011. Brassinosteroids: A Class of Plant Hormone. Springer, London.

Huber, D.M., Graham, R.D., 1992. Techniques for studying nutrient-disease interactions. In Singleton, L.L. et al. (eds.), Methods for Research on Soilborne Phytopathogens, APS Press, St. Paul, MN. pp. 204-214.

Kremer, R.J., 2017a. Biotechnology impacts on soil and environmental services. In Al-Kasai, M., Lowery, B. (eds.), Soil Health and Intensification of Agroecosystems. Elsevier, New York. pp. 353-375.

Kremer, R.J., 2017b. Soil and environmental health after twenty years of intensive use of glyphosate. Advances in Plant & Agricultural Research. 6(5):000224, doi: 1015406/apar2017.0600224.

Kremer, R.J., Means, N.E., 2009. Glyphosate and glyphosate-resistant crop interactions with rhizosphere microorganisms. European Journal of Agronomy 31:153-161.

Levesque, C.A., Rahe, J.E., Eaves, D.M., 1993. Fungal colonization of glyphosate-treated seedlings using a new root-plating technique. Mycological Research 97:299-306.

Pritchett, K.A., Kennedy, A.C., Cogger, C.G., 2011. Management effects on soil quality in organic vegetable

systems in western Washington. Soil Science Society of America Journal 75:605-615.

Wagner, R., Kogan, M., Prada, A.M., 2003. Phytotoxic activity of root absorbed glyphosate in corn seedlings (Zea mays L.). Weed Biology and Management 3:228-232.

Zhou, U., Xia, X., Yu, G., et al., 2015. Brassinosteroids play a critical role in the regulation of pesticide metabolism in crop plants. Scientific Reports 5:9018, doi:10.1038/srep09018

Soybeans *A Study on Synergism with WakeUp Adjuvant*

Researcher: Jerry Carlson
Research organization: Renewable Farming LLC, Cedar Falls, Iowa
Location: Cedar Falls, Iowa
Variety: Asgrow 2431 (2.4 maturity)
Planting date: May 5, 2016
Seeding rate: 140,000 seeds/acre
Row spacing: 30 inches
Experimental design: A 153-acre soybean field of uniform soil types was split in half, with one half treated with Vitazyme and WakeUp Summer (a vegetable-based adjuvant), and the other half serving as the untreated control. The purpose of the study was to evaluate the effect of these two products, applied together on the growth and yield of soybeans, and to see if the results for 2016 would confirm results from 2015.

1 ***Control*** **2** ***Vitazyme + WakeUp Summer***

Fertilization: 2.5 tons/acre of chicken litter spread uniformly over the field in the spring of 2016
Vitazyme and WakeUp Summer application: 13 oz/acre of Vitazyme and 4 oz/acre of WakeUp Summer, mixed together, and sprayed foliar at early bloom on June 24, 2016
Weed control: Ledger on May 6; Flexstar GT+Select on June 14; excellent weed control
Growth results: After product application there were highly visible differences between the two sides of the field. **The treated side was more growthy and lush-appearing, and at senescence the plants remained greener about 7 days longer than the untreated control half of the field.** This required the combine operator to wait a week to combine the treated acres.
Harvest date: October 3, 2016 (control side) and October 10, 2016 (treated side)
Yield results: The moisture content of the soybeans for both halves of the field, though they were harvested a week apart, was 13.6%. A combine monitor on a combine with a 30-foot header recorded the yield of the entire field, as displayed on the accompanying map. Based on the yield monitor printout, the yield is calculated below:

Soybeans treated with Vitazyme produced excellent yields that were amplified by adding Wakeup to the spray solution.

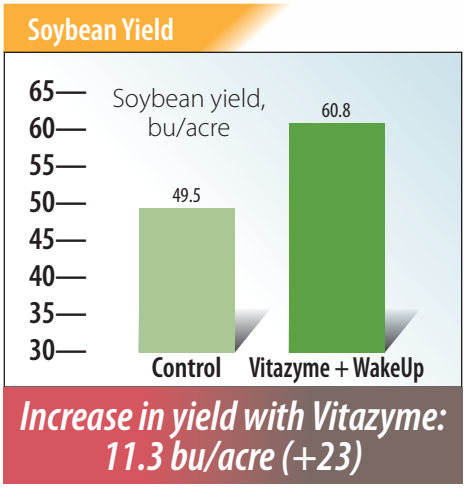
Treatment	Dark green[1]	Light green	Yellow	Orange	Purple	Red[2]
	---------- % of area in the half-field ----------					
Control	1	7	60	14	10	8
Vitazyme + WakeUp	28	32	27	6	5	2

[1]This area is termed > 70.0 bu/acre. A value of 72.0 bu/acre is estimated.
[2]This area is termed < 30.0 bu/acre. A value of 28.0 bu/acre is estimated..

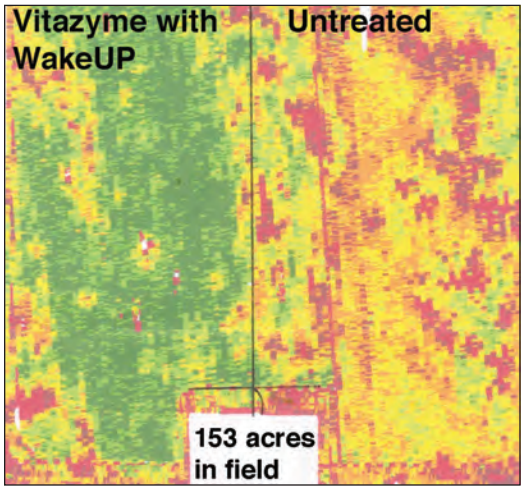
Treatment	Area	Yield[1],	Yield[1],	Yield[1],	Yield[1],	Yield[1],	Yield[1],	Total yield	Yield
		>70	60-70	50-60	40-50	30-40	<30		
	acres	---------- bushels ----------						bushels	bu/acre
Control	76.5	55.1	348.1	2,524.5	482.0	267.8	171.4	3,788.9	49.5
Vitazyme + WakeUp	76.5	1,542.2	1,591.2	1,136.0	206.6	133.9	42.8	4,652.7	60.8

[1]All yield values are calculated as follows: (area) (percent of area/100) x yield for that area. Area yields were estimated at the middle of the range, i.e. the yellow area, having 50 to 60 bu/acre, was assumed to average 55 bu/acre.

This increase in soybean yield was across all soil types. By laying a soils map on top of the yield monitor map, it appears that the same soil type yielded about 10 bu/acre more with Vitazyme + WakeUp Summer.



Conclusions: This soybean trial in a split field arrangement in east-central Iowa revealed that Vitazyme and WakeUp Summer, sprayed foliar at approximately early bloom, improved plant growth and bean yield substantially, by 11.3 bu/acre (23%) on a good crop year. The treated plants showed more aggressive growth and stayed green a week longer than did the untreated control plants. Considering the excellent synergism observed between these two products in a 2015 trial on a nearby farm, wherein Vitazyme increased soybean yield by 5.1 bu/acre and WakeUp Summer added 2.1 bu/acre to this yield, the combination of the two products is seen to be an excellent application for soybeans in eastern Iowa.



Soybean *with Vitazyme application—A Soil Microbiology Study with Roundup (Glyphosate)*

Root deveopment with Vitazyme is excellent compared to the control and the glyphosate treatments, but Vitazyme overcame the negatives of glyphosate and produced an excellent plant response when the two were combined.

Dr. Kremer displays the Vitazyme treated soybeans on the right, which have much better rooting and leaf development than the control plants on the left.

Researcher: Manjula Nathan, Ph.D., and Robert Kremer, Ph.D.
Research institution: University of Missouri Department of Plant and Soil Sciences, and the USDA-ARS, Columbia, Missouri
Location: Greenley Memorial Research Center, Novelty, Missouri
Soil type: clayey
Row spacing: 30 inches
Experimental design: A small plot soybean trial was conducted using four replications and four treatments, to evaluate the effect of Vitazyme and Roundup (glyphosate), alone and in combination, on the yield of soybean, as well as the effects of these products on the rhizosphere soil microbial populations of Fusarium and beneficial bacteria, root mass, and Rhizobium nodulation. Soil residues of glyphosate were also evaluated.

Treatment	In-furrow	Foliar, early bloom
1. Control	0	0
2. Glyphosate	0	36 oz/acre
3. Vitazyme	13/oz/acre	13 oz/acre
4. Vitazyme + Glyphosate	13/oz/acre (Vitazyme only)	13 oz/acre + 36 oz/acre

Fertilization: Nitrogen, phosphorus, and potassium were applied before planting according to soil test recommendations.
Vitazyme application: See the treatment plan.
Glyphosate application: See the treatment plan.
Weed control for the control and Vitazyme treatments: These plots were sprayed with herbicides before planting.
Growing season weather: favorable for soybean growth
Yield results:

Treatment	Yield	Yield change
	bu/acre	bu/acre
1. Control	60.0	—
2. Glyphosate	66.0	6.0 (+10%)
3. Vitazyme	62.4	2.4 (+4%)
4. Vitazyme + Glyphosate	67.0	7.0 (+12%)

Increase in soybean yield

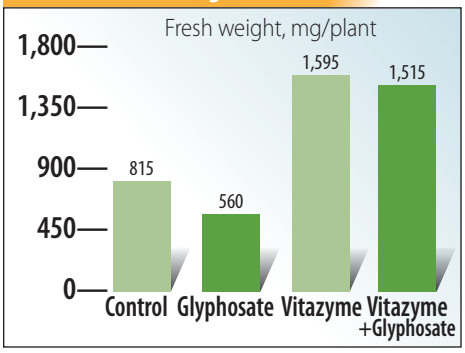
Glyphosate 10%
Vitazyme 4%
Vitazyme + Glyphosate .12%

Yield means were not significantly different, but showed responses for all treatments.

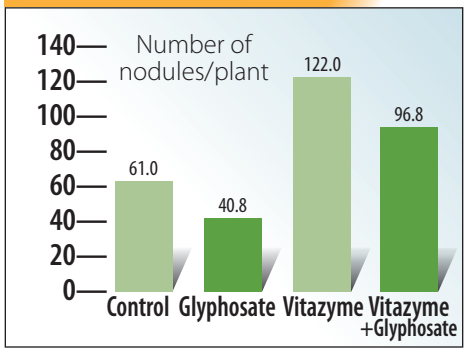
Soybean nodulation results:

Treatment	Nodule fresh weight	Weight change	Nodules/Plant	Nodule change
	mg/plant	mg/plant	nodules	nodules
1. Control	815	—	61.0	—
2. Glyphosate	560	(-) 255 (-31%)	40.8	(-) 2.02 (-33%)
3. Vitazyme	1,595	780 (+96%)	122.0	61.0 (+100%)
4. Vitazyme + Glyphosate	1.515	700 (+86%)	96.8	35.8 (+59%)

Nodule Fresh Weight



Nodule Per Plant



Changes in nodule weight

Glyphosate ..... -31%
Vitazyme .....+96%
Vitazyme+Glyphosate...+86%

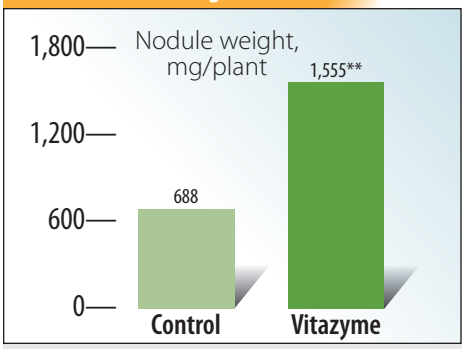
Changes in nodule number

Glyphosate ..... -33%
Vitazyme .....+100%
Vitazyme+Glyphosate...+59%

Although the fresh nodule weight and nodule number means were not significant, the differences were great, with Vitazyme giving the highest values and Vitazyme + Glyphosate being nearly as high as Vitazyme alone. This indicates a remediation affect of Vitazyme on the negative impacts of glyphosate.

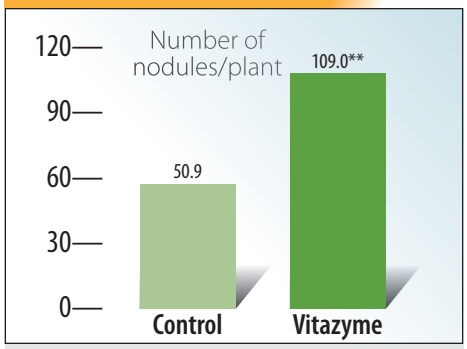
Effect fo Vitazyme on Soybean Nodulation

Nodule Fresh Weight



**Significantly greater than the control at P=0.001.

Nodule Number



**Significantly different than the control at P=0.001.

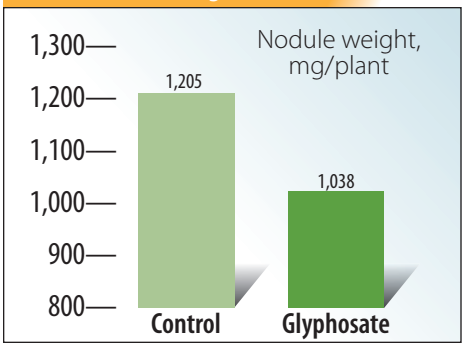
Increase with Vitazyme

Nodule fresh weight...+126%
Nodule number .....+114%

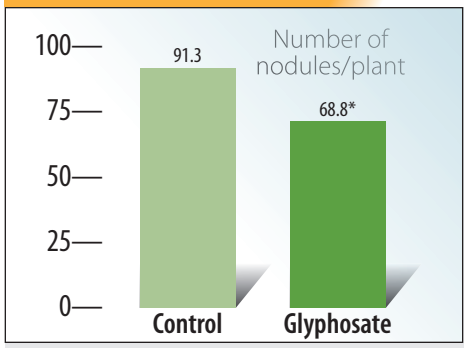
All Vitazyme treated plots were compared with all untreated plots, producing a remarkable increase in nodulation with Vitazmye.

Effect fo Glyphosate on Soybean Nodulation

Nodule Fresh Weight



Nodule Number



*Significantly less than the control at P=0.05.

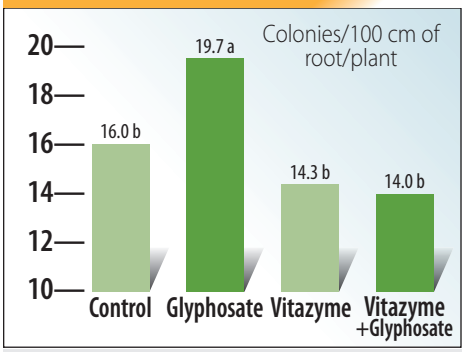
Decrease with Glyphosate

Nodule fresh weight..... -14%
Nodule number ..... -25%

All glyphosate treated plots were compared with all non-glyphosate treated plots. The data reveal that this herbicide reduces soybean nodulation, and thus nitrogen fixation.

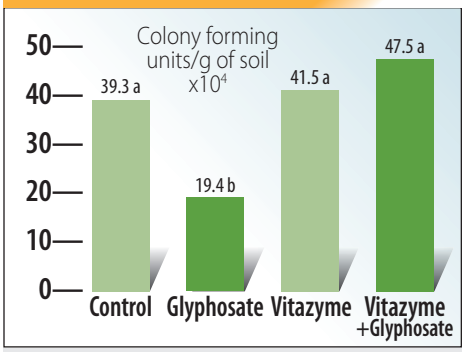
Soil microbial results:

Fusarium Root Colonization[1]



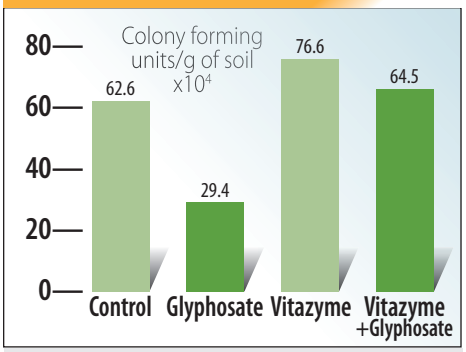
[1]Means followed by the same letter are not significantly different at P=0.05.

Rhizosphere Fluorescent Pseudomonas Colonization[1]



[1]Means followed by the same letter are not significantly different at P=0.05.

Rhizosphere IAA-Producing Bacteria Colonization[1]



[1]Means followed by the same letter are not significantly different at P=0.05.

Changes in Fusarium Colonization

Glyphosate ..... +23%
Vitazyme ..... -11%
Vitazyme + Glyphosate... -13%

Changes in Fluorescent Pseudomonas Colonization

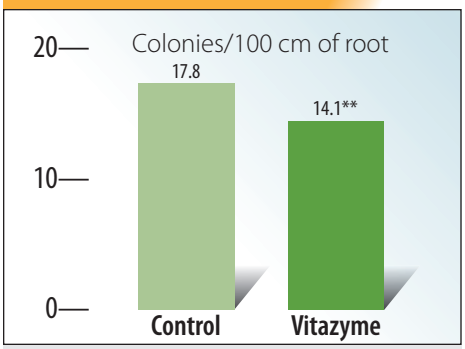
Glyphosate ..... -51%
Vitazyme ..... +6%
Vitazyme + Glyphosate... +21%

Changes in IAA-Producing Bacteria Colonization

Glyphosate ..... -53%
Vitazyme ..... +22%
Vitazyme + Glyphosate..... +3%

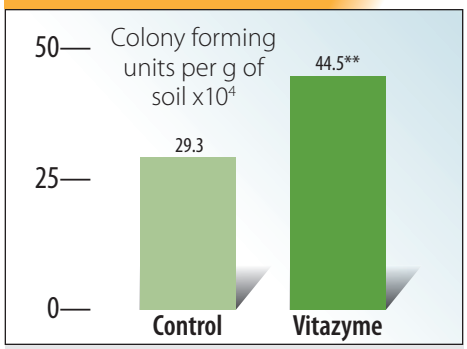
Vitazyme Effects on Fusarium and Beneficial Organism Colonization

Fusarium



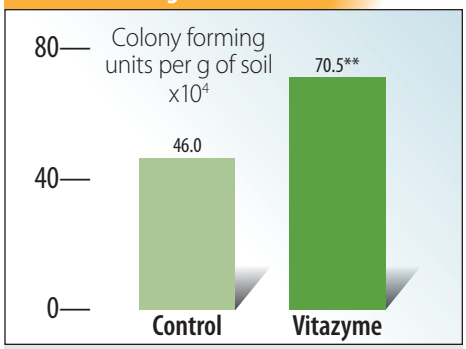
**Significantly less than the control at P=0.001.

Fluorescent Pseudomonas



**Significantly greater than the control at P=0.001.

IAA-Producing Bacteria



**Significantly greater than the control at P=0.001.

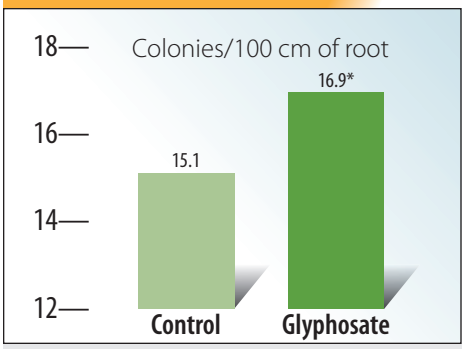
Changes with Vitazyme

Fusarium ..... -21%
Fluorescent Pseudomonas ... +52%
IAA-Producing Bacteria .... +53%

All Vitazyme treated plots were compared with all untreated plots, showing a highly significant reduction in Fusarium colonies and highly significant increases in beneficial bacteria.

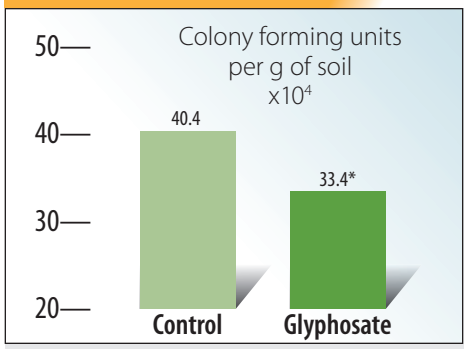
Glyphosate Effects on Fusarium and Bacterial Organism Colonization

Fusarium



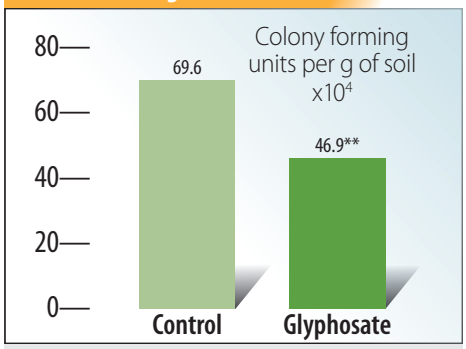
*Significantly greater than the control at P=0.061.

Fluorescent Pseudomonas



*Significantly less than the control at P=0.053.

IAA-Producing Bacteria



**Significantly less than the control at P=0.001.

Changes with Glyphosate

Fusarium ..... +12%
Fluorescent Pseudomonas .....-17%
IAA-Producing Bacteria ..... -33%

All glyphosate treated plots were compared with all non-glyphosate plots, which reveals an increase in the incidence of Fusarium colonization while beneficial bacteria are substantially reduced.

Fatty Acids, Oxidizers, Reducers, Glyphosate, and Enzyme Levels in Rhizosphere Soil

Treatment	TPLFA[1]	Mn Oxidizers[2]	Mn Reducers[3]	Red/Ox Ratio[4]	Glyphosate[5]	B-Glucosamine Activity[6]
	nm/g soil	cfu/g soil x10³	cfu/g soil x10³	cfu/g soil x10³	ug/kg soil	ug PNP/g soil/hr
1. Control	156	6.25	9.72	1.57	185	132
2. Glyphosate	87 (-44%)	7.18 (+15%)	2.63 (-73%)	0.39 (-75%)	135 (-27%)	103 (-22%)
3. Vitazyme	106 (-32%)	5.23 (-16%)	10.8 (+11%)	2.17 (+38%)	98 (-47%)	158 (+20%)
4. Vitazyme + Glyphosate	108 (-31%)	8.57 (+37%)	14.9 (+53%)	1.77 (+13%)	105 (-43%)	175 (+33%)
P>F	0.071	0.334	**0.015**	**0.027**	0.419	0.107

[1]TPLFA = total phospholipid fatty acids; [2]manganese oxidizing bacteria; [3]manganese reducing bacteria; [4]ratio of manganese reducing to oxidizing bacteria; [5]soil glyphosate levels; [6]soil level of this enzyme.

Vitazmye Effects on Fatty Acids, Oxidizers, Reducers, Glyphosate, and Enzymes

Treatment	TPLFA	Mn Oxidizers	Mn Reducers	Red/Ox Ratio	Glyphosate	B-Glucosamine Activity
	nm/g soil	cfu/g soil x10³	cfu/g soil x10³	cfu/g soil x10³	ug/kg soil	ug PNP/g soil/hr
1. Control	121	6.72	6.17	0.980	160	118
2. Vitazyme	107(-13%)	6.90 (+3%)	12.9* (+109%)	1.97**(+101%)	101(-37%)	167*(+42%)
P>F	0.432	0.878	**0.006**	**0.001**	0.118	**0.006**

*Significantly different than the control at P=0.01; **Significantly different than the control at P=0.001.

All Vitazyme treated plots were compared with untreated plots. Note the great increase in the beneficial manganese oxidizers, that convert Mn to its divalent plant available form. This gave rise to a higher Mn reduced/Mn oxidized ratio. Soil enzyme levels were also increased with Vitazyme. Soil glyphosate levels were reduced by 37% overall with Vitazyme.

Glyphosate Effects on Fatty Acids, Oxidizers, Reducers, Glyphosate, and Enzymes						
Treatment	**TPLFA**	**Mn Oxidizers**	**Mn Reducers**	**Red/Ox Ratio**	**Glyphosate**	**B-Glucosamine Activity**
	nm/g soil	cfu/g soil x10^3	cfu/g soil x10^3	cfu/g soil x10^3	ug/kg soil	ug PNP/g soil/hr
1. Control	131	5.74	10.3	1.87	141	145
2. Glyphosate	97 (-26%)	9.88 (+72%)	8.78 (-15%)	1.08**(-42%)	120 (-15%)	139 (-4%)
P>F	0.079	0.104	0.449	**0.001**	0.538	0.669

*Significantly less than the control at P=0.001..

All glyphosate treated plots were compared with non-glyphosate plots, resulting in fewer phospholipid fatty acids, more manganese oxidizers, and fewer manganese reducers, showing the nature of this herbicide to make Mn less available, as evidenced by the lower Red/Ox ration.

Conclusions: A University of Missouri replicated soybean study showed that Vitazyme, when applied with glyphosate herbicide for the foliar application, did an excellent job remediating the damage done by the herbicide to soil and root organisms. While glyphosate increased Fusarium damage (+12%), Vitazyme reduced the incidence (-21%). Conversely, beneficial soil microbes like Fluorescent Pseudomonas were increased by 52% with Vitazyme and reduced by 17% by glyphosate; IAA-producing bacteria were increased by 53% with Vitazyme and decreased by 33% with glyphosate. Combining the two products moved both pathogenic and beneficial organism levels to near the control levels. Soybean nodule fresh weight and number were also greatly enhanced by Vitazyme treatment (96 and 100%, respectively), while Vitazyme coupled with glyphosate brought nodule parameters nearly to the levels for Vitazyme; glyphosate alone greatly crippled nodulation. The highly important manganese reducing bacteria were enhanced by Vitazyme but inhibited by glyphosate; when the two were combined, the reducing bacteria increased even above the Vitazyme alone, to 53% above the control. Soil enzyme activity was also enhanced with Vitazyme—by 20% above the control—while this enhancement increased to 33% when paired with glyphosate. Glyphosate alone reduced enzyme level by 22%. The best soybean yield increase was with Vitazyme+glyphosate, a 12% (7 bu/acre) improvement about the control. These results are similar to those produced in 2014 at the University of Missouri Bradford Research Center, and show the great efficacy of Vitazyme to reduce the harmful effects of glyphosate on soybean nodulation and rhizosphere microbial populations.

Soybeans *with Vitazyme application*

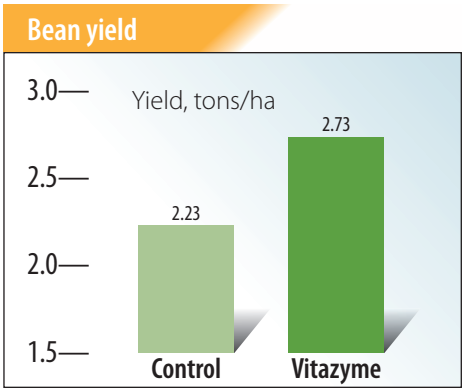
Researcher: V. V. Plotnikov
Research institution: Agro Expert International, Vinnytsya, Ukraine
Location: State Enterprise Research Farm Drabivske, Drabovo-Bariatynske Village, Drabiv District, Cherkasy Region, Ukraine
Variety: Diamond, selected seed
Planting date: April 29, 2016
Seeding rate: 750,000 seeds/ha
Previous crop: winter wheat
Soil type: Chernozem (3.9% organic matter)
Cultivation: disking to 6-8 cm, plowing to 20-22 cm, harrowing, and cultivation to 4-5 cm
Rainfall: 500-550 mm
Experimental design: A soybean field was divided into a Vitazyme treated and untreated area, with the objective of determining the effect of this product on the yield and quality of the beans.
Fertilization: at planting; 16-16-16 kg/ha of N-P_2O_5-K_2O in-row
Vitazyme application: 1.0 liter/ton on the seeds before planting, on April 24, 2016; 0.5 liter/ha on the leaves and soil at early bloom, on June 23, 2016

❶ ***Control*** ❷ ***Vitazyme***

Yield results:

Treatment	Bean yield	Yield change
	tons/ha	tons/ha
Control	2.23	—
Vitazyme	2.73	0.50 (+22%)

Increase in bean yield with Vitazyme: 22%



Income results: Vitazyme increased net profit by 184 USD/ha.
Conclusions: A soybean split-field trial in central Ukraine, on Chernozem soil, revealed that 1 liter of Vitazyme per ton of seed, coupled with a 0.5 liter/ha foliar and soil spray, increased the yield by 22%, a great response that should assure farmers of the viability of this new technology. The yield increase produced a greater net return of 184 USD/ha as well.

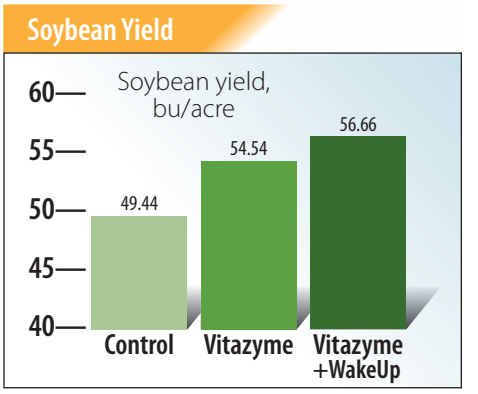
Soybeans *A Synergism Study with WakeUp*

Researcher: Jerry Carlson
Research organization: Renewable Farming LLC, Cedar Falls, Iowa
Location: Cedar Falls, Iowa
Variety: Pioneer 92M72
Planting date: May 29, 2015
Previous crop: Corn
Experimental design: A soybean field was selected to provide strips six rows wide and 350 feet long (0.121 acre), with five strips for the Vitazyme and Vitazyme + WakeUp treatments, and six strips for the untreated control. The objective of the study was to discover a possible interaction between Vitazyme and WakeUp to improve the yield response.

1 ***Control*** **2** ***Vitazyme*** **3** ***Vitazyme + WakeUp***

Fertilization: unknown
Vitazyme application: 13 oz/acre on July 8, with or without WakeUp Summer
WakeUp application: WakeUp Summer was applied along with Vitazyme at 5 oz/acre on Treatment 3 on July 8. WakeUp Summer is a surfactant made from vegetable origin that reduces water surface tension and "clear coats" leaves, cleans and softens the leaf cuticle for nutrient absorption, pulls nutrient ions into plants quicker, and reduces plant sap surface tension for more rapid movement of phloem solutes.
Weed control: Pre-emergent herbicide on May 28; Rhythm post-emergence on June 27; cultivation on July 1.
Harvest date: October 20, 2015
Growing season weather: favorable
Yield results: All plots are averaged for each treatment.

Treatment	Beans yield	Yield Change
	bu/acre	bu/acre
Control	49.44 b	--
Vitazyme	54.54 a	5.10 (+10%)
Vitazyme + WakeUp	56.66 a	7.22 (+15%)
Standard error:	1.67 (Vitazyme) 1.67 (Vitazyme + WakeUp) 1.56 (Control)	
Control vs. Vitazyme + WakeUp: P(0.10)=0.0018 Control vs. Vitazyme: P(0.10)=0.0131 Vitazyme vs. Vitazyme + WakeUp: P(0.10)=0.2421		
Statistics were performed using the Statistical Analysis System.		



Increase in bean yield

Vitazyme alone 10%
Vitazyme + WakeUp.....15%

Moisture and test weight results: Bean moisture at harvest varied from 8.55 to 8.60%, and test weight from 56.17 to 56.82 lb/bu, so were not significantly different.
Conclusions: A soybean trial in east-central Iowa, using Vitazyme and Vitazyme + WakeUp in 0.121-acre field strips, with six equal-sized control strips, revealed that Vitazyme significantly (P=0.0131) boosted bean yield (5.10 bu/acre, or 10%) over the control. WakeUp boosted yield even further, producing a synergism with Vitazyme by increasing yield another 2.12 bu/acre over Vitazyme alone for a 15% yield improvement. This increase was significant at P=0.0018. These results show that Vitazyme, applied at bloom, can significantly improve soybean yield, and WakeUp Summer applied with it can improve the yield even more. This product combination holds great promise for soybean production in Iowa.

Soybeans *A Soil Microbiology Study with Roundup (Glyphosate)*

A soybean trial at The University of Missouri Bradford Research Center proved that Vitazyme can reverse the negative effects of glyphosate on soil microbiology and root growth.

Besides improving rhizosphere microflora and reducing glyphosate residues, Vitazyme increased branching and pod formation by up to 131%.

Researcher: Manjula Nathan, Ph.D., and Robert Kremer, Ph.D.

Research institution: University of Missouri Department of Plant and Soil Science, and the U.S.D.A.-A.R.S., Columbia, Missouri

Location: Bradford Research Center, Columbia, Missouri

Variety: Asgrow 3832 (GMO)

Planting rate: 150,000 seeds/acre

Row spacing: 30 inches

Planting date: May 24, 2014

Experimental design: A replicated soybean trial was arranged with four replications and four treatments, using plots that were 4 rows (10 feet) x 200 feet. A randomized complete block design was used. Glyphosate (Roundup) was applied to two of the treatments to evaluate the effects of the product alone, as well as with Vitazyme, to note the potential of Vitazyme to remediate the toxic effects of glyphosate. These effects were measured by a number of factors including root Rhizobium Nodulation, root mass, rhizosphere microbial biomass, Fusarium root colonization, and populations of Pseudomonas and indoleacetic acid- producing bacteria in the rhizosphere. Glyphosate residues in the soil were also measured.

Treatment	Vitazyme	Glyphosate
1. Control	0	0
2 Vitazyme	x	0
3. Glyphosate	0	x
4. Vitazyme +Glyphosate	x	x

Fertilization: Nitrogen, phosphorus, and potassium were applied according to soil test recommendations. Thus, the required amount of O-46-62% N-$P_2 0_5$-$K_2 0$ was applied before planting;

Vitazyme application: (1) 13 oz/acre (1 liter/ha) applied on the seeds before planting; (2) 13 oz/acre (1 liter/ha) sprayed on the leaves and soil at early bloom, on July 18

Glyphosate application: On July 24, 36 oz/acre of Roundup herbicide was sprayed on appropriate plots. Any surviving weeds were hand pulled.

Weed control for the control and Vitazyme treatments: The entire field plot area was sprayed before planting with 1.25 pint/acre of Dual II magnum herbicide + 3 oz/acre of Fierce herbicide.

Growing season weather: favorable for soybean growth

Harvest date: October 23, 2014

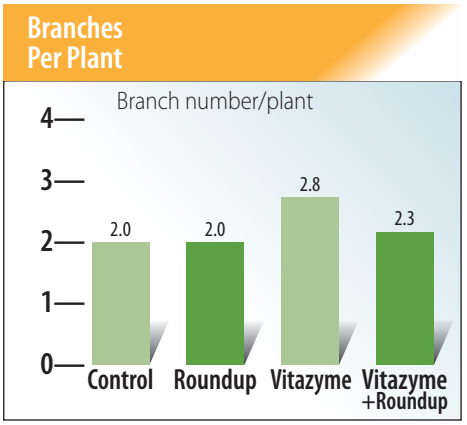
Yield results: Yield differences among the four treatments were not significant.

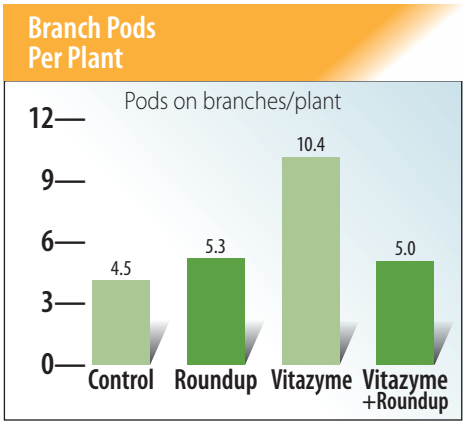
Plant characteristic results: Means followed by the same letter are not significantly different at P=0.05.

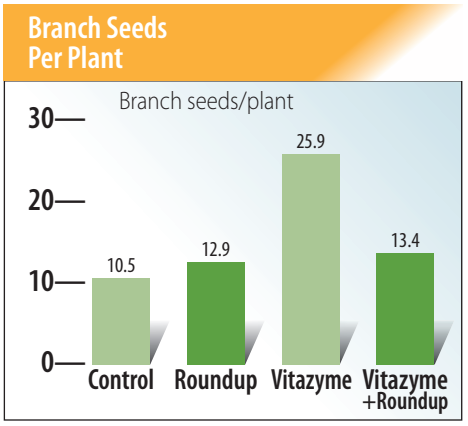
Soybeans *A Soil Microbiology Study with Roundup (Glyphosate) cont.*

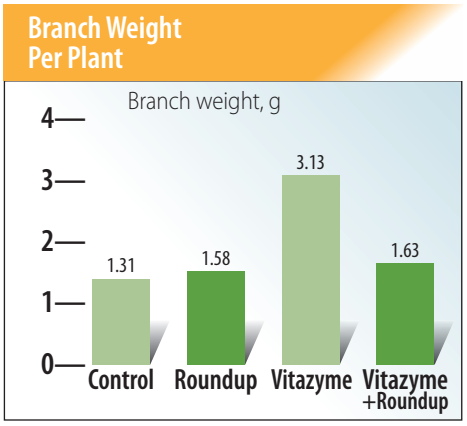
Treatment	Nodes/plant	Main stem pods/plant	Branches/ plant	Change	Branch pods/ plant	Change	Main stem seeds/plant
Control	15.3	28.0	2.0 b	--	4.5 b	--	78
Roundup	16.2	31.4	2.0 b	0	5.3 b	0.8 (+18%)	84
Vitazyme	16.0	31.3	2.8 a	0.8 (+40%)	10.4 a	5.9 (+131%)	89
Vita + Roundup	15.6	29.3	2.3 b	0.3 (+15%)	5.0 b	0.5 (+11%)	79

Treatment	Branch seeds/plant	Change	Main stem seed wt./plant	Branch wt./plant	Change	Main stem seeds/pod	Branch seeds/pod	Main stem seed wt.	Branch seed wt.
				grams	grams			grams	grams
Control	10.5 b	--	9,3	1.31 b	--	2.8	2.4	0.121	0.123
Roundup	12.9 b	2.4 (+23%)	10.3	1.58 b	0.27 (+21%)	2.6	2.4	0.123	0.117
Vitazyme	25.9 a	15.4 (+147%)	10.8	3.13 a	1.82 (+139%)	2.8	2.4	0.121	0.120
Vita + Roundup	13.4 b	2.9 (+28%)	10.4	1.63 b	0.32 (+24%)	2.7	2.4	0.131	0.132









Changes in Plant Characteristics				
	Branches/plant	Branch pods/plant	Branch seeds/plant	Branch wt./plant
Roundup only	0	+18%	+23%	+21%
Vitazyme only	+40%	+131%	+147%	+139%
Vita + Roundup	+15%	+11%	+28%	+24%

Vitazyme greatly increased soybean branching, and the number of pods and seeds on these branches. This fact is reflected in a huge increase in branch weight per plant.

Soil microbial biomass and community structure results:
All values are in nm/g of soil. Means followed by the same letter are not significantly different at P=0.05.

Soybeans *A Soil Microbiology Study with Roundup (Glyphosate) cont.*

Treatment	TPLFA[1]		TBACT[2]		GNEG[3]		GPOS[7]		Anaerobes	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	pico moles /g dry soil		cfu/g soil		cfu/g soil		cfu/g soil		cfu/g soil	
Control	199	15.6	132 a	25.5	68.8	9.6	41.4	3.63	2.33	0.32
Roundup	201	47.1	123 ab	22.0	87.1	21.5	38.3	5.65	2.15	0.40
Vitazyme	193	41.1	107 b	14.2	64.2	17.9	38.3	4.20	1.95	0.13
Vita + Roundup	243	36.9	148 a	17.3	103.0	15.9	42.4	6.50	2.35	0.48
Probability>F	0.26		0.017		0.233		0.215		0.074	

Treatment	Actinomycetes		Total fungi		AM fungi[5]		Eukaryote bacteria	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	cfu/g soil		cfu/g soil		cfu/g soil		cfu/g soil	
Control	21.1	2.17	6.03	1.60	9.18	0.71	4.33	0.98
Roundup	19.9	2.14	11.40	2.10	7.15	1.00	3.73	1.06
Vitazyme	19.4	2.62	6.90	0.96	10.10	1.09	3.80	1.34
Vita + Roundup	20.3	2.60	12.80	3.12	9.48	0.50	5.13	0.83
Probability>F	0.452		0.810		0.143		0.121	

[1]TPLFA=total phospholipid fatty acids; [2]TBACT=total bacteria; [3]GNEG=gram negative bacteria; [4]GPOS=gram positive bacteria; [5]AM fungi=arbuscular mycorrhizal fungi. Std. Dev.=Standard Deviation.

Most values among the microbial community structure were not significantly different at P=0.05.

Only total bacteria was significant, and anaerobic bacteria mean differences were almost significant.

Soil biological and glyphosate residue measurement results: Means followed by the same letter are not significantly different at P=0.05.

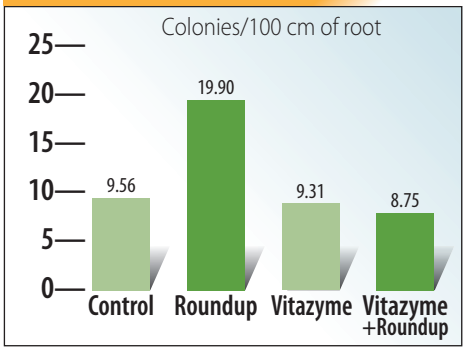
Treatment	Fusarium colonization		RFP[1]		RIPB[2]		SNFW[3]		SRDW[4]	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	colonies/100 cm root		cfu/g dry soil x 10^4		cfu/g dry soil x 10^4		g/plant		g/plant	
Control	9.56 b	0.83	36.6	15.0	25.0	5.72	6.31	2.29	13.4 b	3.34
Roundup	19.90 a	2.55	11.3	3.33	6.5	1.29	4.72	0.73	11.0 b	1.56
Vitazyme	9.31 b	0.59	43.0	9.73	21.8	10.30	6.96	0.87	13.5 b	0.78
Vita + Roundup	8.75 b	1.62	41.0	8.13	15.0	5.77	7.08	1.19	20.0 a	5.12
Probability>F	0.001		0.065		0.121		0.202		0.025	

Treatment	MNOX[5]		MNRED[6]		RORatio[7]		GRRS[8]	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	cfu/g soil		cfu/g soil				ug/g dry soil	
Control	18.4 b	5.01	13.0	3.76	0.72 a	0.13	68.0	27.1
Roundup	87.9 a	17.50	12.3	1.71	0.14 b	0.04	179.0	86.6
Vitazyme	25.3 b	9.22	21.4	6.90	0.86 a	0.05	64.7	20.3
Vita + Roundup	33.6 b	14.10	19.8	6.56	0.61 a	0.11	142.0	47.2
Probability>F	0.001		0.858		0.005		0.464	

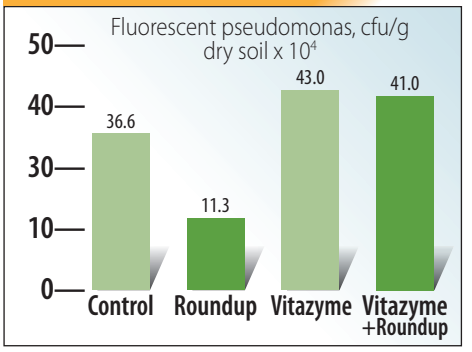
[1] RFP=rhizosphere fluorescent pseudomonas bacteria; [2] RIPB=rhizosphere IAA-producing bacteria; [3] SNFW=soybean nodule fresh weight; [4] SRDW=soybean root dry weight; [5] MNOX=manganese oxidizing bacteria; [6] MNRED=manganese reducing bacteria; [7] Mn reducing/Mn oxidizing ratio; [8] GRRS=glyphosate residue.

Soybeans *A Soil Microbiology Study with Roundup (Glyphosate) cont.*

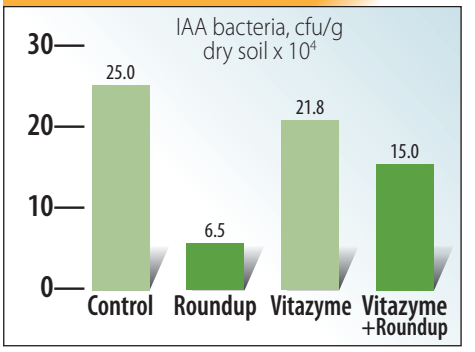
Fusariuam Colonization



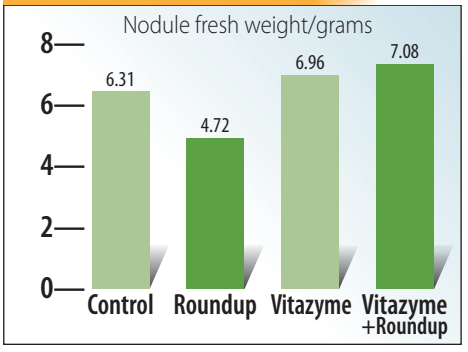
Rhizosphere Fluorescent Pseudomonas Bacteria



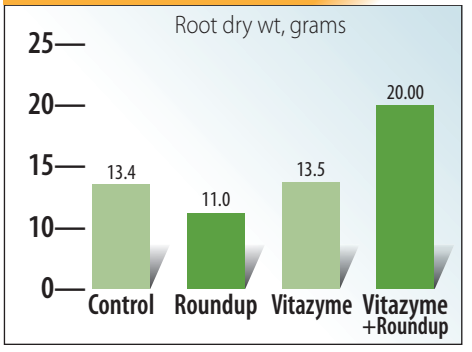
Rhizosphere Indole Acetic Acid Producing Bacteria



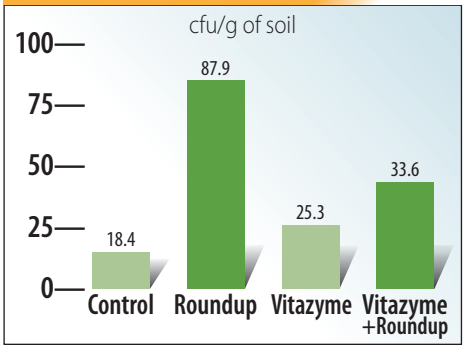
Soybean Nodule Fresh Weight



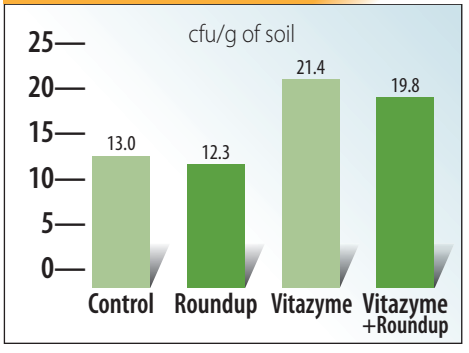
Soybean Root Dry Weight



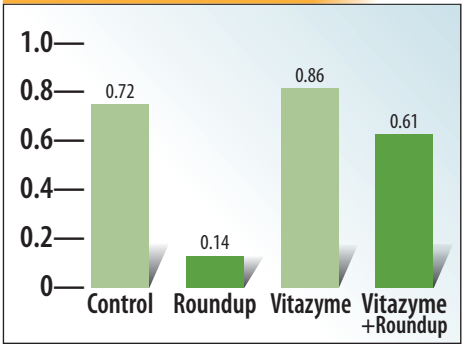
Manganese Oxidizing Bacteria



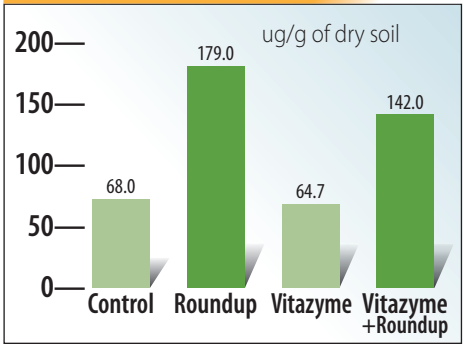
Manganese Reducing Bacteria



Manganese Reducing/ Manganese Oxidizing Ratio



Soil Glyphosate Residue



Changes in Parameters vs. the Control			
Parameter	Roundup only	Vitazyme only	Vitazyme + Roundup
Fusarium colonization	+108%	-3%	-8%
Rhizosphere Fluorescent Pseudomonas	-69%	+17%	+12%
Rhizosphere IAA-producing bacteria	-74%	-13%	-40%
Soybean nodule fresh weight	-25%	+10%	+12%
Soybean dry root weight	-18%	+1%	+49%
Manganese oxidizing bacteria	+378%	+38%	+83%
Manganese reducing bacteria	-5%	+65%	+52%
Ratio of Mn reducing/Mn oxidizing bacteria	-81%	+19%	-15%
Soil glyphosate residue	+163%	-5%	+109%

Soybeans *A Soil Microbiology Study with Roundup (Glyphosate) cont.*

Note that Vitazyme overcame the suppressive effects of Roundup on beneficial soil bacteria (Fluorescent Pseudomonas and IAA-producing bacteria), as well as the beneficial manganese (Mn) reducing bacteria, which change manganese to the soluble +2 oxidation state for plant root uptake; the Mn oxidizing bacteria make the element insoluble and unavailable for plant use. The ratios of these Mn bacteria reflect these effects. Fusarium root colonization was greatly increased with Roundup, but totally alleviated by Vitazyme with Roundup. Roundup negatively impacted root and nitrogen-fixing nodule weights, while Vitazyme increased these two parameters, alone and especially along with Roundup for root weight. Vitazyme reduced glyphosate residues in the soil by 54 percentage points compared to glyphosate alone. These results show how beneficial Vitazyme is to reduce the negative impacts of Roundup in the rhizosphere.

Discussion and conclusions: The following text is by Manjula Nathan, Ph.D.

Soybean yield was not significantly affected by Vitazyme treatment in 2014. However, there was a significant difference in the number of branches and branch pods per plant with Vitazyme treatment which resulted in more branch seeds and seed weight. Treatment with glyphosate reduced the number of branches and pods on branches in the Vitazyme treatment to that of the control. These results are interesting since Schon and Blevins (1990) in Missouri at the Bradford Research Center showed that foliar boron treatments also increased the number of soybean branches and branch pods/branch. The number of branches on soybeans will be affected by several factors including light penetration into the canopy, but also from the auxin/cytokinin balance in the plant. Unpublished field research by Reinbott and Blevins found that foliar and intravenous cytokinin application also increased branch and branch pod number on soybean. Cytokinins are produced at the plant root tips, so a large root system with more root tips could result in more soybean branching and pods per branch. In this case, Vitazyme could be stimulating root growth resulting in more branches and branch pods. However, this stimulus is lost when glyphosate is applied.

Soybean Root Growth and Nodulation

Previous studies revealed detrimental effects of glyphosate on nodulation and root development in soybean grown on Mexico silt loam (Kremer and Means, 2009), the same environment for the current study. Glyphosate alone reduced root biomass relative to no-glyphosate treatment and, interestingly, Vitazyme appeared to counteract the inhibitory effects, resulting in significantly greater root biomass, and might stimulate root growth. Similar effects were observed for nodule biomass, although the increased biomass for Vitazyme was not significant, which may be due to variability in the replicate values. Nodule biomass serves as an indicator of effective nitrogen fixation of the Bradyrhizobium-soybean symbiosis; we did not measure actual nitrogen fixation by assay such as acetylene reduction, but prior experience has shown that nodule biomass correlates positively with acetylene reduction.

Soil Residual Glyphosate

Little information is currently available on glyphosate residues in soils resulting from prior application of Roundup herbicide in row crops. This is likely due to the popular assumption that glyphosate is readily dissipated, immobilized, and degraded in the environment. Results of this study show that glyphosate is indeed remaining in soil at detectable levels (ug glyphosate/g dry soil is equivalent to ppb). We analyzed rhizosphere soil because we previously demonstrated that glyphosate is actively released by treated soybean plants through roots (Kremer et al., 2005). An interesting revelation in this study is that although glyphosate was not applied to half the plots in 2014, residual chemical was detected suggesting that glyphosate was carried over from previous applications on this field site. Furthermore, the concentrations in plots receiving 2014 application were two to three times that in plots without glyphosate. Statistical analysis did not detect significant differences among the treatments, likely due to high variability in glyphosate concentrations from plots receiving applications, ranging from 91 to >300 ug/g of soil. More intensive sampling might reduce this variability. Nevertheless, results suggest that glyphosate is released in relatively high amounts through roots during the year of application, or it may accumulate over seasons. The latter possibility can be tested in 2015 by follow-up soil analysis from the 2014 plots. Based on results of the 2014 study, Vitazyme seems to have a slight, although non-significant, effect in reducing glyphosate in the soybean rhizosphere.

Microbiological Assays

We have consistently documented considerable increases in Fusarium root colonization, and a decrease in beneficial microorganisms in glyphosate-resistant soybean and corn with use of Roundup (Kremer and Means, 2009; Means and Kremer, 2007; Zobiole et al., 2010). Although Fusarium is a ubiquitous group of soil fungi, many species are opportunistic phytopathogens and may cause economically important diseases including wilts, root rots, and sudden death syndrome in soybean under optimum environmental conditions. Thus, a high root colonization by Fusarium species indicates a high potential for disease development. The 2014 soybean study confirmed that glyphosate treatment leads to high Fusarium root colonization relative to soybean not receiving glyphosate. Vitazyme treatment significantly reduced colonization in glyphosate treated soybean, possibly through improved root growth or stimulation of other microorganisms that suppress Fusarium growth and root colonization. The increases in the beneficial rhizobacteria,

Soybeans *A Soil Microbiology Study with Roundup (Glyphosate) cont.*

fluorescent Pseudomonas spp. and indole acetic acid (IAA)-producers, confirm this interaction of Fluorescent Pseudomonas spp. represent a group of Gram-negative bacteria that produce antibiotics , plant-growth-regulation compounds, and nutrient acquisition substances that benefit plant growth and development. The IAA producing bacteria stimulate root growth and aid in plant nutrient uptake. These bacterial groups were suppressed by glyphosate in 2014, confirming previous studies. Vitazyme appeared to overcome glyphosate effects although not significant at P=0.05; however, it is of interest to follow up to determine the impact of the product on potentially remediating effects of glyphosate on the rhizosphere microbial dynamics.

Microbial Community Characterization

Characterization of soil microbial groups indicates relative functioning of biological processes mediated by various microbial components based on their proportion of the total community. We used the phospholipid fatty acid (PLFA) characterization, which provides PLFA patterns that are distinctive for major soil microbial groups (Unger et al., 2013). The total PLFA is an index of the total microbial biomass in soil. In the 2014 soybean study, no differences were detected, likely because although the community may have differed among treatments (i.e., glyphosate treatment caused increases in Fusarium but decreased rhizobacteria, thereby balancing total PLFA), the general biomass remained at similar concentrations across treatments. The greatest impact of glyphosate detected using PLFA analysis was on the bacterial community shown as reductions in total bacteria, which reflects the reductions in cultural rhizobacteria reported as Pseudomonas spp. and IAA-producing bacteria. A notable effect of Vitazyme was the significantly (P=0.05) increased PLFA marker for total bacteria in the glyphosate treated soybean, which seems to coincide with an increase (although non-significant) for the Gram-negative bacteria, which include the Pseudomonas sp. and most of the IAA-producers.

References

Kremer, R.J., Means, N.E., and Kim, S. 2005. Glyphosate affects soybean root exudation and rhizosphere microorganisms. Int. J. Environ. Anal. Chem. 85:1165-1174.

Kremer, R.J. and Means, N.E. 2009. Glyphosate and glyphosate-resistant crop interactions with soil and rhizosphere microorganisms. European J. Agron. 31:153-161.

Means, N.E. and Kremer, R.J. 2007. Influence of soil moisture on root colonization of glyphosate-treated soybean by Fusarium species. Comm. Soil Sci. Plant Anal. 38:1713-1720.

Schon, M.K. and Blevins, D.G. 1990. Foliar boron applications increase the final number of branches and pods on branches of field-grown soybeans. Plant Phys. 92:602-607.

Unger, I.M., Goyne, K.W., Kremer, R.J., and Kennedy, A.C. 2013. Microbial community diversity in agroforestry and grass vegetative filter strips. Agroforestry Syst. 87:395-402.

Zobiole, L.H., R.J. Kremer, R.S. Oliveira, and J. Constantin. 2010. Glyphosate affects microorganisms in rhizospheres of glyphosate-resistant soybeans. J. Appl. Microbiol. 110:118-127.

Soybeans *with Vitazyme application*

Researcher: Steve May and others
Research organization: The Iowa Soybean Association, Ankeny, Iowa
Location: Washington County, Iowa
Variety: Asgrow AG3334
Planting date: May 23, 2015
Row spacing: 30 inches
Seeding rate: unknown
Previous crop: corn
Soil type: Taintor silty clay loam, Mahaska silty clay loam, Kalona silty clay loam (all had 0 to 2% slope)
Experimental design: A soybean field was selected for a replicated trial using six alternating field strips, of sprayer boom width (90 feet), to determine the effect of foliar-applied Vitazyme on soybean yield.

1 ***Control*** **2** ***Vitazyme***

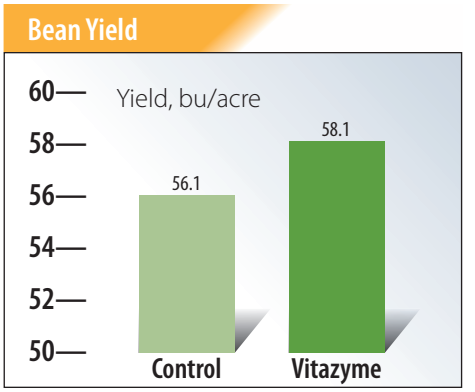
Fertilization: unknown
Vitazyme application: 13 oz/acre on the leaves and soil with glyphosate, on July 1
Harvest date: October 8, 2015
Yield results: The combine speed was 3.9 mph.

Vitazyme on the soybean leaves and soil with glyphosate(right) at an Iowa Soybean Association site show much greater leafing and branching compared to the untreated control.

Treatment	Yield[1]	Yield change
	bu/acre	bu/acre
Control	56.1 b	—
Vitazyme	58.1 a	2.0 (+4%)

[1]Means followed by different letters are significantly different at P=0.05.

Yield increase with Vitazyme: 4%



Soil type	Part of trial		Yield		Yield increase *with Vitazyme*
	Control	Vitazyme	Control	Vitazyme	
	%	%	bu/acre	bu/acre	bu/acre
Taintor silty clay loam	24.3	33.0	56.4	58.2	1.8 (+ 3%)
Mahaska silty clay loam	14.2	13.9	54.6	56.1	1.5 (+3%)
Kalona silty clay loam	6.6	8.0	60.4	63.3	2.9 (+5%)

These three soil types are closely associated with one another, and the only differences between Kalma and Taintor soils is that Kalma soil have no argillic horizon (a layer of higher clay content beneath the topsoil). Possibly the lack of this elevated subsoil clay content is related to the better response of the soybean crop to Vitazyme, such as by allowing better root penetration to the subsoil.

Conclusion: This replicated (with field strips) Iowa Soybean Association soybean trial in southeastern Iowa, using 13 oz/acre applied foliar with a herbicide, produced a significant yield increase of 2.0 bu/acre. Kalona soils, having no argillic horizon, gave the best increase (5%). This 4% improvement was highly profitable and shows the efficacy of the product for soybean growers in Iowa.

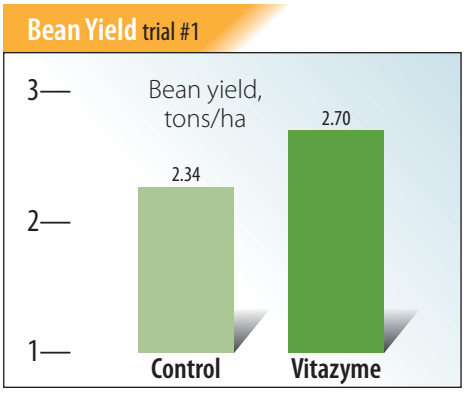
VitalEarth 2015 Crop Results

Soybeans *A Summary of Five Field Trials in Ukraine*

All trials were organized by V.V. Plotnikov, Ph.D, to determine the yield and profit-improving potential of Vitazyme. Fields were divided into Vitazyme treated and control areas.

1. Conducted by LLC "Atlantic Farms" at Myronivs'kyi District, Kyiv Region, Myronivka Farm, Ukraine, on a podzolized chernozem soil (organic matter = 2.8%).

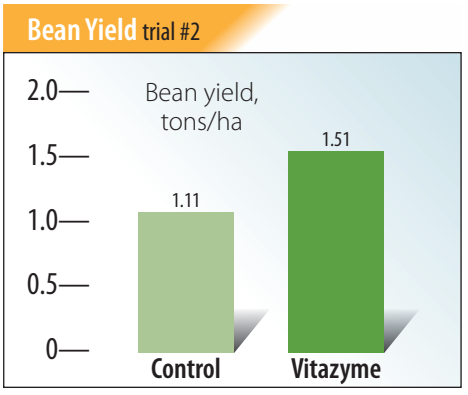
Variety: Highpro
Seeding rate: 700,000 seeds/ha
Planting date: May 2, 2015
Previous crop: winter wheat
Cultivation methods: disking to 8 cm, plowing to 22 cm, cultivation to 5 cm
Fertilization: 16 kg/ha N, 16 kg/ha P_20_5, 16 kg/ha K_20 in-furrow at planting
Vitazyme application: 1 liter/ha on the leaves and soil at the third trifoliate stage on June 1, 2015
Results: *(See bar chart to the right)*



Yield increase with Vitazyme: 0.36 tons/ha(+15%)
Profit increase with Vitazyme: 2,534 UAH/ha

2. Conducted by Private Agricultural Enterprise "Vatutina" at Vil'shans District, Kirovohrad Region, Vil'shanka Town, Ukraine, on a podzolized chernozem soil (organic matter = 3.1%).

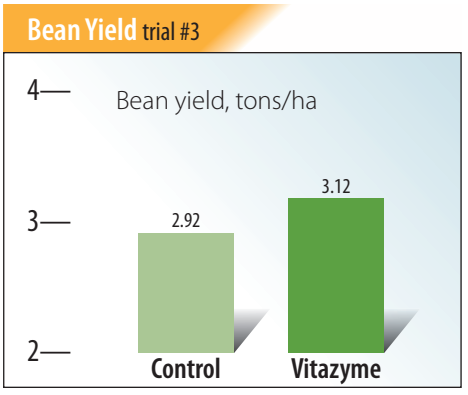
Variety: Volos
Seeding rate: 700,000 seeds/ha
Planting date: April 24, 2015
Previous crop: winter wheat
Cultivation methods: disking to 8 cm, plowing to 22 cm, cultivation to 5 cm
Fertilization: 16 kg/ha N, 16 kg/ha P_20_5, 16 kg/ha K_20 in-furrow at planting
Vitazyme application: 1 liter/ha on the leaves and soil at the third trifoliate stage on June 10, 2015
Results: *(See bar chart to the right)*



Yield increase with Vitazyme: 0.40 ton/ha(+36%)
Profit increase with Vitazyme: 2,870 UAH/ha

3. Conducted by Agricultural LLC "Skif" at Kotelevs 'kyi District, Poltava Region, Bil'sk Village, Ukraine, on a chernozem soil (organic matter = 3.2%).

Variety: Medison
Seeding rate: 700,000 seeds/ha
Planting date: April 30, 2015
Previous crop: corn
Cultivation methods: disking to 8 cm, plowing to 22 cm, cultivation to 5 cm
Fertilization: 35 kg/ha N, pre-plant incorporated; 16 kg/ha N, 16 kg/ha P_20_5, 16 kg/ha K_20 in-furrow at planting
Vitazyme application: 1 liter/ha sprayed on the leaves and soil at the fifth trifoliate, on June 23
Results: *(See bar chart to the right)*

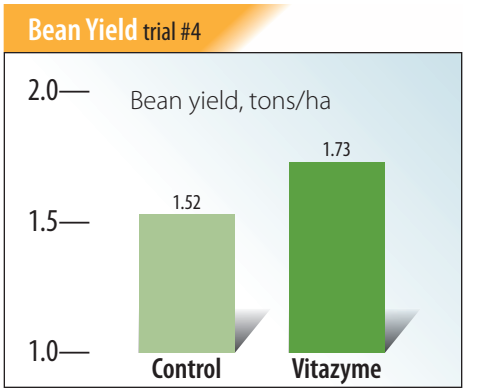


Yield increase with Vitazyme: 0.20 ton/ha(+7%)
Profit increase with Vitazyme: 1,190 UAH/ha

Soybean *A Summary of Five Field Trials in Ukraine cont.*

4. Conducted by Farming Enterprise "Korol" at Pervomayskyi District, Mykolayiv Region, Kamyanyi Mist Village, Ukraine, on podzolized chernozem soil (organic matter = 3.0%).

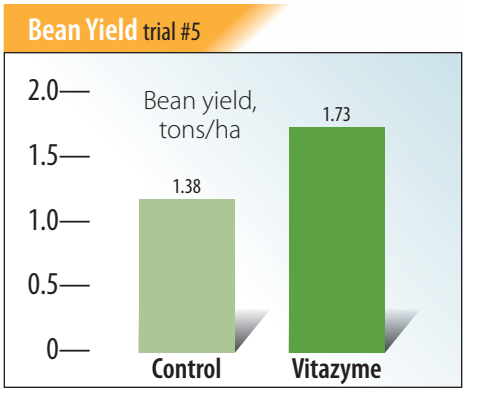
Variety: Don'ka
Seeding rate: 700,000 seeds/ha
Planting date: April 24, 2015
Previous crop: winter wheat
Cultivation methods: disking to 8 cm, plowing to 24 cm, cultivation to 5 cm
Fertilization: 35 kg/ha N, pre-plant incorporated; 15 kg/ha N, 15 kg/ha $P_2 0_5$, 15 kg/ha $K_2 0$ in-furrow at planting
Vitazyme application: 1 liter/ha on the seeds, four days before planting, on April 20, 2015
Results: *(See bar chart to the right)*



Yield increase with Vitazyme: 0.21 ton/ha(+14%)
Profit increase with Vitazyme: 1,694 UAH/ha

5. Conducted by Farming Enterprise "Yuzko-Agro", at Kivertsivs'Kyi District, Volyn' Region, Zviriv Village, Ukraine, on podzolized chernozem soil (organic matter = 1.8%).

Variety: Cheremosh
Seeding rate: 750,000 seeds/ha
Planting date: April 29, 2015
Previous crop: winter wheat
Cultivation methods: disking to 8 cm, plowing to 24 cm, cultivation to 5 cm
Fertilization: 35 kg/ha N, pre-plant incorporated; 16 kg/ha N, 16 kg/ha $P_2 0_5$, 16 kg/ha $K_2 0$ in-furrow at planting
Vitazyme application: 1 liter/ha on the seeds, eight days before planting, on April 21, and (2) 0.6 liter/ha on the leaves and soil at the third trifoliate stage on June 5, 2015
Results: *(See bar chart to the right)*



Yield increase with Vitazyme: 0.35 ton/ha(+25%)
Profit increase with Vitazyme: 2,572 UAH/ha

Summary of the Five Ukraine Soybean Trials

All five field trials in this Ukrainian Vitazyme study gave good to excellent responses to a seed treatment, a foliar spray, or a combined seed and foliar application. The average yield increase was 19.4%. Profit improvements also were sizable, averaging 2,172 UAH/ha. This program is an excellent choice for soybean growers in Ukraine.

Location	Yield increase	Profit increase
	%	UAH/ha
Central Ukraine (500-550 mm ppt.)		
"Atlantic Farms" — Myronivka	15	2,534
"Vatutina" — Vil'shanka	36	2,870
"Skif" — Bil'sk	7	1,190
Southern Ukraine (300-350 mm ppt.)		
"Korol" — Kamyanyi Mist	14	1,694
Western Ukraine (650-700 mm ppt.)		
"Yuzko-Agro" — Zviriv	25	2,572
Mean	19.4	2,172

Soybeans *A Synergism Study with Seaweed*

Bert Schou at ACRES Research explains plot treatments at the facility near Cedar Falls, Iowa.

Researcher: Bertel Schou, Ph.D.
Research organization: ACRES Research, Cedar Falls, Iowa
Location: Cedar Falls, Iowa
Variety: NuTech 7240
Seeding rate: 53 lb/acre
Planting depth: 1.5 inches
Row width: 30 inches
Soil type: Floyd loam (pH=6.3, organic matter=4.4%, cation exchange capacity=13.3 meg/100g, fertility level=excellent, drainage=excellent)
Planting date: May 7, 2015
Experimental design: A small-plot soybean trial, using a randomized complete block design and four replicates, was laid out in plots that were 15 (six rows) x 30 feet, with the objective of determining the effectiveness of Vitazyme and seaweed to influence bean yield, alone and together.

1 ***Control*** **2** ***Vitazyme***
3 ***Seaweed*** **4** ***Vitazyme + Seaweed***

Fertilization: All plots received a fall (2014) broadcast application of 18-16-60 lb/acre of N-$P_2 0_5$-$K_2 0$.

Vitazyme applied twice to the soybeans in this trial greatly increased top and root growth and branching, giving a 7% yield increase

Soybeans *A Synergism Study with Seaweed cont.*

Vitazyme application: For Treatments 2 and 4, (2) 13 oz/acre in-furrow at planting on May 7: (2) 13 oz/acre on the leaves and soil at R1 on June 27.

Seaweed application: For Treatments 3 and 4, (1) 2 qts./acre in-furrow at planting on May 7; (2) 2 qts./acre on the leaves and soil at R1 on July 2. The seaweed was from Ocean Organics based in Waldoboro, Maine, and Ann Arbor, Michigan.

Growing season weather: Excellent, with rainfall evenly distributed throughout the spring and summer, and average temperatures were good for growth. Rainfall: April=2.97 in.; May=5.62 in.; June=5.40 in.; July=4.65 in.; August=7.50 in.; September=3.33 in. Temperature (daily average maximum): April=66; May=70; June=80; July=85; August=79; September=8.

Harvest date: September 25, 2015

Bean moisture results: Bean moisture varied from 11.86 to 12.17%, and differences among treatments were not significant.

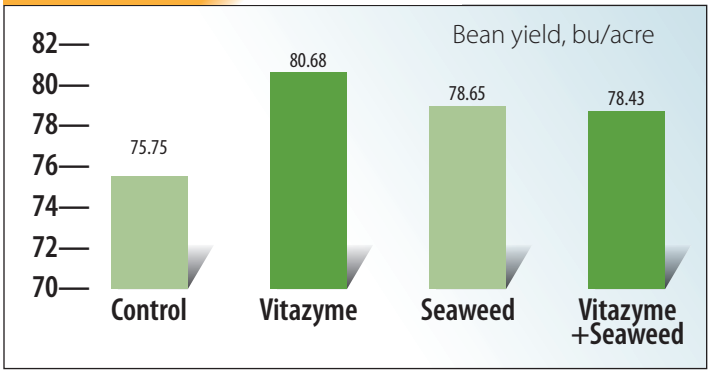
Yield results: The beans were harvested using a Massey-Ferguson plot combine, with an electronic scale and moisture meter.

Treatment	Bean yield[1]	Yield change
	bu/acre	bu/acre
1. Control	75.75 b	—
2 Vitazyme	80.68 a	4.93 (+7%)
3. Seaweed	78.65 ab	2.90 (+4%)
4. Vita + Seaweed	78.43 ab	2.68 (+4%)
LSD (P=0.05)	3.99	
CV	3.66	
Replicate probability	0.9545	
Treatment probability	0.8906	

[1] Means followed by the same letter are not significantly different at P=0.05 according to the Student-Newman-Keuls Test.

Conclusions: This small-plot soybean trial in east central Iowa revealed that soybean yield was significantly improved (at P=0.05) by 4.93 bu/acre (+7%) with Vitazyme only—in-furrow and foliar at R1—during an especially favorable cropping year. Seaweed, applied in-furrow and foliar at R1 at 2 quarts/acre each time, increased the yield by 2.90 bu/acre (+4%), but the increase was not significantly greater than the control. Neither was the combined Vitazyme and Seaweed treatment, which increased bean yield by 2.68 bu/acre (4%). This combined treatment received foliar treatments of Vitazyme and seaweed at different times, separated by 5 days to minimize possible negative interactions that appeared during a 2014 Vitazyme-seaweed study by ACRES Research. However, the separated foliar applications did not remove the lack of positive interaction for the two products. Both Vitazyme and seaweed are highly effective agents for improving soybean yields in Iowa when applied at planting, and as a foliar at early bloom.

Bean Yield



Increase in Bean Yield

Vitazyme alone 7%
Seaweed alone 4%
Vitazyme + Seaweed 4%

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2014 Crop Results

Vitazyme on Soybeans

University of Missouri - Bradford Research Center

Researcher: Majula Nathan, Ph.D. Columbia, Missouri

Location: University of Missouri Bradford Research Center,

Variety: Pioneer 94MO1 *Population*: 180,000 seeds/acre

Row spacing: 30 inches *Planting date*: June 12, 2013

Experimental design: A replicated soybean study (four replications) was set up using a randomized complete block design, with plots four rows wide and 400 feet long (0.09183 acre per plot.) Two Vitazyme applications were made — at planting on the seeds and at bloom — to determine the effect of the product on soybean leaf tissue analysis, bean yield, and growth and seed parameters.

1. Control **2. Vitazyme on the seeds and leaves**

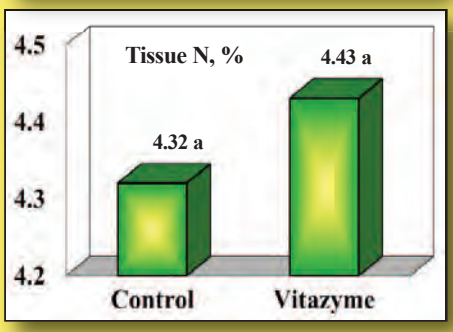
Fertilization: according to soil test recommendations using 0-46-62 lb/acre N-P_2O_5-K_2O before planting

Vitazyme application: (1) 13 oz/acre equivalent on the seeds, mixed thoroughly, just before planting; (2) 13 oz/acre on the leaves and soil at full bloom (R-2) on July 17.

Weather during the 2013 growing season: A wet spring delayed planting, and a drought in August and early September caused some abortion of pods.

Tissue nutrient levels: The youngest, most fully expanded leaves were collected at R-5, on September 6, from 24 plants of each plot for nutrient analysis. These samples were analyzed for N, P, K, Ca, and Mg at the University of Missouri.

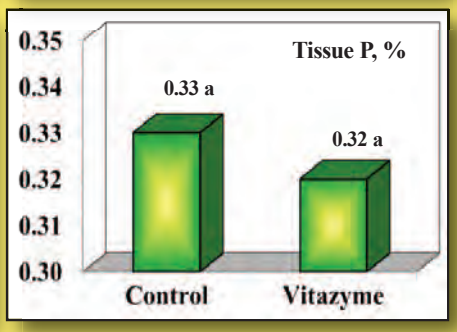
Soybean Tissue Nitrogen



P > F = 0.364

Increase in N with Vitazyme: 3%

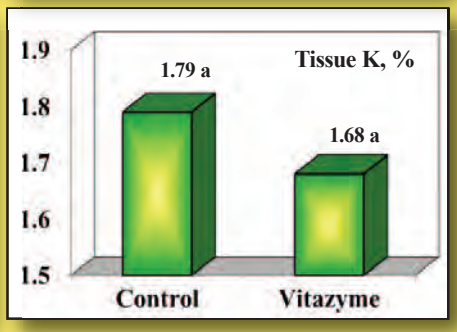
Soybean Tissue Phosphorus



P > F = 0.567

Decrease in P with Vitazyme: 3%

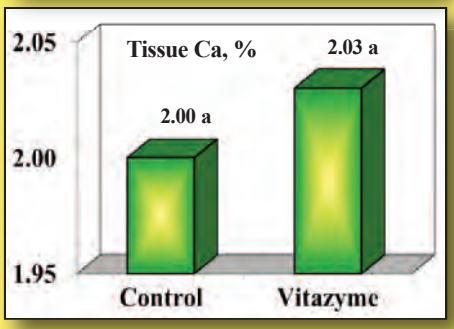
Soybean Tissue Potassium



P > F = 0.306

Decrease in K with Vitazyme: 6%

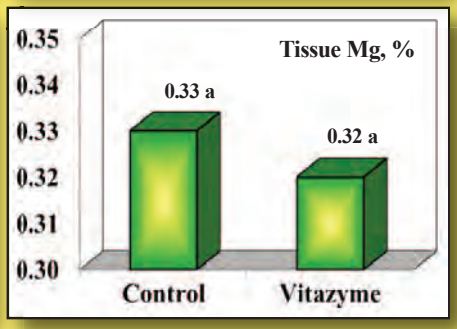
Soybean Tissue Calcium



P > F = 0.845

Increase in Ca with Vitazyme: 2%

Soybean Tissue Magnesium



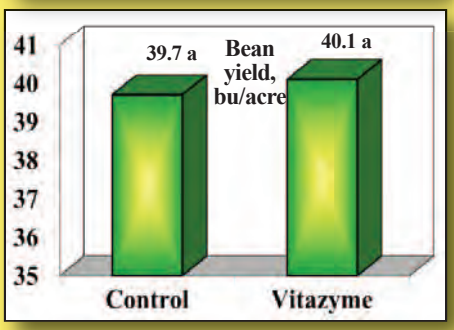
P > F = 0.556

Decrease in Mg with Vitazyme: 3%

There was very little change in tissue elemental levels with Vitazyme application compared with the control treatment.

Growth and yield parameter results: Before harvest, various plant and seed parameters were measured.

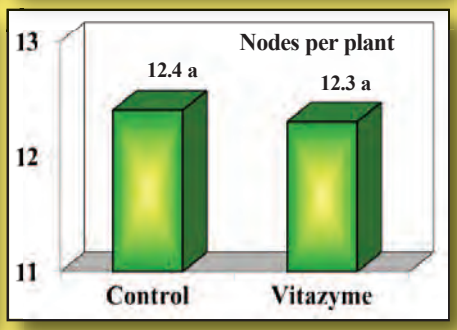
Soybean yield



P > F = 0.840

Increase with Vitazyme: 1%

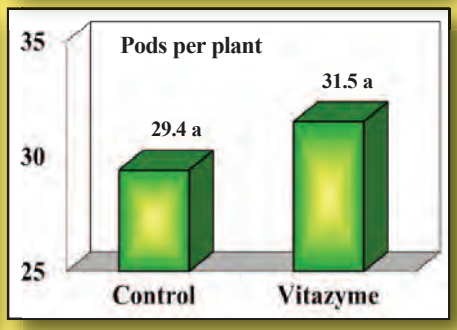
Nodes Per Plant



P > F = 0.806

Decrease with Vitazyme: -1%

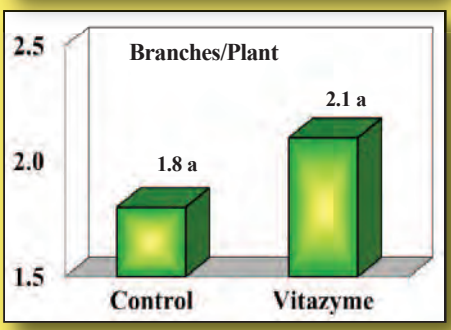
Main Stem Pods Per Plant



P > F = 0.179

Increase with Vitazyme: 7%

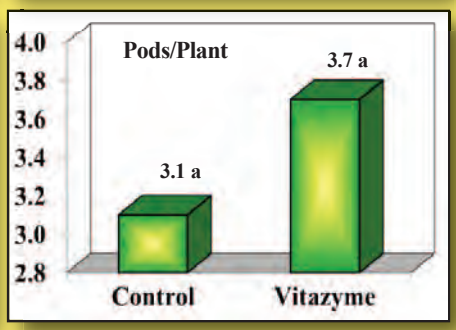
Branches Per Plant



P > F = 0.396

Increase with Vitazyme: 17%

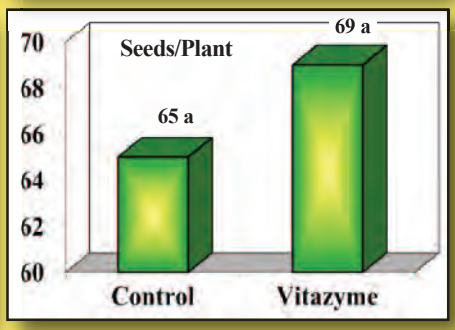
Branch Pods Per Plant



P > F = 0.433

Increase with Vitazyme: 19%

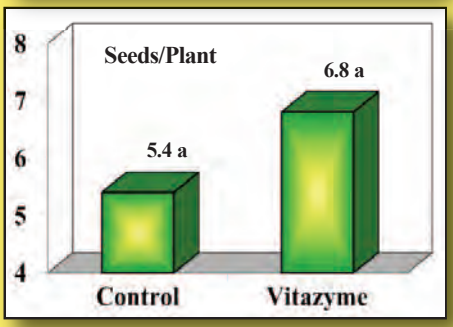
Main Stem Seeds Per Plant



P > F = 0.350

Increase with Vitazyme: 6%

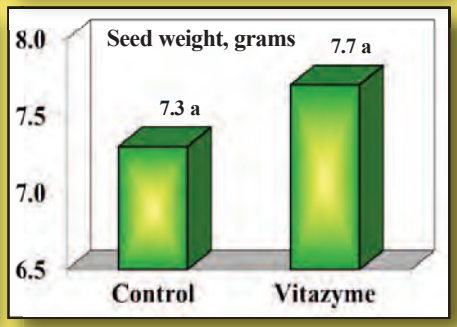
Branch Seeds Per Plant



P > F = 0.387

Increase with Vitazyme: 26%

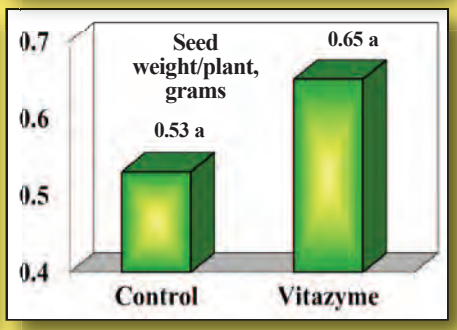
Main Stem Seed Weight Per Plant



P > F = 0.603

Increase with Vitazyme: 5%

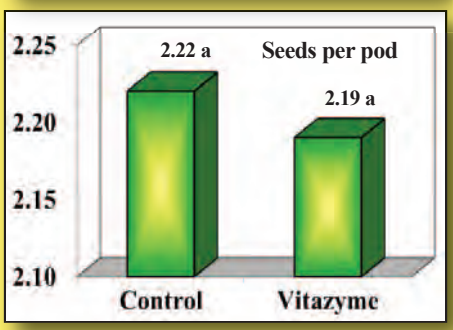
Branch Seed Weight Per Plant



P > F = 0.351

Increase with Vitazyme: 23%

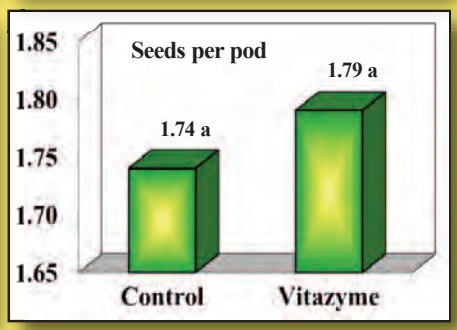
Main Stem Seeds Per Pod



P > F = 0.755

Decrease with Vitazyme: (-) 1%

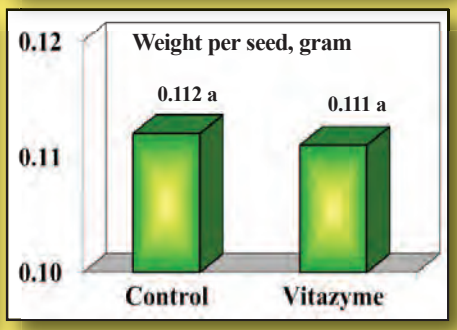
Branch Seeds Per Pod



P > F = 0.679

Increase with Vitazyme: 3%

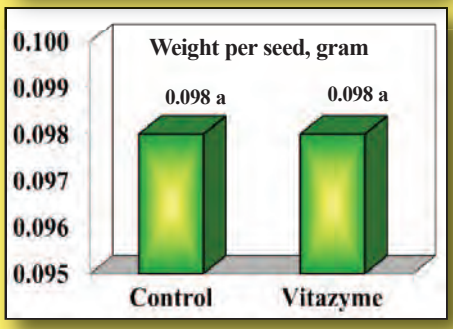
Main Stem Weight Per Seed



P > F = 0.830

Decrease with Vitazyme: 1%

Branch Weight Per Seed



P > F = 0.994

Soybean yield was increased only 1% by Vitazyme, although most plants characteristics were improved substantially, in particular pod number, branches, and seed weight per plant. However, pod abortion during the summer drought caused a loss of yield potential by season's end.

Crude protein and oil results: The crude protein and oil content of the beans were determined at the University of Missouri, and showed little difference between the two treatments, Vitazyme being only slightly higher for both.

Treatment	Crude protein, %	Oil, %
Control	23.7	37.4
Vitazyme	23.9	37.5

Conclusions: A replicated soybean trial at the University of Missouri in 2013 proved that Vitazyme can substantially improve plant and seed characteristics. In this study, however, a summer drought caused many pods to abort so that the potential yield increase was reduced to only 1%. Tissue element levels were changed little, and bean oil and protein levels were only slightly elevated by Vitazyme. Plant and seed characteristics were affected as follows.

Change with Vitazyme

Nodes per plant ..... -1%	Main stem seed weight ..... +5%
Main stem pods per plant .... +7%	Branch seed weight per plant ... +23%
Branches per plant ..... +17%	Main stem seeds per plant ..... -1%
Branch pods per plant ..... +19%	Branch seeds per plant ..... +3%
Main stem seeds per plant ... +6%	Main stem weight per seed ..... +1%
Branch seeds per plant ..... +26%	Branch weight per seed 0%

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2014 Crop Results

Vitazyme on Soybeans

Agricultural Custom Research and Education Services (ACRES)

Researcher: Bertel Schou, Ph.D.
Research organization: Agricultural Research and Educational Services
Location: Cedar Falls, Iowa
Variety: NuTech 7240 (Roundup Ready)
Planting rate: 53 lb/acre
Planting date: May 19, 2014
Planting depth: 1.5 inches
Soil type: Aredale loam (36% sand, 42% salt, 22% clay, 4.6% organic matter, pH = 6.2, cation exchange capacity = 17.6 meq/100 g)
Soil test results: (Perry Agricultural Laboratory, Bowling Green, Missouri): total exchange capacity = 25.00, pH = 5.8, organic matter = 3.2%, nitrogen = 82 lb/acre, sulfur (as sulfate) = 30 lb/acre, phosphorus = 117 lb/acre, calcium (Ca) = 5,793 lb/acre, magnesium (Mg) = 805 lb/acre, potassium (K) = 232 lb/acre, sodium (Na) = 75 lb/acre, boron (B) = 2.36 lb/acre, iron (Fe) = 686.6 lb/acre, manganese (Mn) = 109.6 lb/acre, copper (Cu) = 3.0 lb/acre, zinc (Zn) = 11.6 lb/acre; base saturations: Ca = 57.9, Mg = 13.4, K = 1.2, Na = 0.9, other bases = 5.8, H = 21.0.
Row width: 30 inches
Planting conditions: good
Tillage: conventional
Previous crop: corn
Experimental design: A randomized complete block design of a small plot study was used to evaluate the effect of Vitazyme and seaweed, alone and together, on the yield of soybeans. The treatments were replicated four times, and plants were four rows wide x 30 feet long (0.00689 acre/plot).

Treatment	In-furrow at planting	Foliar
1. Control	0	0
2. Vitazyme	13 oz/acre	13 oz/acre
3. Seaweed	2 quarts/acre	2 quarts/acre
4. Vitazyme + Seaweed	13 oz/acre + 2 quarts/acre	13 oz/acre + 2 quarts/acre

Fertilization: according to soil test
Vitazyme application: (1) 13 oz/acre in-furrow at planting (May 19, 2014) using 38 ml/gallon at 10 gallons/acre; (2) 13 oz/acre on the leaves and soil at V6-R1 (July 2, 2014), using 26 ml/gallon at 10 gallons/acre
Seaweed application: obtained from Ocean Organics; (1) 2 quarts/acre in-furrow at planting (May 19, 2014) using 189 ml/gallon at 10 gallons/acre; (2) 2 quarts/acre on the leaves and soil at V6-R1 (July 2, 2014) using 126 ml/gallon at 15 gallons/acre
Weather for 2014: Growing conditions for the trial were very good with below-normal temperatures and adequate precipitation, except for a few days in June and August that received irrigation water.

Harvest date: October 6, 2014

Bean moisture results:

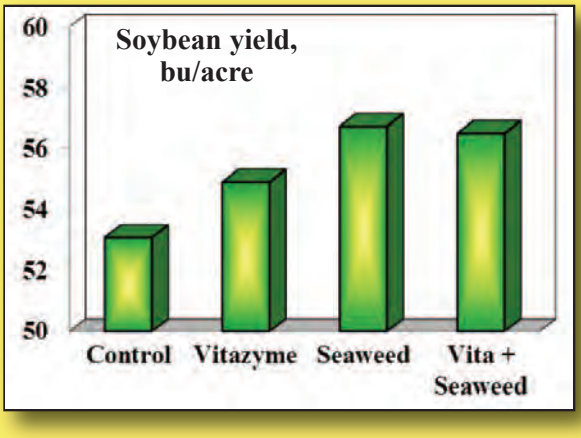
Treatment	Bean moisture	Moisture change
	%	%
1. Control	13.45	—
2. Vitazyme	13.47	(+) 0.02
3. Seaweed	13.44	(-) 0.01
4. Vitazyme + Seaweed	13.44	(-) 0.01

The moisture content of the beans was nearly identical for all four treatments.

Bean yield results:

Treatment	Bean yield[1]	Yield change
	bu/acre	bu/acre
1. Control	53.08 b	—
2. Vitazyme	59.90 a	6.82 (+13%)
3. Seaweed	56.73 ab	3.65 (+7%)
4. Vitazyme + Seaweed	56.50 ab	3.42 (+6%)
LSD (P = 0.05)	3.04	
CV	3.36%	
Treatment F	8.627	
Treatment probability	0.005	

[1]Means followed by the same letter are not significantly different at P = 0.05, according to the Student-Newman-Keuls Test.



Increase in soybean yield with Vitazyme: 13%

Vitazyme significantly increased the soybean yield at P = 0.005, a great increase above the control, and greater than the seaweed by 6%. The combined products showed no synergism in this study.

Conclusions: A replicated soybean study in east-central Iowa revealed that two applications of Vitazyme significantly increased the soybean yield above the control (+13%). Seaweed at two applications increased bean yield by 7%, which was statistically equal to the Vitazyme treatment as well as to the control. The two products combined did not reveal a synergine, though possibly a synergine could be realized if the two were applied seperately, perhaps a week apart as revealed on studies on grapes.

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2013 Crop Results

Vitazyme on Soybeans

Researcher: Tim Heikens
Farmer: Tim Heikens
Location: Lake Park, Iowa
Variety: Asgrow
Planting date: June 12, 2013
Row spacing: 7.5 inches
Plant population: 145,000 seeds/acre
Previous crop: corn
Tillage: soybeans planted directly into standing corn stalks
Soil type: Okoboji

Experimental design: A 30-acre uniform soybean field was treated with Vitazyme, except for a 90-foot strip that served as a control. The purpose of the study was to evaluate the effect of this product on the yield of soybeans.

1. Control **2. Vitazyme**

Fertilization: 100 lb/acre of 0-0-60% N-P_2O_5-K_2O the fall of 2012

Vitazyme application: 20 oz/acre (1.5 liters/ha) sprayed on the leaves and soil at flowering, the first part of July

Weed control: Roundup (glyphosate) herbicide

Aphid control: insecticide

Growing season weather: wet spring, dry summer and fall

Harvest date: October 8, 2013

Yield results: A weigh wagon was used to weigh samples from the two treatments.

Treatment	Yield	Yield change
	bu/acre	bu/acre
Control	52.8	—
Vitazyme	54.5	1.7 (+3.2%)

Moisture content was about the same for both treatments at harvest (11.9 to 12.1%), and test weight was a bit higher for the control treatment.

Increase in bean yield with Vitazyme: 3.2%

Conclusions: A soybean study in northwestern Iowa in 2013 revealed that Vitazyme improved the yield by 3.2%. A higher increase would likely have been achieved if an early, at-planting treatment had been made, in addition to the 20 oz/acre spray made at bloom.

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2013 Crop Results

Vitazyme on Soybeans

Researcher: unknown *Farmer*: Dam Van Huan *Location*: Dakrong, Cu Jut, Dak Nong, Viet Nam
Variety: DT 26 *Planting date*: April 28, 2013
Experimental design: A soybean field was divided into a Vitazyme treated area and an untreated control area, to determine the effect of this product on plant growth parameters and bean yield.

1. Control **2. Vitazyme**

Fertilization: unknown
Vitazyme application: 1 liter/ha at 2, 4, and 6 weeks after planting
Plant growth results: Both treatments germinated on May 5, 2013, 7 days after planting, and had more than 98% germination.

Plant Height at 70 Days

Increase in plant height with Vitazyme: 8%

Plant height was somewhat greater with Vitazyme at 70 days after planting.

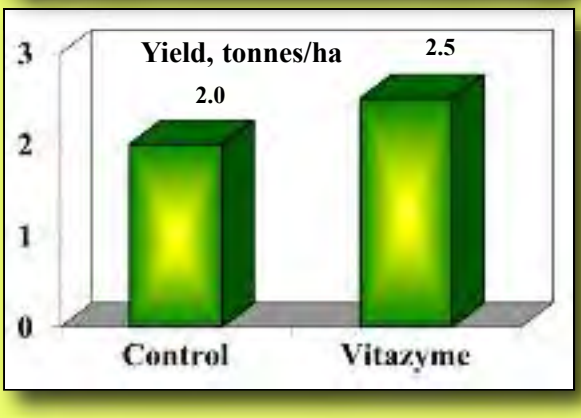
Yield results: The crop was harvested July 29, 2013. There were 32 plants/m^2 for both treatments.

Treatment	Pods/Plant	Unfilled pods/Plant	Pods with ...			Weight of 1,000 seeds
			1 seed	2 seeds	3 seeds	
	number	number	number	number	number	grams
Control	24	6	5	10	3.2	191
Vitazyme	30	4	3	20	3.7	195

Change With Vitazyme	
Pods/Plant	+25%
Untilled Pods/Plant	-50%
Pods With 1 Seed	-67%
Pods With 2 Seeds	+100%
Pods With 3 Seeds	+16%
Weight of 1,000 Seeds	+2%

.
Only the unfilled and 1 seed/pod parameters were not increased with Vitazyme application, the pod number, 2-seeded pods, 3-seeded pods, and weight of 1,000 seeds all improved with the product.

Bean Yield



Increase in yield with Vitazyme: 25%

A sizable increase of 25% in yield was realized from the program.

Income results: Extra cost for Vitazyme: 1,500,000 VND/ha
Increase in income for Vitazyme: 6,000,000 VND/ha
Return On Investment: 4:1

Conclusions: A soybean trial in Viet Nam, using three foliar applications of the product, produced a sizable 25% yield increase as a result of larger plants having 25% more pods, fewer unfilled pods, twice as many 2-bean pods, and 16% more 3-bean pods than the control. The seeds were 2% heavier as well. This yield increase produced 6,000,000 VND/ha more income, and a 4:1 Return On Investment, showing the great efficacy of Vitazyme for soybean production in Viet Nam.

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2013 Crop Results

Vitazyme on Soybeans

Researcher: Linden Heikens and Leonard Jensen *Farmer*: Leonard Jansen
Location: Lake Park, Iowa *Variety*: Golden Harvest S20-Y2 (Roundup Ready)
Row spacing: 15 inches *Seeding rate*: 150,000/acre *Previous crop*: corn
Planting date: May 15, 2013
Tillage: stalks chopped in the fall of 2012, and ripped; field cultivated before planting
Experimental design: A 100-acre, uniform soybean field was treated with Vitazyme except for an 80-foot strip to serve as a control. The objective of the study was to evaluate the effect of this product on soybean yield.

1. Control **2. Vitazyme**

Fertilization: 18-46-60 lb/acre of N-P_2O_5-K_2O, plus 9 lb/acre of S and 1 lb/acre of Zn
Vitazyme application: 13 oz/acre sprayed foliar on July 1, at early flowering
Weed control: Sonic herbicide at 3 oz/acre on May 16 (preemergence), and Roundup (glyphosate) at 1 quart/acre with Vitazyme on July 1; Roundup (glyphosate) again at 1 quart/acre on July 22
Weather for 2013: a wet spring, followed by a dry summer and fall
Harvest date: October 10, 2013
Yield results: A harvest sample was taken for the control strip and the Vitazyme treated areas and weighed in a weigh wagon.

Treatment	Yield	Yield change	Bean moisture	Moisture change
	bu/acre	bu/acre	%	%
Control	57.61	—	10.8	—
Vitazyme	59.62	2.01 (+3.5%)	10.2	-0.6

Increase in soybean yield with Vitazyme: 3.5%

Decrease in bean moisture with Vitazyme: 0.6 percentage point

Conclusions: This northwestern Iowa soybean study revealed that Vitazyme, applied once with a Roundup application at early bloom, increased the bean yield by 3.5%, while reducing bean moisture at harvest by 0.6 percentage point. A Vitazyme application at planting would very likely have substantially improved this yield increase.

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2013 Crop Results

Vitazyme on Soybeans

Researcher: V.V. Plotnikov *Research organization*: Scientific, Innovation, and Technology Center of the Institute of Forages and Agriculture of Podillya NAAS *Location*: National Academy of Agricultural Sciences, Ukraine *Variety*: Khutorianochka *Soil type*: ash gray soil (humus = 2.2%, hydrolyzed-N = 8.4 mg/100 g of soil, P = 15.8 mg/100 kg of soil, exchangeable K = 12.4 mg/100 g of soil, pH = 5.5) *Previous crop*: soybeans *Planting date*: May 2, 2013
Soil preparation: disking, plowing, harrowing *Seeding rate*: 800,000 seeds/ha
Experimental design: A small plot soybean study was conducted, with four replications, to determine the effect of Vitazyme on bean yield, profitability, quality, and plant characteristics. One treatment was on soils treated with Vitazyme in 2012 to evaluate the carryover effect.

Treatment	2012 treatment	Seed treatment	Third trifoliate	Branching
		liter/tonne	liter/ha	liter/ha
1. Control	0	0	0	
2. Vitazyme carryover	X	0	0	0
3. Vitazyme twice	0	1	1	0
4. Vitazyme three times	0	1	0.5	0.5

Fertilization: All phosphorus and potassium fertilizers were applied the fall of 2012.
Vitazyme application: See the table above. The seed treatment was applied May 2, at planting time, the third trifoliate soil and foliar spray on June 11, and the branching soil and foliar spray on June 18.
Yield results:

Increase in soybean yield

Carryover effect 8%
Vitazyme twice 20%
Vitazyme three times 22%

There was a small carryover effect from Vitazyme applied in 2012, and a sizable yield increase (20 to 22%) for both two and three Vitazyme applications.

Income results:

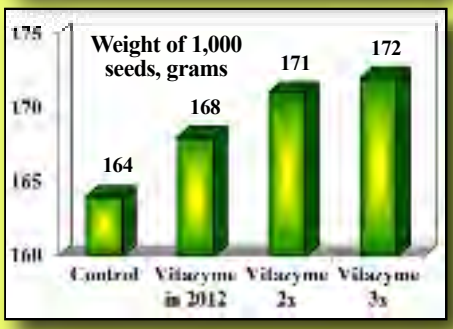
Increase in net income with Vitazyme

Carryover effect ..... 840 UAH/ha
Vitazyme twice ..... 1,850 UAH/ha
Vitazyme three times .... 2,050 UAH/ha

Two or three Vitazyme applications boosted the net income significantly over the control treatment. The carry-over was substantial, giving 840 UAH/ha more income.

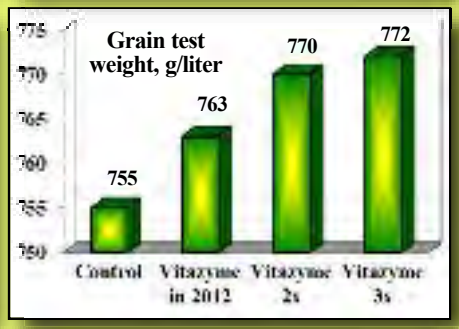
Grain quality results:

1,000 Seed Weight



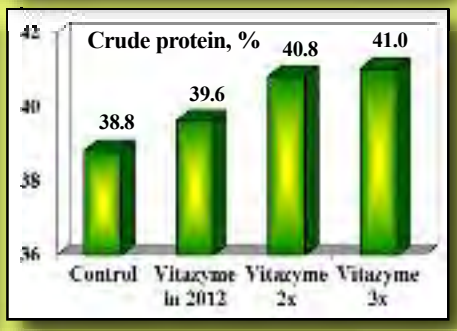
Increase in 1,000 seed weight with Vitazyme: 2 to 5%

Grain Density



Increase in grain density with Vitazyme: 1 to 2%

Crude Protein

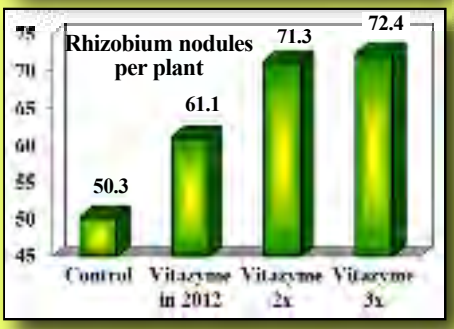


Increase in grain crude protein with Vitazyme: 0.8 to 1.2%-points

All three grain quality parameters were slightly improved with all three Vitazyme regimes, in particular protein, which increased by up to 1.2%-points.

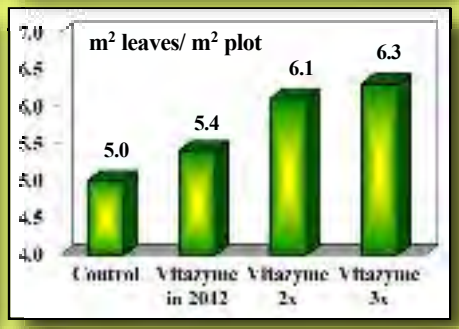
Plant characteristic results:

Rhizobium Nodules



Increase in nodules per plant with Vitazyme: 21 to 44%

Leaf Area



Increase in leaf area with Vitazyme: 8 to 26%

Both nodule number and leaf area of the plants increased with the number of Vitazyme applications. Three applications improved nodule number by an amazing 44%, and leaf area by 126%, but the two-application treatment was nearly as effective.

Conclusions: The researchers concluded,

1. Soybean plants with either one or two foliar treatments (1 L/ha, and 1 L/ha + 0.5 L/ha) of Vitazyme, on top of a 1 L/tonne seed treatment, provided a yield increase of 0.52-0.57 tonne/ha, or 20-22%, and a profit of 1,850-2,050 UAH/ha.

2. The impact of Vitazyme applied in 2012 on soybean yield provided a yield increase of 0.21 tonne/ha (8%), and a profit of 840 UAH/ha.

3. Vitazyme application provided soybean seed quality improvement; the weight of 1,000 seeds increased by 4-8 grams, grain density by 8-17 grams/L, and crude protein by 0.8-2.2%.

4. Vitazyme application on seeds and plants, and carryover effects from 2012, provided an increase of nitrogen-fixing nodules of 9.7-18.6 nodules, and an increase of soybean leaf area of 0.4-1.3 m^2 per one square meter of the plot (m^2/m^2).

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2013 Crop Results

Vitazyme and Fish on Soybeans

Researcher: Bertel Schou, Ph.D. *Research organization*: ACRES (Agricultural Research and Educational Services), Cedar Falls, Iowa
Location: Cedar Falls, Iowa *BBCH scale*: BSOY
Variety: NuTech 7240 (Roundup Ready) *Planting depth*: 1.5 inches *Row spacing*: 30 inches
Planting rate: 53 lb/acre *Planting date*: June 1, 2013 *Slope of plot*: 2%
Tillage: conventional (field cultivating and harrowing) *Previous crop*: corn
Soil type: Maxfield silty clay loam
Soil test values: pH = 6.3, organic matter = 4.7%, cation exchange capacity = 36.5 meq/100 g, N = 97 lb/acre, SO_4-S = 31 lb/acre, P_2O_5 = 278 lb/acre, Ca = 10,225 lb/acre, Mg = 1,129 lb/acre, K_2O = 250 lb/acre, Na = 99 lb/acre, B = 1.7 lb/acre, Fe = 232.2 lb/acre, Mn = 95.4 lb/acre, Cu = 2.2 lb/acre. Zn = 18.0 lb/acre; percent base saturations: Ca = 70.0%, Mg = 12.9%, K = 0.9%, Na = 0.6%, other bases = 5.1%, H = 10.5%.
Experimental design: A soybean area having plots that were 30 x 10 feet, with six replications, in a randomized complete block configuration, was set up to evaluate the effect of Vitazyme and fish, alone and together, on the yield and growth of soybeans.

Treatment	At planting	At V6R1	At R4
1. Control	0	0	0
2. Vitazyme	13 oz/acre	13 oz/acre	0
3. Fish	2 gal/acre	2 gal/acre	2 gal/acre
4. Vitazyme + Fish	13 oz + 2 gal (Trt. 2 + 3)	13 oz + 2 gal (Trt. 2 + 3)	2 gal/acre (Fish only)

Fertilization: In the fall of 2012, 100 lb/acre of 18-46-0 (% N-P_2O_5-K_2O) and 100 lb/acre of 0-0-60.
Vitazyme application: At planting, for Treatments 2 and 4, 13 oz/acre (1 liter/ha) in-row in a 10 gallon solution; at V6R1 (Treatments 2 and 4), 13 oz/acre (1 liter/ha) sprayed on July 19 at 15 gallons/acre.
Fish application: At planting, for treatments 3 and 4, 2 gallons/acre in-row; at V6R1, 2 gallons/acre on the leaves on July 19; at R4, 2 gallons/acre on the leaves on August 22.
Weed control: herbicides, including glyphosate
Harvest date: October 2, 2013

Yield results:

Treatment	Yield[1]	Yield change
	bu/acre	bu/acre
1. Control	57.85 a	—
2. Vitazyme	58.98 a	1.13 (+2.0%)
3. Fish	60.53 a	2.68 (+4.6%)
4. Vitazyme + Fish	60.03 a	2.18 (+3.8%)
LSD (P = 0.05)	3.72	
Standard deviation	3.03	
CV	5.1%	
Replicate F	4.992	
Treatment F	0.451	

[1] Means followed by the same letter are not significantly different at P = 0.05 according to the Student-Newman-Kuels Test.

None of the treatments yielded significantly more than the control at P = 0.05. Increases varied from 2.0% for Vitazyme to 4.6% for the fish; the products together gave a 3.8% yield increase.

Bean moisture results: There were no significant differences in soybean moisture, which ranged from 12.49 to 12.64%.

Conclusions: This Iowa soybean study, using Vitazyme and fish alone and in combination, revealed that yields were improved but not significantly. These increases were from 2.0 to 4.6%, and there appeared to be no synergism between the two products, even though testimonials from growers indicate that Vitazyme and fish products work exceptionally well in combination.

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2012 Crop Results

Vitazyme on Soybeans

Researcher: Linden Heikens
Location: Lake Park, Iowa
Variety: Pioneer 91Y92
Planting date: May 26, 2012
Soil type: silty clay loam
Planting rate: 166,000 seeds/acre
Planting depth: 1.75 inches
Row spacing: 30 inches

Experimental design: A soybean field was divided into Vitazyme treated and control areas, to determine the effects of Vitazyme on the yield from one application.

1. Control **2. Vitazyme**

Fertilization: 100 lb/acre of 0-0-60% N-P_2O_5-K_2O, and 100 lb/acre 18-46-0, applied in April of 2012

Vitazyme application: 13 oz/acre at early bloom (June 28, 2012), along with herbicide

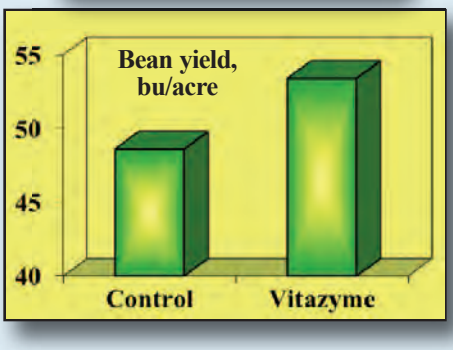
Herbicide application: pre-emergence (May 17, 2012), 2 lb/acre Encompass /AC and 32 oz/acre Roundup (glyphosate); early bloom (June 28, 2012), 0.3 oz/acre Cadet, 5 oz/acre Select, and 36 oz/acre Roundup along with Vitazyme

Harvest date: September 22, 2012

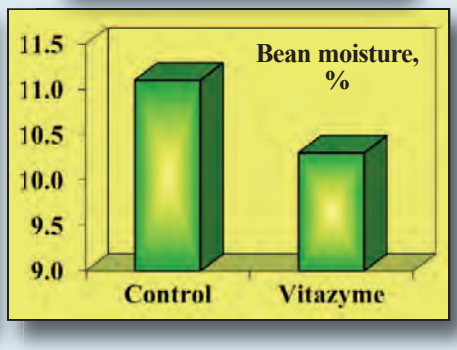
Yield results: A John Deere 9670 combine with a 630F platform and a weigh wagon were utilized.

Treatment	Area	Total yield	Area yield	Yield change	Bean moisture	Moisture change
	acres	lb	bu/acre	bu/acre	%	%
Control	1.61	4,699	48.6	—	11.1	—
Vitazyme	1.61	5,161	53.4	4.8 (+10%)	10.3	-0.8

Bean Yield



Bean Moisture



Increase in bean yield with Vitazyme: 10%

Decrease in bean moisture with Vitazyme: -0.8 %-point

Conclusions: This soybean field trial in northwestern Iowa, using a single foliar Vitazyme application at early bloom, provided a 10% yield increase along with 0.8% less bean moisture at harvest. An income increase of about $67.20/acre — using a price of $14.00/bu — was realized, making the return on product invested about 15:1. Not only was the yield improved, but the beans were drier at harvest, indicating maturity was reached sooner with Vitazyme. Had a treatment been made at planting, the yield increase would likely have been greater. These results prove the great efficacy of this program for soybeans in Iowa.

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2012 Crop Results

Vitazyme on Soybeans

Free Amino Acid Levels -- University of Missouri

Researcher: Manjula Nathan, Ph. D. *Location*: University of Missouri, Columbia, Missouri
Variety: unknown *Planting date*: June 6, 2011 *Row spacing*: 15 inches
Seeding rate: 180,000 seeds/acre *Soil type*: unknown
Experimental design: A soybean area with plots of 15 feet by 200 feet (0.0689 acre), with four replications, was set up to compare Vitazyme treatment with an untreated control, and determine differences in yield, growth characteristics, and tissue levels of free amino acids. This report discusses the effect of Vitazyme on free amino acid levels, which are correlated with plant pathogen activity.

1. Control **2. Vitazyme**

Fertilization: none
Vitazyme application: The seeds were treated with 100% Vitazyme before planting to achieve a 13 oz/acre rate on 180,000 seeds; the untreated seeds received water only. A second Vitazyme application of 13 oz/acre was applied to the leaves and soil on July 13 (R1 stage).
Hail damage event: On July 3 a powerful hailstorm, dropping golf ball sized hailstones, severely damaged the beans, leaving only one trifoliate intact. The soybean plants quickly recovered and produced a reasonable crop.
Free amino acid analysis: Soybean leaves were harvested on July 28 (R3 stage) and August 18 (R5 stage), by collecting 24 of the youngest fully expanded trifoliates from each plot. These samples were washed and frozen for later analyses at a University of Missouri laboratory. The results of the second analysis (August 18 collection) are shown on the next page, except for those amino acids that were not present. The results of the first analysis (July 28 collection) did not show much difference between the two treatments, so are not shown.

Amino acid*	Control	Vitazyme	Change
	µg/100 mg	µg/100 mg	µg/100 mg
Aspartic acid	20.86	12.25	-8.61
Threonine	22.25	18.02	-4.23
Serine	19.58	15.55	-4.03
Asparagine	17.78	16.98	-0.80
Glutamic acid	7.01	3.91	-3.10
Glutamine	6.12	6.07	-0.05
Proline	24.11	15.23	-8.88
Glycine	8.52	5.88	-2.64
Alanine	32.67	22.78	-9.89
Citrulline	2.14	2.35	+0.21
α-amino-n-butyric acid	2.59	2.05	-0.54
Valine	26.92	21.45	-5.47
Methionine	5.33	1.69	-3.64
Cystine	14.57	15.53	+0.96
Isoleucine	19.39	20.27	+0.88
Leucine	35.21	26.50	-8.71
Tyrosine	11.88	9.81	-2.07
Phenylalanine	25.99	17.86	-8.13
∂-amino butyric acid	52.45	47.24	-5.21
Homocystine	0.83	2.52	+1.69
Tryptophan	6.69	7.75	+1.06
Ornithene	18.73	26.67	+7.94
Lysine	26.55	19.73	-6.82
Histidine	4.51	4.20	-0.31
Arginine	24.87	17.17	-7.70
Totals	437.55	359.46	-78.09 (-18%)

In all but a few cases, Vitazyme lowered the amino acid level in the soybean plant tissue, with an overall 18% reduction in total free amino acids. This great reduction very likely would inhibit the proliferation of pathogenic bacteria, fungi, nematodes, and other organisms that would prey on the plant, reducing their number and activity, and the loss of production due to their presence.

Conclusions: In this University of Missouri study on the effect of Vitazyme on soybean yield, growth parameters, and free amino acids levels, the free amino acids were shown to be significantly reduced by two Vitazyme applications, one at planting (on the seeds) and one at the R1 stage. The reduction was 18%, meaning the plant pathogens (bacteria, fungi, nematodes, viruses, and some insects) would be inhibited from damaging the plants. Vitazyme enhances metabolic cycles in plants, thus speeding the incorporation of free amino acids into proteins (proteosynthesis) and reducing their buildup in plant tissues.

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2012 Crop Results

Vitazyme on Soybeans

Yield and Plant Characteristics - University of Missouri

Researcher: Manjula Nathan, Ph. D., and Timothy Reinbott, research station supervisor
Location: University of Missouri Division of Plant Sciences, Columbia, Missouri, research farm
Variety: unknown *Planting date*: June 6, 2011 *Row spacing*: 15 inches
Planting rate: 180,000 seeds/acre
Experimental design: An experimental area was established with soybeans in plots that were 15 feet wide by 200 feet long (0.0689 acre), with four replications. The objective of the trial was to determine the effect of Vitazyme on bean yield and growth characteristics, and also to evaluate the effects of the product on free amino acid levels; this evaluation is discussed in a separate report.

1. Control **2. Vitazyme**

Fertilization: none
Vitazyme application: The seeds were treated with 100% Vitazyme before planting to achieve a 13 oz/acre rate on 180,000 seeds; the untreated seeds received water only. A second Vitazyme application of 13 oz/acre was applied to the leaves and soil on July 13 (R1 stage).
Hail damage event: On July 3 a powerful hailstorm, dropping golf ball sized hailstones, severely damaged the beans, leaving only one trifoliate intact. The soybean plants quickly recovered, however, and produced a reasonable crop.
Plant analysis results: Twenty-four of the youngest fully expanded trifoliate leaves from each plot were harvested on July 28 (R3) and August 18 (R5) for analysis at the University of Missouri Soil and Crop Testing Laboratory. The July 28 data is not shown here because of lack of uniformity of the data. Below is the data for the August 18 sample. d.m. = dry matter.

Treatment	Nitrogen	N change	Phosphorus	P change	Potassium	K change	Crude protein	Protein change
	% d.m.	% d.m.	% d.m.	% d.m.	% d.m.	% d.m.	%	%
Control	3.40	—	0.26	—	1.35	—	21.3	—
Vitazyme	3.50	0.10 (+3%)	0.29	0.03 (+12%)	1.42	0.07 (+5%)	21.6	0.3 (+1.4%)

Increase in leaf tissue levels with Vitazyme:

Nitrogen 3%
Phosphorus 12%
Potassium 5%
Crude Protein 1.4% (0.3%-point)

All leaf nutrient parameters and crude protein, especially leaf phosphorus, were increased with Vitazyme.

Bean analysis results: Soybean samples ar harvest were analyzed for elements, protein, and oil at the University of Missouri Soil and Plant Testing Laboratory, with the following results.

Treatment	N	P	K	Ca	Mg	Zn	Fe	Mn	Cu	B	Mo	S	N:S
	%	%	%	%	%	ppm	ppm	ppm	ppm	ppm	ppm	%	
Control	5.32	0.55	1.66	0.35	0.27	35.6	59.8	26.4	10.5	39.2	1.6	0.18	29.5
Vitazyme	5.16	0.53	1.65	0.35	0.27	36.2	53.5	26.3	10.3	39.5	1.5	0.19	27.5

The elements varied little between the two treatments.

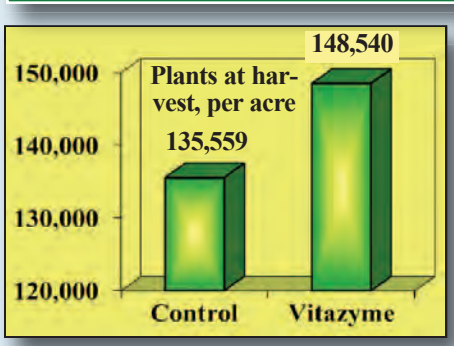
Treatment	Crude protein	Oil
	%	%
Control	33.5	19.5
Vitazyme	32.1	19.6

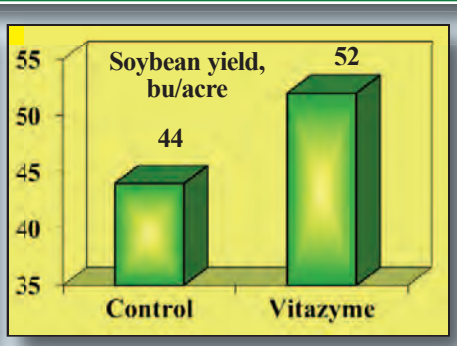
While crude protein dropped with Vitazyme, the oil content rose slightly, but neither change was great.

Yield and stand results:

Treatment	Stand count	Stand change	Bean yield[1]	Yield change
	plants/acre	plants/acre	bu/acre	bu/acre
Control	135.559	—	44 b	—
Vitazyme	148,540	12,981 (+10%)	52 a	8 (+18%)

[1]Letters a snd b are significantly different at P = 0.10.



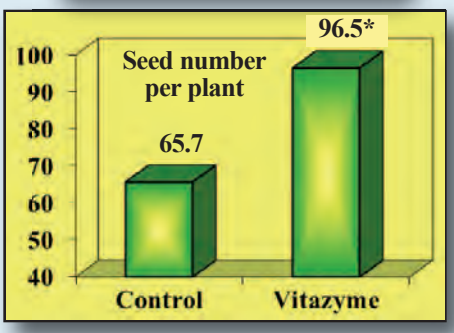


Increase in final stand with Vitazyme: 10%

Increase in yield with Vitazyme: 18%

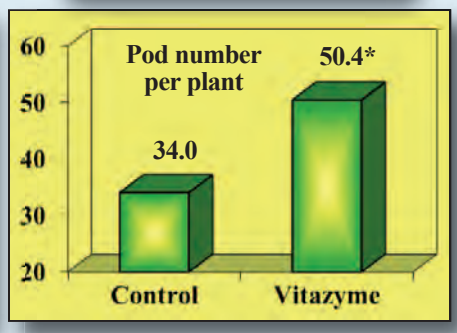
Vitazyme enhanced both the population and yield of the soybeans, even with a severe hailstorm in July.

Seeds Per Plant



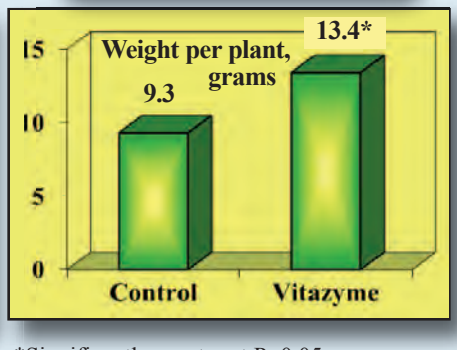
*Significantly greater at P=0.05.

Pods Per Plant



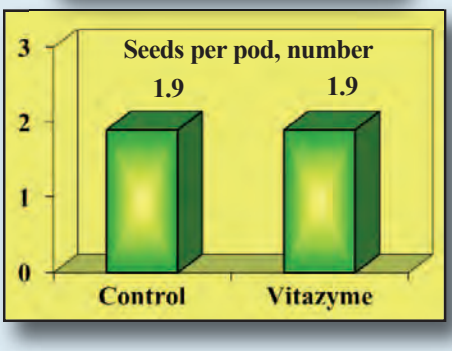
*Significantly greater at P=0.05.

Weight Per Plant

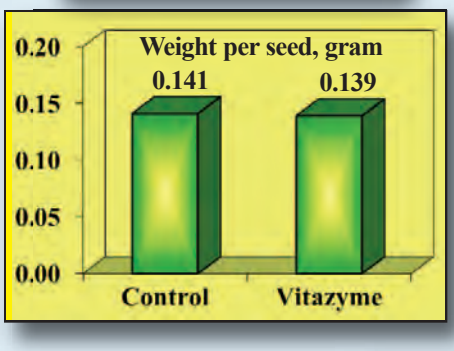


*Significantly greater at P=0.05.

Seeds Per Pod



Weight Per Seed



Vitazyme produced more vigorous plants having more pods, seeds, and plant weight. However, the seeds per pod and weight per seed were the same for both treatments.

Increase with Vitazyme

Seeds per plant 47%
Pods per plant 48%
Weight per plant 44%

Conclusions: A replicated plot study on soybeans at the University of Missouri -- Columbia revealed that Vitazyme increased leaf nutrients during growth, especially for phosphorus (by 12%), and leaf crude protein as well. There was little effect in grain nutrient, protein, and oil levels. Growth parameters and yield were greatly enhanced: seeds per plant by 47%, pods per plant by 48%, and weight per plant by 44%; seeds per pod and seed weight were not affected. The final stand was improved by 10%, perhaps due to enhanced recovery after a severe hailstorm in early July, and yield was increased by 8 bu/acre, or 18%. These results show the great utility of using Vitazyme to improve soybean growth and yield in Missouri. Data on free amino acids in tissues are discussed in a separate report.

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2012 Crop Results

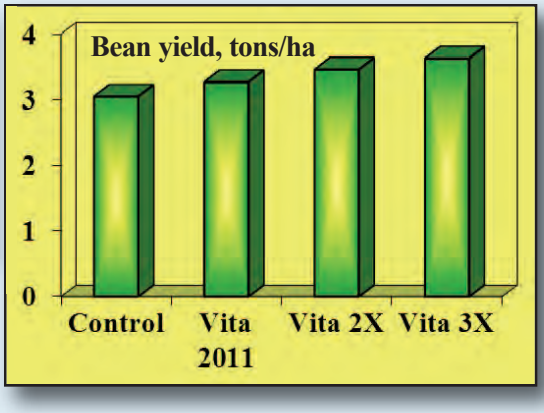
Vitazyme on Soybeans

Researcher: V. Plotnikov *Research organization*: National Academy of Agricultural Sciences
Location: Vinnytsia, Ukraine *Variety*: Hutoryanochka *Tillage*: conventional (disking, plowing, harrowing, and cultivation) *Soil type*: gray podzolic (2.2% organic matter, 8.4 mg/100 g of soil hydrolyzed N, 15.8 mg/100 g of soil P, 12.4 mg/100 g of soil exchangeable K, pH = 5.5)
Planting date: May 12, 2012 *Previous crop*: soybeans *Planting rate*: 750,000 seeds/ha
Experimental design: A small plot soybean trial, using 0.1 ha plots and four replications, was established to evaluate the effects of Vitazyme, applied two or three times, on soybean yield, income, nodulation, and quality. Some plots were placed on soils treated the previous year with Vitazyme to evaluate any carryover effects.

1. Control **2. Vitazyme carryover** **3. Vitazyme twice** **4. Vitazyme three times**

Fertilization: none
Vitazyme application: For Treatment 2, applications were made in 2011 on soybeans that had been treated twice. For Treatment 3, 1 liter/ton of seeds was applied before planting (May 12), and 0.5 liter/ha was sprayed on the leaves and soil at the second trifoliate (June 12). For Treatment 4, the same applications were made as for Treatment 3, plus an additional 0.5 liter/ha at branching (June 22).
Yield results:

Treatment	Bean yield	Yield change	Income increase
	tons/ha	tons/ha	hrn/ha
1. Control	3.05	—	—
2. Vitazyme in 2011	3.27	0.22 (+7%)	924
3. Vitazyme 2X	3.46	0.41 (+13%)	1,602
4. Vitazyme 3X	3.63	0.58 (+19%)	2,221



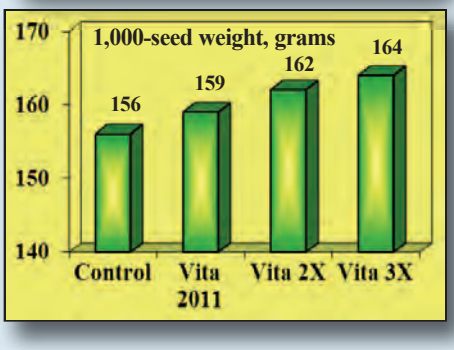
Yields of soybeans responded very well to Vitazyme application, with a carryover effect of 7%, and two applications giving a 13% increase. Three applications provided an excellent 19% yield improvement, granting 2,221 hrn more income per hectare.

Increase in soybean yield with Vitazyme

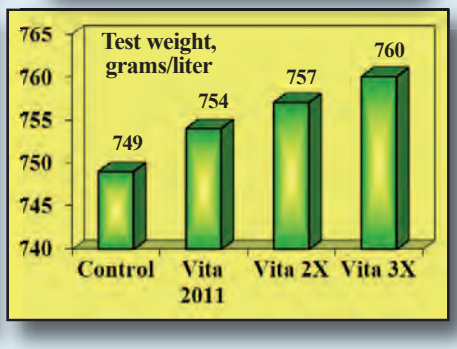
Carryover effect 7%
Vitazyme two times 13%
Vitazyme three times 19%

Bean quality results:

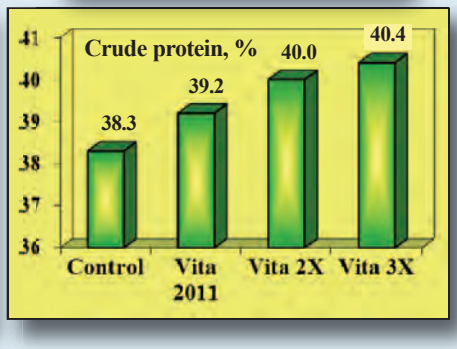
Weight of 1,000 Seeds



Bean Test Weight



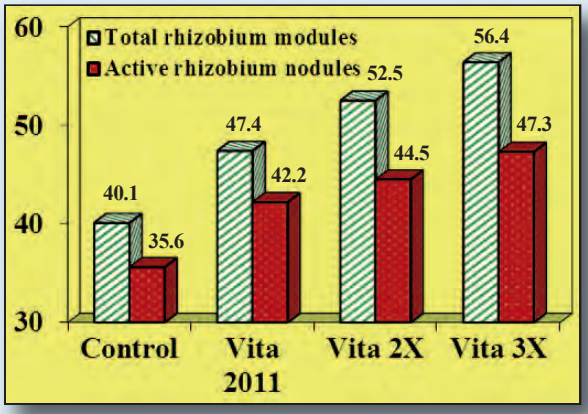
Crude Protein



Increase in bean quality with Vitazyme			
	1,000 seeds, grams	Test weight, grams/liter	Protein, %
Vitazyme carryover	3	5	0.9
Vitazyme twice	6	8	1.7
Vitazyme three times	8	11	2.1

All bean quality parameters were enhanced with Vitazyme, three applications doing better than two. There was good evidence of a carryover effect from 2011 as well.

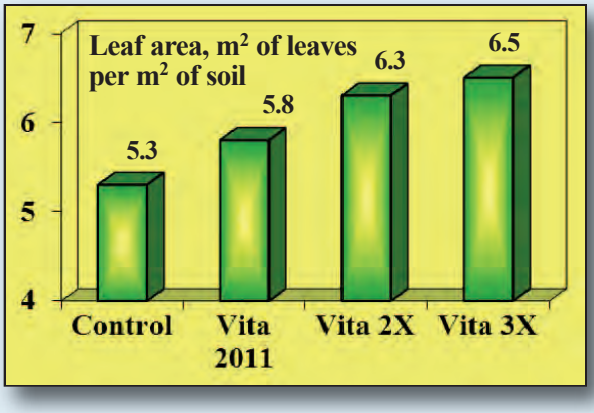
Rhizobium nodulation results: Counts were made of the nodules in the late flowering stage.



Increase in Rhizobium nodules with Vitazyme		
	Total	Active
Vitazyme carryover	+18%	+19%
Vitazyme twice	+31%	+25%
Vitazyme three times	+41%	+33%

Vitazyme n all cases caused great increases in *Rhizobium* nodulation of both total and active types. Three applications produced the greatest increases (33% more active nodules).

Leaf area results: At the late flowering stage, leaf area determinations were made.



Increase in leaf area with Vitazyme
Vitazyme in 2011 ..... +9%
Vitazyme twice ..... +19%
Vitazyme three times ..... + 23%

Leaf area increased up to 23% as more Vitazyme was applied. There was a noticeable carryover effect of 9% from a 2011 application.

Conclusions: A soybean trial in Ukraine compared Vitazyme with an untreated control. Vitazyme was applied the year before and in 2012 on the seeds before planting at 1 liter/ton of seed, and either once or twice more during growth at 0.5 liter/ha. Yields responded consistently to all applications, increasing by 7% for the 2011 carryover effect, and 13 to 19% for the two and three application treatments, respectively. Bean quality also was positively influenced by Vitazyme, the 1,000-seed weight, test weight, and crude protein all responding to the applications in stairstep fashion. The 2011 treatment gave the smallest response in bean quality. Three Vitazyme applications produced 8 more grams per 1,000 seeds, 11 more grams per liter for test weight, and 2.1% more protein than the untreated control. Root nodulation was greatly enhanced by Vitazyme, increasing by up to 33% with three treatments, but by 19% with a 2011 application. Leaf area increases were from 9 to 23%. The *Rhizobium* nodulation and leaf area increases both point towards greater nitrogen and carbon fixation to stimulate growth that produced the yield and quality results noted in this study. Vitazyme is shown to be a very viable soybean amendment for Ukraine.

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2012 Crop Results

Vitazyme on Soybeans

Researcher: Bert Schou, Ph.D.
Research organization: Agricultural Custom Research and Education Services (ACRES)
Location: Cedar Falls, Iowa *Variety*: Pioneer 92M72 (non-GMO) *Previous crop*: corn
Soil type: Kenyon Loam (39% sand, 40% silt, 21% clay), 4.7% organic matter, pH = 5.9, C.E.C. = 16.8 meq/100g, fertility level = excellent, soil drainage = excellent *Planting depth*: 1.5 inches
Row spacing: 30 inches *Planting rate*: unknown *Seedbed at planting*: fine
Planting date: May 18, 2012 *Plot size*: 15 x 40 feet (600 ft.^{2}) *Tillage*: conventional
Irrigation: 3 inches total in late July and early August
Experimental design: A small plot, replicated trial, with four replicates, was set up to evaluate the ability of two Vitazyme variations, plus an amino acid formulation, alone and in combination, to affect soybean yield and quality.

Treatment	Vitazyme 1*	Vitazyme 2*	Amino acids*
1	0	0	0
2	13 oz/acre (2x)	0	0
3	0	13 oz/acre (2x)	0
4	0	0	2 oz/acre (2x)
5	13 oz/acre (2x)	0	2 oz/acre (2x)

*All applications were on the seeds at planting, and on the leaves and soil later.

Fertilization: none
Vitazyme application: For Treatments 2, 3, and 5, 13 oz/acre on the seeds at planting (May 18), and again at 13 oz/acre on the leaves and soil at V8R1 (early bloom; July 4), were applied. Treatments 2 and 5 received Vitazyme 1, and Treatment 3 received a slight modification called Vitazyme 2.
Amino acid application: A proprietary amino acid blend was applied to Treatments 4 and 5, to the seeds at 2 oz/acre on May 18, and to the leaves and soil at the V8R1 stage at 2 oz/acre on July 4. For Treatment 5, the amino acids were mixed with the Vitazyme.
Sprayer settings: seed treatment, 10 gallons/acre of 115 ml of Vitazyme in 3 gallons of water, or 18 ml of amino acids in 3 gallons of water; foliar and soil treatment, 15 gallons/acre of 77 ml of Vitazyme in 3 gallons of water, or 12 ml of amino acids in 3 gallons of water
Weed control: Stellar herbicide at 4 oz/acre, Basagran at 1 pint/acre, Select Max at 8 oz/acre, and the surfactant Class Act 17% at 1 pint/acre, applied June 20
Weather during the growing season: The season was hot and dry, with the July average high temperature being 92.3^o F, and the August high being 85.5^o F. Rainfall for April through October 12 was 12 inches, whereas the normal is 26 inches.
Harvest date: September 25, 2012. A Massey-Ferguson 9 plot combine harvested the middle two rows of

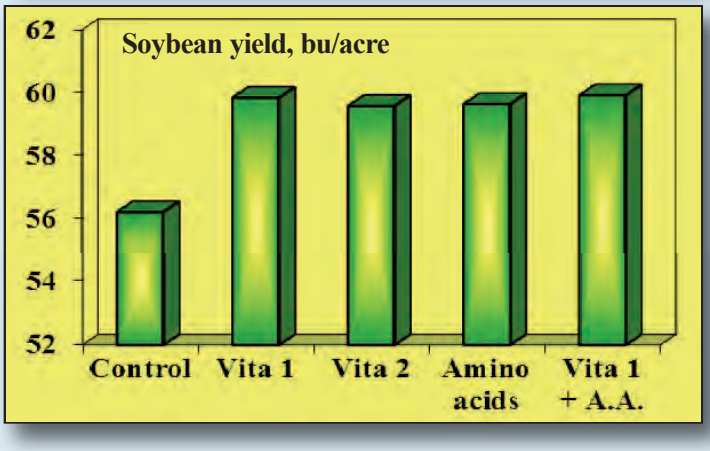
each plot, and the soybeans were weighed on an electronic scale.
Plant population results: no significant differences
Test weight results: no significant differences
Soybean protein results: Composite bean samples from the four replicates of each treatment were sent to Midwest Laboratories, Inc., Omaha, Nebraska, to evaluate protein levels. All five treatments varied within a narrow range, of 38.7 to 40.2%, the control being 39.4%.
Yield results: The two inner rows of each plot were harvested.

Treatment	Yield[1]	Yield change
	bu/acre	bu/acre
1. Control	56.22 b	—
2. Vitazyme 1	59.84 a	3.62 (+6%)
3. Vitazyme 2	59.58 ab	3.36 (+6%)
4. Amino acids	59.64 a	3.42 (+6%)
5. Vita 1 + A.A.	59.92 a	3.70 (+7%)
$LSD_{0.05}$	3.39 bu/acre	
Standard deviation	2.53 bu/acre	
Replicate F	16.910	
Treatment F	1.960	
C.V.	6.09%	

[1]Means followed by the same letter are not significantly different at P = 0.05, according to the Student-Newman-Keuls Test.

Yield increase with Vitazyme and amino acids

Vitazyme 1 ..... 6%
Vitazyme 2 ..... 6%
Amino acids 6%
Vitazyme + Amino acids 7%



All four treatments increased soybean yield to about the same level: 6 to 7%. All displayed significant increases over the control, except Vitazyme 2, which was nearly significant.

Conclusions: A soybean replicated trial in east-central Iowa, during a hot and dry season, revealed that two varients of Vitazyme and an amino acid formulation, alone or together, all raised bean yield by 6 to 7%; all increases were significant, except for the Vitazyme 2 treatment, which was nearly so. Test weight and protein were not influenced significantly by the treatments. These results show the great efficacy of utilizing these materials for Corn Belt soybean production, since at $16.00/bu (the fall 2012 soybean price) a 3.62 bu/acre increase for Vitazyme 1 equals $57.92/acre greater income.

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2012 Crop Results

Vitazyme on Soybeans

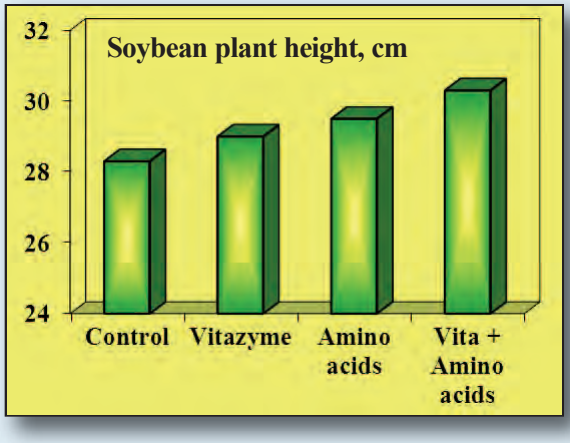
A Greenhouse Trial - Synergism with Amino Acids

Researcher: Paul W. Syltie, Ph.D.
Location: Vital Earth Resources Research Greenhouse, Gladewater, Texas
Variety: "Common" *Planting date*: January 19, 2012 *Pot size*: 1 gallon
Soil type: silt loam *Planting rate*: 12 seeds/pot, thinned to two plants per pot
Experimental design: A greenhouse pot trial, using four replicates, was arranged to determine the effect of Vitazyme and amino acids, alone and in combination, on plant height and dry weight accumulation.

1. Control **2. Vitazyme** **3. Amino acids** **4. Vitazyme + amino acids**

Fertilization: none
Vitazyme application: Pots of Treatments 2 and 4 received 100 ml/pot of a 0.1% Vitazyme solution just after seeding.
Amino acid application: A special liquid proprietary amino acid blend was applied at 100 ml/pot of a 0.04% solution to Treatments 3 and 4. For Treatment 4, the product was mixed with Vitazyme in 100 ml of water.
Harvest date: March 1, 2012, 41 days after planting
Height results: The two plants from each pot were measured to the nearest cm, and averaged. A statistical analysis was performed on these averages.

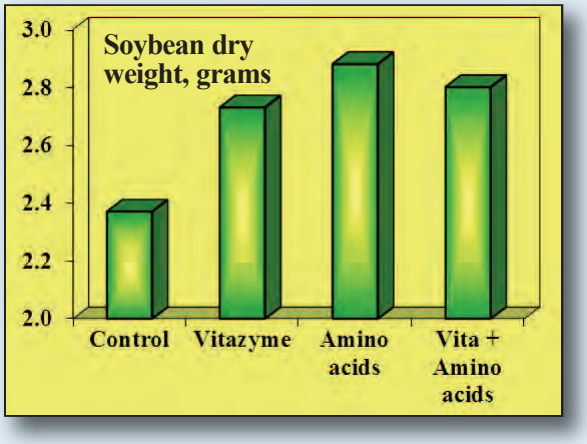
Treatment	Plant height	Height change
	cm	cm
1. Control	28.3 b	—
2. Vitazyme	29.0 ab	0.7 (+2%)
3. Amino acids	29.5 ab	1.2 (+4%)
4. Vita + A.A.	30.3 a	2.0 (+7%)
Block F	0.1105	
Main effects F	0.1338	
Model F	0.1006	
$CV_{0.10}$	3.83%	
$LSD_{0.10}$	1.5 cm	



Increase in plant height with Vitazyme + amino acids: 7%

All treatments increased the height of the soybean plants, the combined products doing this significantly (+7%).

Dry weight results: The plants from each pot were dried in a drying oven at 125° F for 24 hours, and weighed to the nearest 0.01 gram.



Treatment	Plant dry weight	Weight change
	grams	grams
1. Control	2.37 b	—
2. Vitazyme	2.73 a	0.36 (+15%)
3. Amino acids	2.88 a	0.51 (+22%)
4. Vita + A.A.	2.80 a	0.43 (+18%)
Block F	0.679	
Main effects F	0.0053**	
Model F	0.0216*	
$CV_{0.10}$	5.69%	
$LSD_{0.10}$	0.20 gram	

All of the treatments significantly improved soybean dry weight (P = 0.10) above the control, and were not significantly different from one another.

Increase in dry weight

Vitazyme 15%
Amino acids 22%
Vitazyme + Amino acids 18%

Conclusions: This greenhouse trial with soybeans revealed that both Vitazyme and amino acids improved the dry weight of the crop significantly, and the plant height as well for the combined products. No synergism of the products was detected in this trial, except for an indication of it in plant height response.

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2011 Crop Results

Vitazyme on Soybeans

Researcher: Unknown
Research coordinator: I.V. Braginets
Research organization: Alfa-Agro, Ukraine
Variety: unknown
Experimental design: A field was divided into a Vitazyme treated and an untreated portion to evaluate the effect of this product on crop yield.

1. Control **2. Vitazyme**

Fertilization: farm practice
Vitazyme application: 1 liter/ha sprayed on the leaves and soil at flower initiation
Yield results: No yield results are available, but the increase in yield is given.

Increase in soybean yield with Vitazyme:
0.53 tons/ha (7.9 bu/acre)

Conclusion: This yield increase was an excellent result of Vitazyme application in this Ukraine study.

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2011 Crop Results

Vitazyme on Soybeans

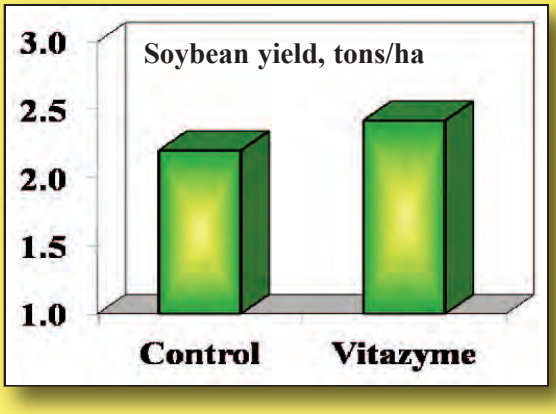
Farmer: unknown *Location*: Chau Thanh District, Dong Thap Province, Mekong Delta, Viet Nam
Variety: unknown *Soil type*: alluvial *Planting date*: February through May 2011
Experimental design: A soybean test involving 118 farmers on a total of 70 ha was initiated the spring of 2011 to evaluate the effects of Vitazyme on soybean yield and profitability.

1. Control **2. Vitazyme**

Fertilization: unknown
Vitazyme application: (1) 1 liter/ha on the leaves and soil 15 days after seeding; (2) 1 liter/ha on the leaves and soil 55 days after seeding
Yield results:

Treatment	Soybean yield	Yield change
	tons/ha	tons/ha
Control	2.20	—
Vitazyme	2.42	0.22 (+10%)

Increase in yield with Vitazyme: 10%



Growth results: Soybeans treated with Vitazyme showed **fewer insect and disease infestations** than the untreated beans.
Income results:

Parameter	Control	Vitazyme
	------ Vietnamese dollars/ha[2] ------	
Total income	33,000,000	36,420,000
Total expenditures[1]	15,297,000	14,920,000
Net income	17,703,000	21,500,000
Extra profit with Vitazyme	---	3,797,000

[1]Costs for the control soybeans were 6,953 VND/kg of crop; for Vitazyme soybeans, the costs were 6,156 VND/kg of crop.
[2]1 USD = 20,000 VND.

Increase in profit with Vitazyme: 3,797,000 VND/ha ($189.85)

Plant protection chemicals	Applications of sprays for plant protection	
	Control	Vitazyme
Pesticides	5	4.4
Anti-disease products	2	1.6
Herbicides	1	1

The improved net income with Vitazyme was due to ...
(1) increased yield
(2) reduced cost for plant protection

Conclusion: A soybean study in the Mekong Delta of Viet Nam, involving 118 farmers and 70 ha of land, compared two Vitazyme applications to none, and revealed that the yield with this product was increased by 10%. Besides, the number of pesticides and anti-disease products applied with Vitazyme treatments was reduced, further reducing costs. The total returns from Vitazyme application were $189.85/ha (3,797,000 VND/ha) greater than for the control areas.

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Average Values for 2009 to 2011 in Ukraine

Vitazyme on Soybeans

Researcher: V.V. Plotnikov *Location*: National Academy of Agrarian Sciences, Vinnytsia State Agricultural Research Station, Vinnytsia, Ukraine (Central Forest and Steppe Region)

Demonstration plot values averaged over three years, 2009 to 2011:

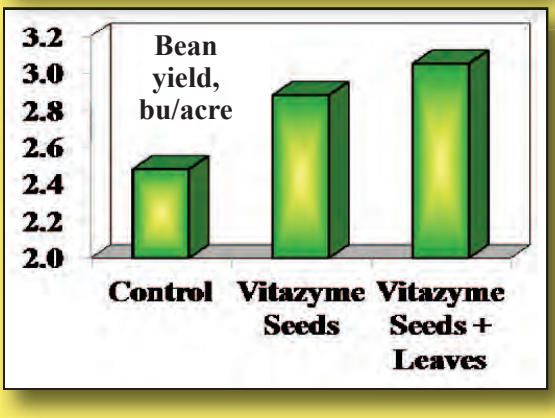
Treatment	Yield	Yield change
	tons/ha	tons/ha
1. Control	2.48	—
2. Vitazyme on seeds[1]	2.88	0.40 (+16%)
3. Vitazyme on seeds + leaves[2]	3.05	0.57 (+23%)

[1]1 liter/ton of seeds; [2]1 liter/ha at branching.

Three-Year Average Increases With Vitazyme

1 liter/ton of seed ..... +16%
1 liter/ton of seed + 1 liter/ha ... +23%

Three-Year Average



Conclusion: Over three years of demonstrations, Vitazyme is shown to be an excellent adjunct to soybean production in Ukraine, especially the seed plus foliar applications.

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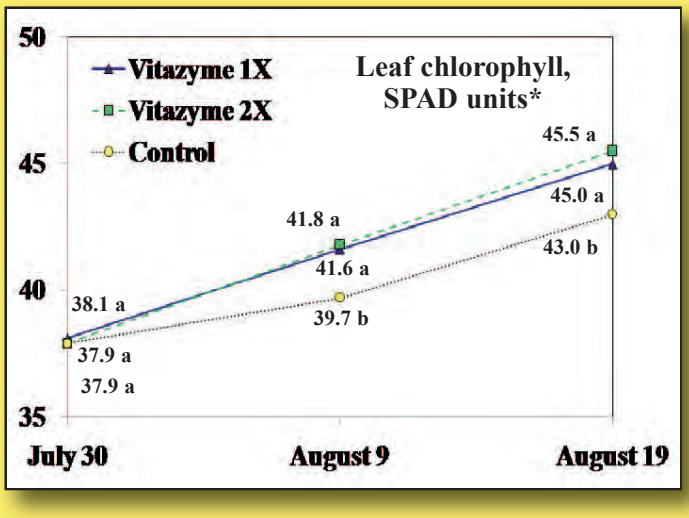
2011 Crop Results

Vitazyme on Soybeans

Researcher: Michael Rethwisch, S.J. Boggs, T. Peterson, and B. Whitson.
Research organization: University of Nebraska-Lincoln Extension, David City, Nebraska
Location: Waverly, Nebraska *Variety*: Pioneer 93M11 *Planting date*: May 28, 2010
Previous crop: corn *Tillage*: disking once before planting
Soil type: Kennebec silt loam (pH=5.6-7.3, low salinity, high water availability, excellent permeability)
Seeding rate: 133,000 seeds/acre *Row spacing*: 30 inches
Experimental design: A soybean field in eastern Nebraska was divided into plots that were 12 rows wide x 1,100 feet long. Four replications were utilized. Upon those were superimposed several seed and foliar treatment products applied at low rates to enhance crop growth. The responses to these products were evaluated, including leaf chlorophyll, nodes, height, pods, pod distribution on the nodes, yield, moisture of the beans at harvest, and certain other parameters. Some of the products were fungicides. Only the results with Vitazyme will be reported here.

1. Control **2. Vitazyme on seeds** **3. Vitazyme on seeds + leaves**

Fertilization: none
Vitazyme application: 13 oz/acre (1 liter/ha) directly over the seed at planting on May 28 for Treatments 2 and 3; 13 oz/acre (1 liter/ha) on the leaves and soil on July 20
Chlorophyll results: Chlorophyll readings were taken on July 30, August 9, and August 19 using an SPAD 502 meter on 30 leaflets per plot, using leaves from the top node having fully expanded leaves



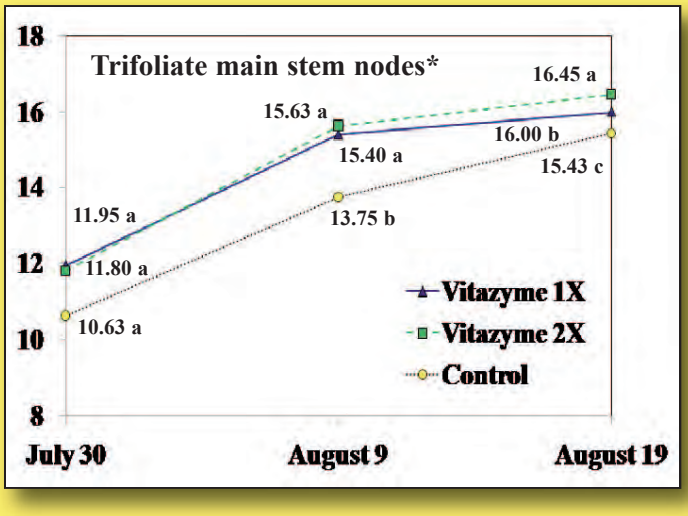
*Means followed by the same letter are not significantly different at P-0.05 according to the Tukey-Kramer HSD Test.

Increase in SPAD units with Vitazyme on August 19

Vitazyme once ..... 2.0 units
Vitazyme twice ..... 2.5 units

During the latter part of the growing season Vitazyme significantly increased leaf chlorophyll for both one and two applications.

Trifoliate main stem nodes results: On July 30, August 9, and August 19 the number of nodes on the main stem was counted for each plot, using ten randomly selected plants.



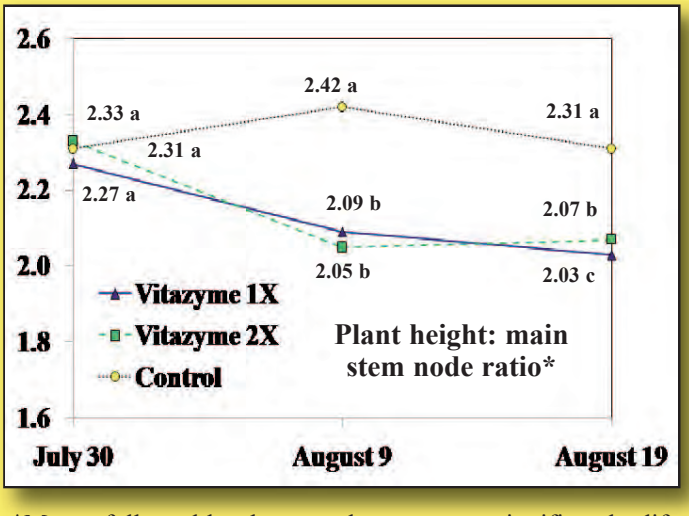
*Means followed by the same letter are not significantly different at P-0.05 according to the Tukey-Kramer HSD Test.

Increase in main stem nodes with Vitazyme

Vitazyme once ..... 4 to 12%
Vitazyme twice ..... 7 to 14%

In every case, both Vitazyme treatments significantly increased the number of nodes on the main stems, especially the two applications treatment.

Plant height:main stem node ratio results: The ration of plant height to the number of nodes on the stem was determined for July 30, August 9, and August 19 on ten randomly selected plants from each plot.



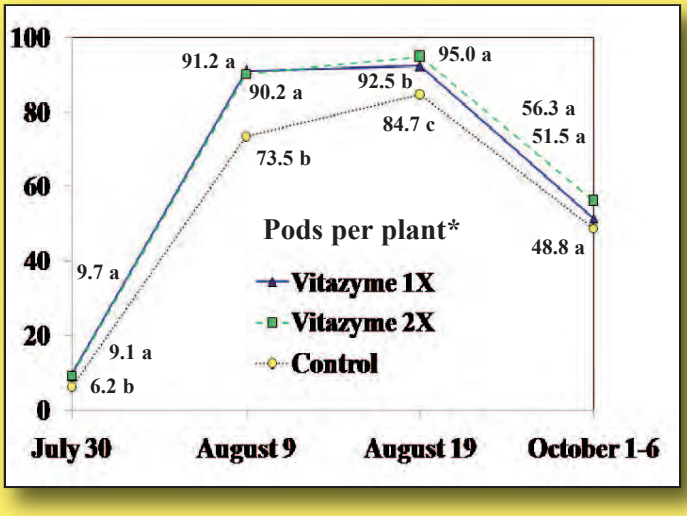
*Means followed by the same letter are not significantly different at P-0.05 according to the Tukey-Kramer HSD Test.

Change in plant height:main stem ratio with Vitazyme

Vitazyme once ... -0.28 to 0.33
Vitazyme twice ... -0.24 to 0.37

A low ratio of plant height to node number is desirable because a lower number means more nodes per unit height of stem. Both Vitazyme treatments significantly reduced the ratio.

Pods per plant results: The total pods per plant were counted on ten randomly selected plants for each plot on several dates.



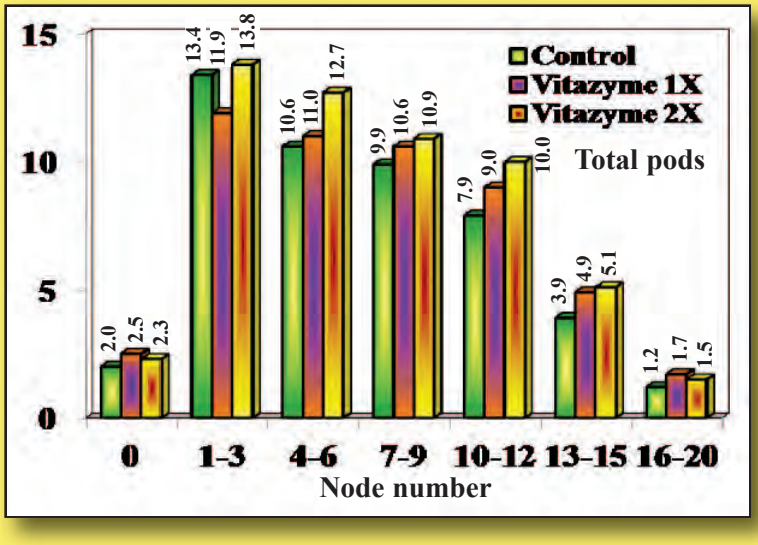
*Means followed by the same letter are not significantly different at P-0.05 according to the Tukey-Kramer HSD Test.

Increase in pods per plant with Vitazyme

Vitazyme once ..... 6 to 56%
Vitazyme twice ..... 15 to 47%

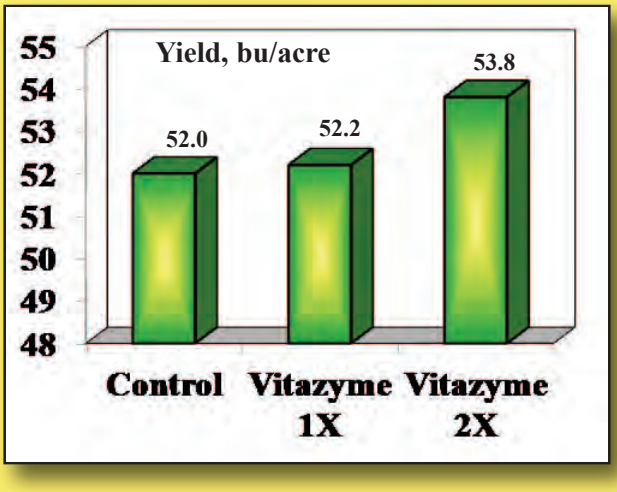
Vitazyme treatments increased pods per plant significant;y for the first three dates, but not for the last date. Many pods were aborted before harvest, giving a reduction for the October count.

Pod distribution results: At harvest, 15 consecutive plants from one of the middle four rows in each plot were collected, and the number of pods was counted for each main stem node.



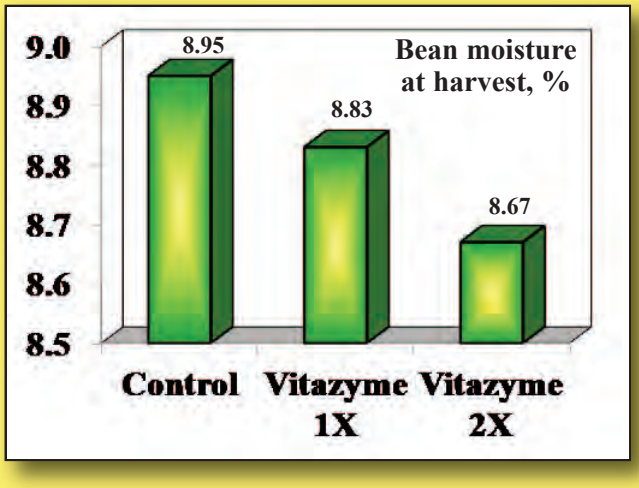
At most nodes, both Vitazyme treatments – especially the two application treatment – increased pods per node. None of the values were significantly different than the untreated control.

Yield results:



Vitazyme treatments increased yield slightly, especially for the two applications, but these increases were not significant at P=0.05.

Moisture at harvest results:



Although the differences in bean moisture at harvest were not significant, both Vitazyme treatments – especially the two application treatment – dried down faster at harvest than did the control.

Conclusions: A replicated soybean study in eastern Nebraska revealed that Vitazyme, as either a seed or a seed plus foliar treatment, significantly improved leaf chlorophyll (2.o to 2.5 SPAD units), main stem nodes (4 to 14%), plant height;main stem node ratios (-0.24 to -0.37), and pods per plant (6 to 56%). Both treatments – especially the seed plus foliar treatment – increased the pods distributed along the stem, and slightly increased yield and reduced moisture at harvest. The lack of a significant yield response is likely due to a lack of adequate soil fertility to fill the pods that were available to fill as the season progressed. These results show the utility of Vitazyme as a powerful tool for soybean producers in the Corn Belt of the United States.

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2011 Crop Results

Vitazyme on Soybeans

Effects on Oil Content

Researcher: Michael Rethwisch
David City, Nebraska
Research organization: University of Nebraska — Lincoln Extension,
Location: Clay Center, Cortland, Bancroft, and Elba, Nebraska
Variety: Pioneer 93M11

Experimental design: Four soybean field locations in Nebraska were selected to place replicated trials using several products. These products included inoculants, humates, fertilizers, and non-microbial biostimulants, of which Vitazyme was one. Evaluations were made of yield, protein, and oil to determine effects of these products on economically important parameters.

Product applications: All products were applied according to the manufacturers' recommendation, with Vitazyme applied at 13 oz/acre (1 liter/ha) at planting using a "splitter" (products were placed beside the seeds). An untreated control was included at all four sites.

Yield results: For all four sites, yield did not vary significantly, ranging from 64.3 to 71.9 bu/acre at Clay Center, from 66.5 to 70.1 bu/acre at Cortland, from 59.9 to 62.2 bu/acre at Bancroft, and from 68.1 to 71.7 bu/acre at Elba.

Protein results: The protein content of the soybeans showed no significant difference amongst all treatments at all four locations, ranging from 34.07 to 34.53% at Clay Center, from 35.19 to 35.53% at Cortland, from 32.83 to 33.35% at Bancroft, and from 34.03 to 34.28% at Elba.

Oil results: At all four sites the Vitazyme treated soybeans produced the highest oil content, although none of the differences among treatments were significant at P=0.05. Because of this consistency of response, the data are presented here.

Clay Center

Treatment	Oil content, %
Vitazyme	19.35
CALFA	19.34
Carbon Boost-S	19.33
CMPX	19.31
GreenSol 48	19.31
BioGerminator 11-0-1	19.30
BioGerminator 3-0-1	19.27
Control	19.24
GS-48	19.12
CXMPX	19.11

Cortland

Treatment	Oil content, %
Vitazyme	19.36
GS-48	19.24
CMPX	19.23
Carbon Boost-S	19.21
Control	19.18
CALFA	19.18
GreenSol 48	19.11
CXMPX	19.11
BioGerminator 3-0-1	19.08
BioGerminator 11-0-1	19.01

Bancroft

Treatment	Oil content, %
Vitazyme	19.71
GreenSol 48	19.70
CXMPX	19.69
BioGerminator 11-0-1	19.63
CMPX	19.61
CALFA	19.60
Bio Germinator 3-0-1	19.60
Carbon Boost-S	19.59
Control	19.58
GS-48	19.46

Elba

Treatment	Oil content, %
Vitazyme	20.03
GreenSol 48	19.99
Control	19.98
CMPX	19.97
CXMPX	19.94
Carbon Boost-S	19.93
BioGerminator 11-0-1	19.91
GS-48	19.90
BioGerminator 3-0-1	19.90
CALFA	19.87

Average for All Locations

Treatment	Oil content, %
Vitazyme	19.62
CMPX	19.53
GreenSol 48	19.53
Carbon Boost-S	19.52
CALFA	19.50
Control	19.50
Bio Germinator 11-0-1	19.46
Bio Germinator 3-0-1	19.46
CXMPX	19.46
GS-48	19.43

Conclusions: It is clear from the total averages from all four locations that Vitazyme had a real effect on soybean oil content. The product boosted oil content by 0.09 percentage point above the next closest oil value, while the other nine treatments varied within a range of only 0.10 percentage point. This product elicited a small but consistent boost in bean oil content in this four-location Nebraska soybean study.

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2011 Crop Results

Vitazyme on Soybeans

An Evaluation of Two Formulations

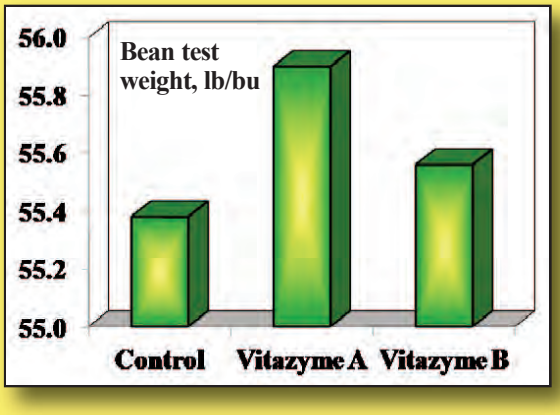
Researcher: Bert Schou, Ph.D. *Research organization*: Agricultural Custom Research and Education Services (ACRES) *Location*: Cedar Falls, Iowa *Variety*: NuTech 7249 (GMO)
Soil type: Floyd loam (42% sand, 39% silt, 19% clay, 4.4% organic matter, pH = 6.4, C.E.C. = 13.3 meq/100 g, fertility level = excellent, drainage = excellent) *Planting depth*: 2 inches
Row spacing: 30 inches *Planting rate*: 150,000 seeds/acre *Seedbed at planting*: fine
Planting date: May 19, 2011 *Tillage*: conventional *Plot size*: 15 x 40 feet (600 ft.^{2})
Experimental design: A small plot study, having six replicates, involved two Vitazyme formulations in a randomized complete block design. The purpose of the study was to evaluate the effectiveness of the two Vitazyme formulations on crop yield and quality.

1. Control **2. Vitazyme A** **3. Vitazyme B**

Fertilization: none
Weed control: herbicides
Vitazyme application: (1) 13 oz/acre (1 liter/ha) in the seed row at planting on May 19, 2011; (2) 13 oz/acre (1 liter/ha) on the leaves and soil at R1 (14 inches height) on July 7, 2011
Weather during the growing season: The season was favorable for soybean growth in terms of temperature and rainfall, despite a dry early July.
Harvest date: October 8, 2011. A Massey Ferguson 8 plot combine harvested the middle two rows of plots, and the beans were weighed using an electronic scale.
Test weight results: There were some differences in test weight for the treatments.

Treatment	Test weight[1]	Test weight change
	lb/bu	lb/bu
1. Control	55.38 b	—
2. Vitazyme A	55.90 a	0.52 (+1%)
3. Vitazyme B	55.56 ab	0.18 (0%)
$LSD_{0.05}$	0.50 lb/bu	
Standard deviation	0.39 lb/bu	
Replicate F	1.54	
Treatment F	2.71	
CV	2.77	

[1]Means followed by the same letter are not significantly different at P=0.05 according to the Student-Newman-Keuls-Test.



Vitazyme A significantly increased bean test weight above the control, while Vitazyme B gave a nonsignificant test weight increase.

Yield results:

Treatment	Yield[1]	Yield change
	bu/acre	bu/acre
1. Control	63.9 a	—
2. Vitazyme A	63.4 a	(-) 0.5 (0%)
3. Vitazyme B	65.2 a	1.3 (+2%)
$LSD_{0.05}$	2.3 bu/acre	
Standard deviation	1.8 bu/acre	
Replicate F	3.64	
Treatment F	1.68	
CV	2.77%	

[1]Means followed by the same letter are not significantly different at P=0.05 according to the Student-Newman-Keuls-Test.

Neither of the products significantly increased yield, although Vitazyme B gave a 1.4 bu/acre yield increase.

Conclusion: A replicated soybean study in east-central Iowa revealed that two Vitazyme formulations improved bean test weight, the Vitazyme A formulation significantly, above the control. Yield increases were not significant, though Vitazyme B improved yield by 1.3 bu/acre over the control. Very high yields during this favorable cropping year may indicate reduced crop stress, thus limiting the crop's response as yields approached the maximum.

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2011 Crop Results

Vitazyme on Soybeans

A Long-Term Crop and Soil Study: Year 4

Researcher: Bert Schou, Ph.D. *Research Organization*: Agricultural Custom Research and Education Services (ACRES)
Location: Cedar Falls, Iowa
Variety: Nu Tech 7244 *Soil type*: Kenyon loam (34% sand, 46% silt, 20% clay, 4.5% organic matter, pH = 7.3, C.E.C = 17.8 meq/100 g, fertility level = excellent, drainage = excellent)
Planting depth: 2 inches *Row spacing*: 30 inches *Planting rate*: 150,000 seeds/acre
Seedbed at planting: fine *Planting date*: May 19, 2011 *Tillage*: conventional
Previous crop: corn (with glyphosate) *Plot size*: 15 x 50 feet (600 ft^2)
Experimental design: The fourth year of research on the long-term effects of Vitazyme on crop yield and quality, and on soil conditions, was conducted on the same plots as the previous three years. Two treatments were utilized, as during previous years, and with five replicates.

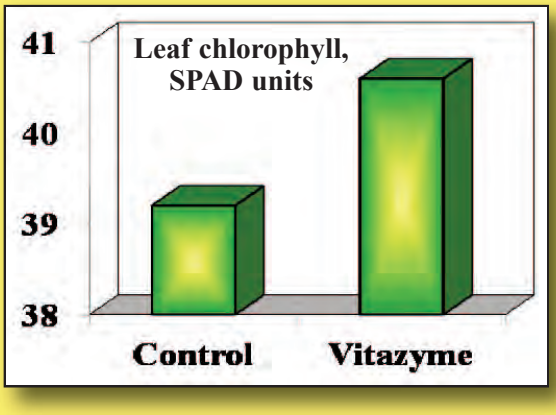
1. Control **2. Vitazyme**

Fertilization: none
Weed control: glyphosate
Vitazyme application: (1) 13 oz/acre (1 liter/ha) on the seeds in-furrow at planting (May 19); (2) 13 oz/acre (1 liter/ha) on the leaves and soil at R1 (July 7)
Weather during the growing season: The season was favorable to soybean growth in terms of temperature and rainfall, except for a dry early July.
Harvest date: October 8, 2011. A Massey-Ferguson 8 plot combine was used to harvest the three center rows of each plot; the beans were weighed electronically, and grain moisture was also measured at this time.
Leaf chlorophyll: On July 26, 2011, 25 random leaves of the first mature trifoliated were measured, and averaged for each plot using a Minolta SPAD meter.

Treatment	Leaf chlorophyll[1]	Chlorophyll change
	SPAD units	SPAD units
1. Control	39.2 b	—
2. Vitazyme	40.6 a	+1.4

[1]Means followed by the same letter are not significantly different at P=0.05 according to the Student-Newman-Kuels Test. $LSD_{0.05}$=0.7 SPAD unit.

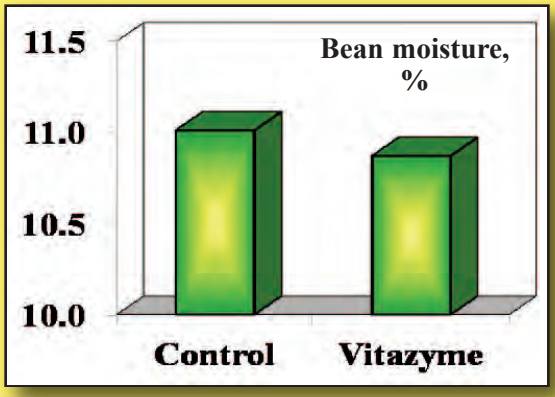
Increase in leaf chlorophyll with Vitazyme: 1.4 SPAD units



Bean moisture: There was a nonsignificant lower moisture content of the Vitazyme treated soybeans compared to those that were untreated.

Treatment	Bean moisture[1]	Change
	%	%
1. Control	11.01 a	—
2. Vitazyme	10.87 a	(-) 0.14
LSD (P=0.05)	0.81%	
Standard deviation	0.46%	
CV	4.22%	
Replicate F	0.845	
Treatment F	0.224	

[1]Means followed by the same letter are not significantly different according to the Student-Newman-Kuels Test (P=0.05).



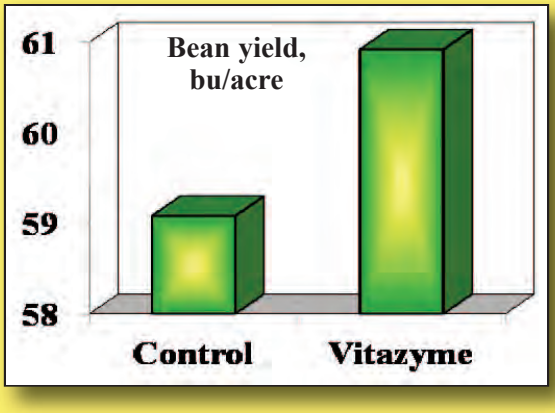
Reduction in bean moisture with Vitazyme: 0.14 percentage point

Bean test weight: There was a nonsignificant increase in test weight with Vitazyme versus the control, of 0.14 lb/bu (55.43 lb/bu for Vitazyme, versus 55.29 lb/bu for the control).

Yield results:

Treatment	Bean yield[1]	Yield change
	bu/acre	bu/acre
1. Control	59.08 a	—
2. Vitazyme	60.92 a	1.84 (+2%)
LSD (P=0.05)	3.75 bu/acre	
Standard deviation	2.13 bu/acre	
CV	3.56%	
Replicate F	10.388	
Treatment F	1.860	

[1]Means followed by the same letter are not significantly different according to the Student-Newman-Kuels Test (P=0.05).



Increase in yield with Vitazyme: 2%

The yield increase with Vitazyme was not significant at P=0.05, but was highly profitable, At $12.00/bu, this 1.85 bu/acre increase was worth $22.08/acre

Grain quality results: Samples of soybeans from each plot was sent to Midwest Laboratories, Omaha, Nebraska, for analyses of protein and minerals. Statistical analyses were conducted on these data.

Treatment	Crude protein	Sulfur	Phosphorus	Potassium	Magnesium	Calcium	Iron	Manganese
	%	%	%	%	%	%	ppm	ppm
1. Control	42.08	0.30	0.602	1.96	0.266	0.332	85.6	34.4 b
2. Vitazyme	42.34	0.31	0.602	2.01	0.268	0.338	92.2	36.6 a
Treatment F		0.374			0.374		0.135	0.011*
$LSD_{0.1}$		0.01			0.004		7.5	1.0

*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Kuels Test.

Treatment	Copper	Zinc
	ppm	ppm
1. Control	11.6	33.8 b
2. Vitazyme	12.6	35.0 a
Treatment F		0.109*
$LSD_{0.1}$		1.2

*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Kuels Test.

Nutrient increases with Vitazyme

- **Crude protein 0.26%-pt**
- **Sulfur 0.01%-pt**
- **Potassium 0.05%-pt**
- **Magnesium 0.002%-pt**
- **Calcium 0.006%-pt**
- **Iron ..... 6.6 ppm**
- **Manganese ..... 2.2 ppm**
- **Copper ..... 1.0 ppm**
- **Zinc ..... 1.2 ppm**

All parameters, except phosphorus and protein, increased in the beans from Vitazyme application. Increases were not always large or significant, but they were positive.

Soil microorganism results: A composite soil sample from each rep of both treatments was collected and sent to the Soil Food Web laboratory in Corvalis, Oregon, for microorganism analyses.

Treatment	Active Bacteria	Total Bacteria	Active Fungi	Total Fungi	Amoebic Protozoa	Nematodes	Nitrogen Release	Actinomycetes
	µg/gram	µg/gram	µg/gram	µg/gram	µg/gram	number/gram	lb/acre	µg/gram
1. Control	8.31	1,762	11.2	304	7,376	7.23	88	2.94
2. Vitazyme	11.90	3,166	14.5	372	34,657	18.30	125	4.30

Improvements in microbial populations with Vitazyme

- **Active bacteria ..... +43%**
- **Total bacteria ..... +80%**
- **Active fungi ..... +29%**
- **Total fungi ..... +22%**
- **Amoebic protozoa..... +370%**
- **Nematodes..... +153%**
- **Nitrogen release..... +37 lb/acre**
- **Actinomyceyes..... +46%**

[1]Most of these nematodes are beneficial types.

Vitazyme increased the number of fungi, bacteria, actinomycetes, and protozoa in the soil versus the untreated control. The ratio of total fungi to total bacteria was 0.17 for the control, and 0.12 for the Vitazyme treatment, showing a preference to soil fungi with Vitazyme, a beneficial trait. Available nitrogen production by soil microorganisms was increased by 42% by Vitazyme treatment as well.

Soil results: Soil samples from each plot of both treatments were sent to Perry Agricultural Laboratory in Bowling Green, Missouri, for a broad analysis of minerals and other parameters. Statistical analyses were conducted on these data.

Treatment	Cation Exchange Capacity	pH	Organic Matter	Nitrogen	Sulfur	Phosphorus	Calcium	Magnesium
	meq/100 grams		%	lb/acre	ppm	lb/acre	lb	lb/acre
1. Control	27.34	5.64 b	2.68	73.6	7.8	128.4	5,398	1,077 b
2. Vitazyme	26.27	5.78 a	2.68	73.6	6.4	147.4	5,447	1,138 a
Treatment F	0.1215	0.0046**	1.000	1.000	0.431	0.452	0.575	0.015*
$LSD_{0.1}$	1.16	0.05	0.26	5.2	3.4	48.7	172.6	172.6

*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Kuels Test.

Treatment	Potassium	Sodium	Boron	Iron	Manganese	Copper	Zinc
	lb/acre	lb/acre	ppm	ppm	ppm	ppm	ppm
1. Control	272	80	0.65	241.2	57.4	0.94	4.60
2. Vitazyme	312	62	0.67	222.8	58.0	0.94	4.54
Treatment F	0.215	0.228	0.918	0.103	0.816	1.000	0.529
$LSD_{0.1}$	58	27	0.23	18.6	5.2	0.15	0.19

Changes in soil parameters with Vitazyme

pH ..... +0.14*
Organic matter ..... no change
Nitrogen ..... no change
Sulfur ..... -1.4 ppm
Phosphorus ..... +19.0 lb/acre
Calcium ..... +49 lb/acre
Magnesium ..... +61 lb/acre
Cation exchange capacity .... -1.07 meq/100g
Potassium ..... +40 lb/acre
Sodium ..... -18 lb/acre
Boron ..... +0.02 ppm
Iron ..... -18.4 ppm
Manganese ..... +0.6 ppm
Copper ..... no change
Zinc ..... -0.06 ppm

Note that most soil parameters were improved with Vitazyme, and significantly for pH and magnesium. Even sodium, which is undesirable at higher levels, was reduced in this study while calcium, magnesium, and potassium were increased.

Balance of Soil Cations

Vitazyme had a remarkable effect on the percentages of base saturation for all of the measured cations, moving the composition of the soil colloid towards a more favorable balance.

Treatment	Calcium Saturation	Magnesium Saturation	Potassium Saturation	Sodium Saturation	Hydrogen Saturation
	% B.S.	% B.S.	% B.S.	% B.S.	% B.S.
1. Control	49.64 b	16.51 b	1.29 b	0.64	25.8 a
2. Vitazyme	52.25 a	18.22 a	1.57 a	0.52	21.6 b
Treatment F	0.013*	0.002**	0.090*	0.294	0.005**
$LSD_{0.1}$	1.31	0.51	0.27	0.21	1.57

B.S. = base saturation
*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Kuels Test.

Control base saturations	Vitazyme base saturations
Ca 49.6	Ca 52.3
Mg 16.5	Mg 18.2
K 1.3	K 1.6
Na 0.6	Na 0.5
H 25.8	H 21.6

All of the elements moved in favorable directions with Vitazyme compared to the control, after four years of treatment. Calcium, magnesium, and potassium increased, while sodium and hydrogen decreased, thus providing better nutrient availability to plants, as mediated by the added microbial stimulation of Vitazyme's active agents. This microbe evidence is available for this year and previous years as well.

Conclusion: The fourth year of a long-term study into the effects of Vitazyme on crop yield (corn-soybean rotation), crop quality, and soil characteristics has shown that this product continues to favorably affect the yields and quality of the crop, and also improves soil parameters. Soybeans were grown in 2011, following corn in 2010, and the following results were obtained.

Leaf chlorophyll. Vitazyme significantly improved leaf chlorophyll in a midsummer evaluation, by 1.4 SPAD units.

Bean moisture at harvest. The treated soybeans were slightly dryer at harvest then were the untreated beans.

Bean yield. Vitazyme increased the yield above the control by 1.84 bu/acre (2%), which was not significant but was highly profitable.

Bean composition. Nearly all minerals and protein were increased in the beans with Vitazyme treatment – especially manganese and zinc, which responded significantly at P=0.10 – and only phosphorus did not respond at all.

Soil microorganisms. Both active and total bacteria and fungi increased above the control with Vitazyme (22 to 80%), but especially the fungi, leading to a lower fungi;bacteria ratio, a favorable result. Protozoa, beneficial nematodes, and actinomycetes also increased with Vitazyme, and projected nitrogen release rose by 37 lb/acre.

Soil parameters. After four years of treatment, the Vitazyme treated soils showed consistent improvements in availability of most elements – except sulfur, iron, copper, and zinc, and sodium, which declined – although soil organic matter and available nitrogen showed no change from the control; magnesium increased significantly at P=0.01. Soil pH increased significantly to 5.78 with Vitazyme. Of special interest is the fact that the cations all significantly moved towards a more favorable balance in terms percent base saturation, sodium declining at the same time.

These results show the considerable benefit of Vitazyme for soybeans and for soil characteristics over a long-term use program on highly fertile Iowa soils.

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2011 Crop Results

Vitazyme on Soybeans

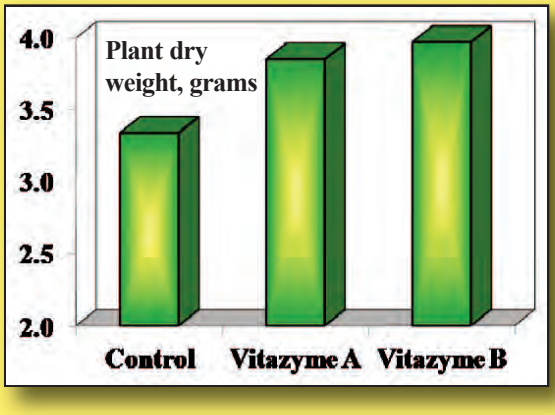
Researcher: Paul W. Syltie, Ph.D *Location*: Vital Earth Resources Research Greenhouse, Gladewater, Texas
Variety: Common *Pot size*: 1 gallon *Soil type*: silt loam
Planting rate: 12 seeds/pot, thinned to 3 plants/pot *Planting date*: November 12, 2010
Experimental design: A replicated greenhouse pot study was conducted to evaluate the effect of two Vitazyme formulations to increase plant growth. Seven replicates were used.

1. Control **2. Vitazyme A** **3. Vitazyme B**

Fertilization: none
Vitazyme application: Vitazyme A: 100 ml/pot at planting of a 0.1% solution, for regular product; Vitazyme B: 100 ml/pot at planting of a 0.1% solution, diluted directly from concentrate
Dry weight results: The plant roots were washed clean of soil on December 15, and weighed to the nearest 0.01 gram.

Treatment	Dry Weight*	Weight change
	grams	grams
Control	3.34 b	—
Vitazyme A	3.85 a	0.51 (+15%)
Vitazyme B	3.97 a	0.63 (+19%)
Treatment P	0.0133*	
Model P	0.0133*	
CV	10.05%	
$LSD_{0.05}$	0.42 gram	

[1]Means followed by the same letter are not significantly different at P=0.05 according to the Student-Newman-Keuls-Test.



Increase in dry weight with Vitazyme A: 15%

Increase in dry weight with Vitazyme B: 19%

Conclusion: A replicated greenhouse soybean study, using two Vitazyme formulations, revealed that both significantly increased dry weight accumulation over the control treatments, by 15% for Vitazyme A and by 19% for Vitazyme B. The results reveal the excellent effectiveness of both products to improve soybean growth, especially the B formulation that is made directly from concentrate.

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2011 Crop Results

Vitazyme on Soybeans

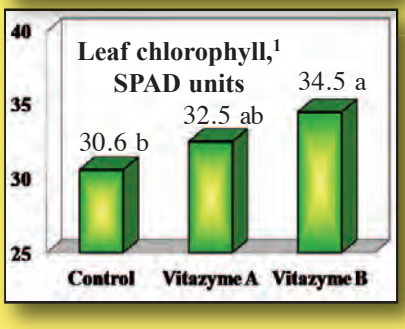
A Greenhouse Study

Researcher: Paul W. Syltie, Ph.D. *Location*: Vital Earth Resources Research Greenhouse, Gladewater, Texas
Variety: common *Pot size*: 1 gallon *Soil type*: silt loam
Planting rate: 12 seeds/pot, thinned to 3 plants/pot *Planting date*: February 14, 2011
Experimental design: A replicated greenhouse pot study was established to evaluate the effects of two Vitazyme formulations on the growth of soybeans. Seven replications were utilized.

1. Control **2. Vitazyme A** **3. Vitazyme B**

Fertilization: none
Vitazyme application: Vitazyme A: 100 ml/pot at planting of a 0.1% solution, from regular product; Vitazyme B: 100 ml/pot at planting of a 0.1% solution, diluted directly from concentrate
Chlorophyll results: At harvest on March 22, chlorophyll determinations were made on the first fully expanded trifoliate, as well as on the second trifoliate; the values for the same pot were averaged. A Minolta SPAD meter was used.

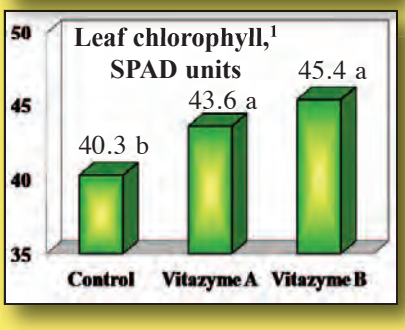
First Trifoliate



Block P - 0.399
Treatment P - 0.039*
Model P - 0.148
$CV_{0.10}$ - 7.86%
$LSD_{0.10}$ - 2.4 units

[1]Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls-Test.

Second Trifoliate



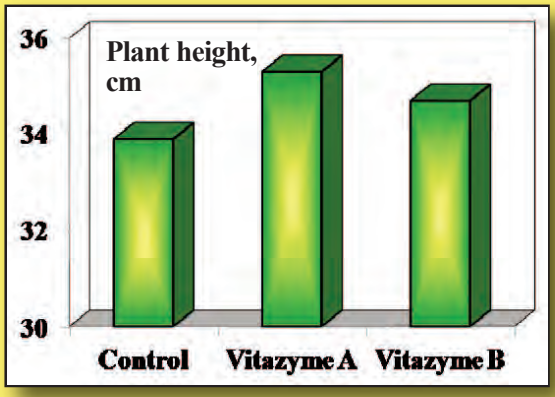
Block P - 0.679
Treatment P - 0.026*
Model P -0.182
$CV_{0.10}$ - 7.09%
$LSD_{0.10}$ - 2.9 units

[1]Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls-Test.

Plant height results: At harvest on March 22, the heights of the three plants for each pot were measured and averaged.

Treatment	Plant height[1]	Height change
	cm	cm
Control	33.9 a	—
Vitazyme A	35.3 a	1.4 (+4%)
Vitazyme B	34.7 a	0.8 (+2%)
Block P	0.288	
Treatment P	0.422	
Model P	0.334	
CV	5.70%	
$LSD_{0.10}$	1.9 cm	

[1]Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls-Test.

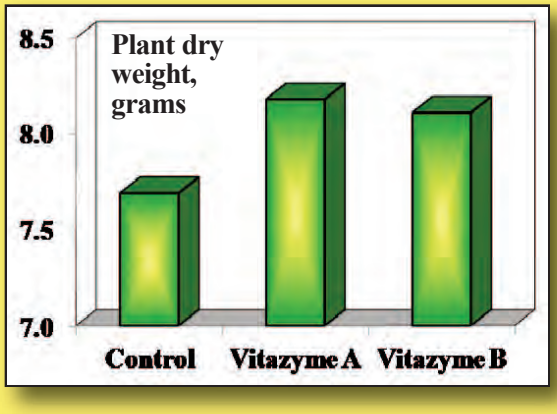


No significant differences were detected on plant height for the three treatments.

Dry weight results: On March 22, the soil was washed from the roots of all plants, and they were placed in a drying oven for 24 hours at 120º F. Weights were made to the nearest 0.01 gram.

Treatment	Dry weight[1]	Weight change
	grams	grams
Control	7.69 a	—
Vitazyme A	8.18 a	0.49 (+6%)
Vitazyme B	8.11 a	0.42 (+5%)
Block P	0.714	
Treatment P	0.335	
Model P	0.641	
$CV_{0.10}$	8.11%	
$LSD_{0.10}$	0.62 gram	

[1]Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls-Test.



Increase in dry weight with Vitazyme

Vitazyme A 6%
Vitazyme B 5%

Although the soybean dry weights were not significantly different, both Vitazyme types increased the weight.

Conclusion: A replicated greenhouse trial with regular Vitazyme, as well as Vitazyme diluted directly from concentrate, revealed significant improvements in leaf chlorophyll for both the first and second mature trifoliates, up to 5.1 SPAD units for Vitazyme B. Both Vitazyme A and Vitazyme B increased plant height (2 to 4%) and dry weight (5 to 6%), but not significantly. These results reveal a tendency of both products to increase crop yield by elevating the rate of photosynthesis and nutrient uptake.

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2011 Crop Results

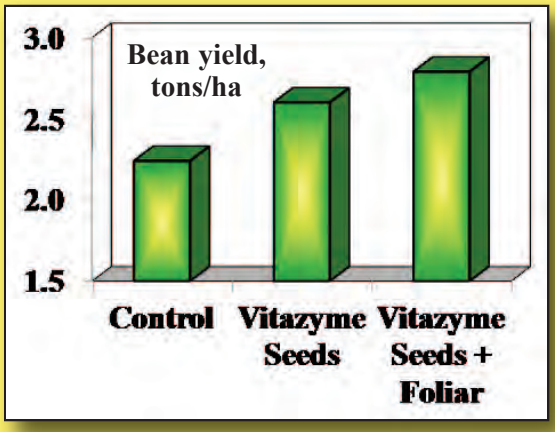
Vitazyme on Soybeans

Researcher: Unknown *Research organization*: National Academy of Agrarian Sciences, Vinnytsia State Agricultural Research Station *Location*: Vinnytsia, Ukraine (Central Forest and Steppe Region)
Variety: Kyivska 98 *Planting date*: unknown
Soil type: gray podzolic (organic matter = 2.2%, hydrolyzed N = 8.4 mg/100 g soil, P = 15.8 mg/100g soil, exchangeable K = 12.4 mg/100 g soil, pH = 5.5)
Experimental design: Soybean plots were prepared and treated with two Vitazyme treatments, to evaluate the effect of the product on bean yield and profitability.

1. Control **2. Vitazyme on seeds** **3. Vitazyme on seeds and soil**

Vitazyme applications: Treatments 2 and 3, 1 liter of Vitazyme per ton of seed on May 8, 2011; Treatment 3, 1 liter/ha on the leaves and soil at branching on June 21, 2011
Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
Control	2.24	—
Vitazyme, seeds	2.60	0.36 (+16%)
Vitazyme, seeds + foliar	2.79	0.55 (+25%)



Yield increase with a Vitazyme seed treatment: 16%
Yield increase with a Vitazyme seed + foliar treatment: 25%

Income results:

- Income increase with a Vitazyme seed treatment: +992 hrn/ha
- Income increase with a Vitazyme seed + foliar treatment: +1,364 hrn/ha

Conclusion: This Ukrainian soybean study parallels other studies performed in Vinnytsia during previous years, showing that Vitazyme dramatically improved crop yield (16 to 25%), and increased income by from 992 to 1,364 hrn/ha, using a seed treatment, or a seed and a later foliar treatment. This program is proven to be consistent in its effects to aid in soybean productivity and profitability in Ukraine.

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2009 Crop Results

Vitazyme on Soybeans

A Long-Term Study: Year 2

Researcher: Bertel Schou, Ph.D. *Research organization*: ACRES (Agricultural Custom Research and Environmental Services), Cedar Falls, Iowa
Variety: Pioneer 92M40 (BBCH: BSOY) *Planting rate*: 62 lb/acre
Planting depth: 2 inches *Planting date*: May 21, 2009
Tillage: conventional (field cultivated and harrowed) *Row width*: 30 inches
Previous crop: corn

Experimental design: The same plots from the first year of this long-term study were preserved for the second year. These plots were arranged in a randomized complete block design, with five replicates and two treatments. The study is designed to assess the long-term effects of Vitazyme on the yield and growth of corn and soybeans in rotation, and especially the effects on the physical, chemical, and microbial properties of the soil.

1. Control **2. Vitazyme**

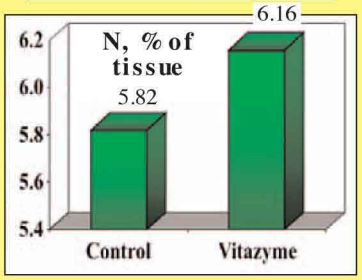
Fertilization: none

Vitazyme application: 13 oz/acre (1 liter/ha) in the seed furrow at planting (May 21, 2009), and 13 oz/acre (1 liter/ha) sprayed on the leaves and soil on June 23, 2009, at the V3 stage

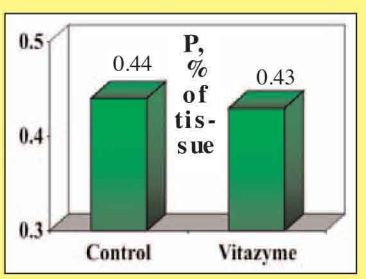
Weed control: glyphosate

Plant analyses: One sampling of leaves from the two treatments was made and sent to Midwest Laboratories, Omaha, Nebraska. Leaves were received on June 24, 2009, as a composite of the five replicates for each treatment.

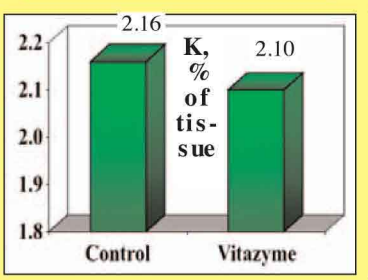
Nitrogen



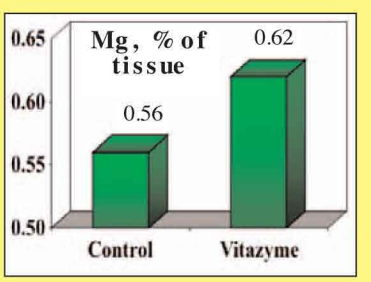
Phosphorus



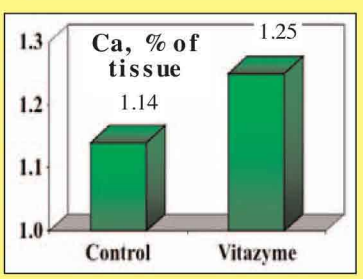
Potassium



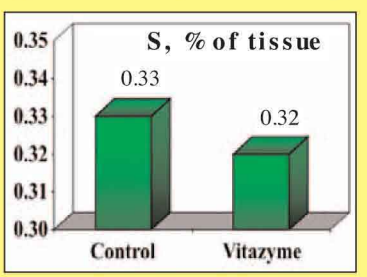
Magnesium



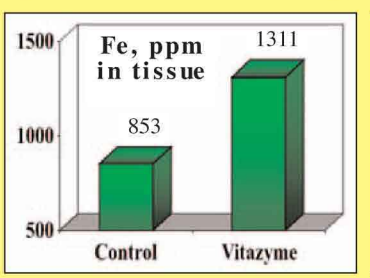
Calcium



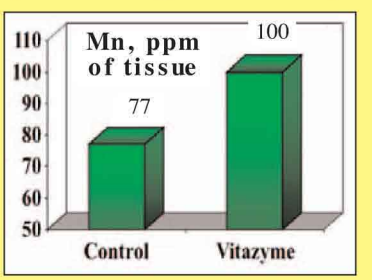
Sulfur



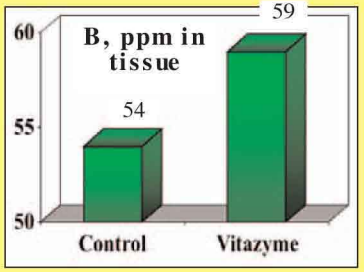
Iron



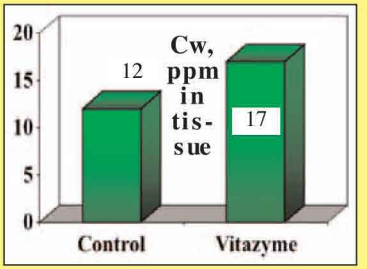
Manganese



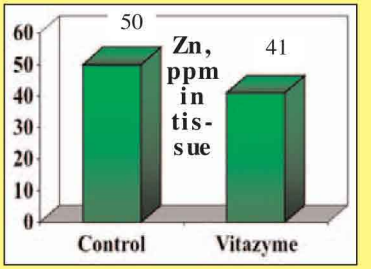
Boron



Copper



Zinc



Harvest date: The crop was harvested on September 29, 2009, with a Massey Ferguson 8 plot combine. Two rows 40 feet long were harvested from each plot.

Grain moisture: There was no major difference in the moisture content of the two treatments.

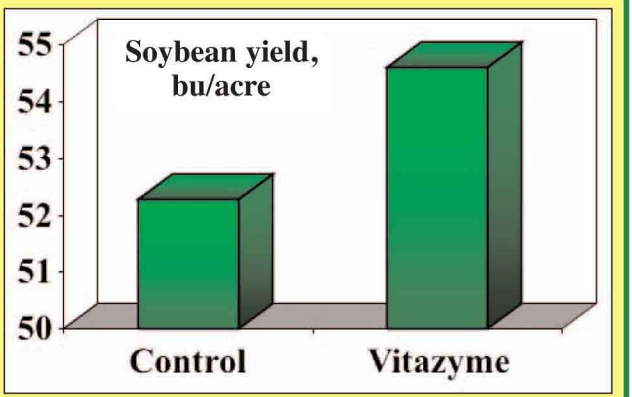
Control moisture: 14.10 Vitazyme moisture: 14.07

Yield results: All soybean yields were adjusted to 13.0% moisture.

Treatment	Bean yield*	Yield increase
	bu/acre	bu/acre
Control	52.28 a	—
Vitazyme	54.60 b	2.32 (+4%)
LSD (0.10)	2.13	
Standard deviation	1.58	
Coeff. of variation	2.96	
Replicate F	5.98	
Replicate probability	0.056	
Treatment F	5.38	
Treatment probability	0.081	

Change in soybean tissue elements with Vitazyme

N ..... +6%	Fe ..... +54%
P ..... -2%	Mn .... +30%
K ..... -3%	B ..... +8%
Mg .... +11%	Cu ..... +42%
Ca .... +10%	Zn ..... -18%
S ..... -3%	



Yield increase with Vitazyme: 4%

Conclusions: This long-term soil and crop study in Iowa, with soybeans grown the second year, revealed that the yield was significantly improved by 2.32 bu/acre (4%) with Vitazyme. Soil and plant analyses results showed improvements in tissue contents of N, Mg, Ca, Fe, Mn, B, and, Cu. These values will be monitored each year as the study progresses, as will other physical, chemical, and microbiological parameters.

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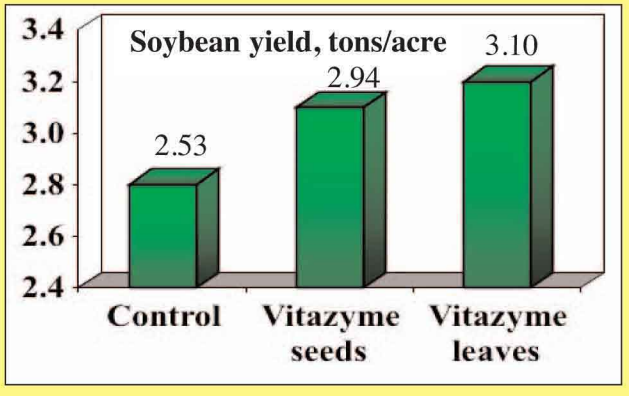
2009 Crop Results

Vitazyme on Soybeans

Researcher: O.V. Kornijchuk, V.V. Plotnikov, and agronomic scientists
Organization: Vinnytsia State Agricultural Experiment Station, Ukraine Academy of Agrarian Sciences, Vinnytsia, Ukraine
Location: Ukraine central forest-steppe area near Vinnytsia
Planting date: May 2, 2009
Seeding rate: 800,000 seeds/ha
Variety: Podil'ska 416, super elite
Tillage: plowing, harrowing, and cultivation
Previous crop: winter wheat
Soil type: gray forest steppe soil; in the 0-30 cm layer, 2.2% organic matter, 8.4 mg/100 g of soil "hydrolyzed nitrogen", 15.8 mg/100g of soil phosphorous, 12.4 mg/100 g of soil exchangeable potassium, and pH=5.5.
Experimental design: A uniform field was divided into plots of 1.0 ha each with three treatments and four replications . The objective of the study was to evaluate the effect of Vitazyme as either a seed application, or a seed plus foliar application, on the yield of soybeans.

1. Control **2. Vitazyme on seeds** **3. Vitazyme on seeds + leaves**

Fertilization: 30 kg/ha N, 30 kg/ha P_2O_5, and 60 kg/ha K_2O
Vitazyme application: Treatment 2 received 1.0 liter of Vitazyme per ton of seed on May 1, 2009, and Treatment 3 received this treatment plus a foliar treatment of 1.0/liter/ha on June 20, 2009, at branching.
Yield results:



Increase in soybean yield with Vitazyme once: 16%

Increase in soybean yield with Vitazyme twice: 23%

Income results:

- **Income increase with Vitazyme on seeds: 1.104 hrn**
- **Income increase with Vitazyme twice: 1,343 hrn**

Conclusions: In Ukraine in 2009, this Vitazyme study with soybeans using either a seed treatment alone, or a seed treatment plus a foliar treatment, proved that this product increased yield by 16% (seed treatment) or 23% (seed and foliar treatment); income was also substantially increased in both cases. These excellent improvements show the great utility of this product in soybean culture in Ukraine.

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2009 Crop Results

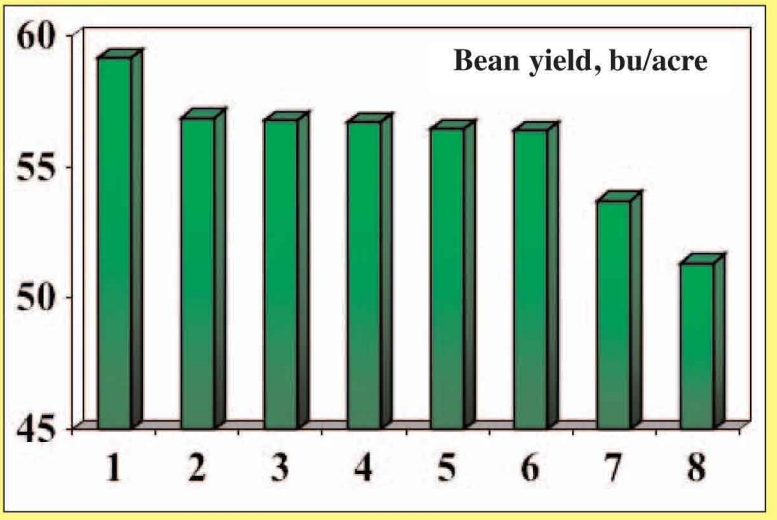
Vitazyme on Soybeans

Farmer: David Herbst *Location*: Herbst/Tierney Farms, Chaffee, Missouri, in cooperation with the University of Missouri Extension Service, Cape Girardeau and Jackson, Missouri
Variety: Nashville (Merschman) *Irrigation*: furrow, on a leveled field *Soil type*: silt loam
Previous crop: wheat, harvested before soybeans were planted (double-cropped)
Population: 140,000 seeds/acre *Planting date*: June 7, 2008 *Row spacing*: 30 inch
Experimental design: A soybean field was divided into plots that were 24 rows wide, and replicated two times, with a check (untreated) plot between each treatment. The purpose of the trial was to evaluate the relative effects of several biostimulants and foliar fertilizers.

1. Vitazyme
2. Foliar Blend
3. Impact
4. Foliar Blend + GroMax
5. GroMax
6. GroMax Plus
7. Headline (fungicide)
8. Control (no treatment)

Fertilization: none
Product applications: 13 oz/acre at R4 to R5
Yield results: The data below are from the higher yielding of the two plots from each treatment.

Treatment	Yield	Yield change
	bu/acre	bu/acre
1. Vitazyme	59.15	7.81 (+15%)
2. Foliar Blend	56.88	5.54 (+11%)
3. Impact	56.79	5.45 (+11%)
4. Foliar Blend + GroMax	56.70	5.36 (10%)
5. GroMax	56.45	5.11 (+10%)
6. GroMax Plus	56.40	5.06 (+10%)
7. Headline	53.72	2.38 (+5%)
8. Control	51.34	—



Soybean yield increase with Vitazyme: 15%

Conclusions: This soybean crop in a wheat-soybean double cropping situation revealed that, of all products used, Vitazyme performed the best, increasing the yield by 15% (7.81 bu/acre) above the control. This increase was 2.27 bu/acre above the next highest yield increase (Foliar Blend). Vitazyme was shown in this trial to be a highly effective soybean yield booster.

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2009 Crop Results

Vitazyme on Soybeans, Organic

Researcher: Dennis Demel
Location: Ogallala, Nebraska
Variety: Blue River 29A7C
Soil type: Cuma sandy loam
Plant population: unknown
Watering: center pivot
Tillage: conventional
Planting date: unknown

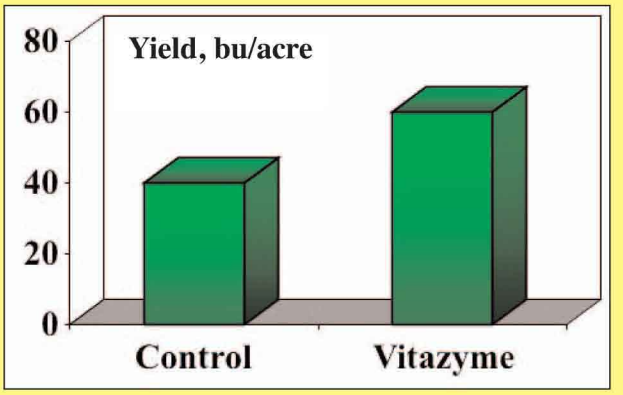
Experimental design: A soybean field was divided into a Vitazyme treated area (treated seeds only), and an untreated control area, with the objective to evaluate the effect of this product on the yield of soybeans grown under organic, irrigated conditions.

1. Control **2. Vitazyme**

Fertility treatments: In the fall of 2008 the field was subsoiled, and through drop tubes on the subsoiler were injected 0.5 gal/acre liquid humate, 1 gal/acre nitrogen (Summit), 0.5 gal/acre molasses, and 0.25 gal/acre fish. Also applied over all areas in the fall through the center pivot were 3 gal/acre nitrogen (Summit) with molasses and fish. In the spring, manganese, molasses, 1.4 gal/acre compost extract, and 1 oz/acre SP1 (Agri-Energy) were applied through the center pivot to all areas. At planting, 0.75 gal Dram 1 fish and Chilean nitrate, with Vitazyme, were applied in-furrow.
Rhizobium application: liquid, on the seeds at planting
Mycorrhizae application: 4 oz/acre in the seed box
Vitazyme application: 13 oz/acre in the furrow at planting
Test weight results: Both treatments produced soybeans weighing 57 lb/bushel.
Yield results: At harvest, eight rows were harvested from each side of the treatment boundary, with a 16-row separation between the strips that were 20 x 2,640 ft (1.212 acre). A weigh wagon was used to measure the yield.

Treatment	Yield	Yield change
	bu/acre	bu/acre
Control	48	—
Vitazyme	60	12 (+25%)

Increase in yield with Vitazyme: 25%



Conclusions: This organic soybean study in western Nebraska, under irrigation, revealed that Vitazyme increased bean yield by 25%, a very big increase. This large boost in yield with the product substantiates results with other organic producers, which have shown similar large yield improvements with the program. The grower was surprised with the degree of yield increase, but the weigh wagon had been properly calibrated.

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2009 Crop Results

Vitazyme on Soybeans

Researcher: Nathan Temples
Farm cooperator: David Murray Farms
Location: Sikeston, Missouri
Variety: Dyna-Gro
Soil type: sandy loam
Planting rate: 60 lb/acre
Planting date: June18, 2009
Row-spacing: 30 inches
Irrigation: four times

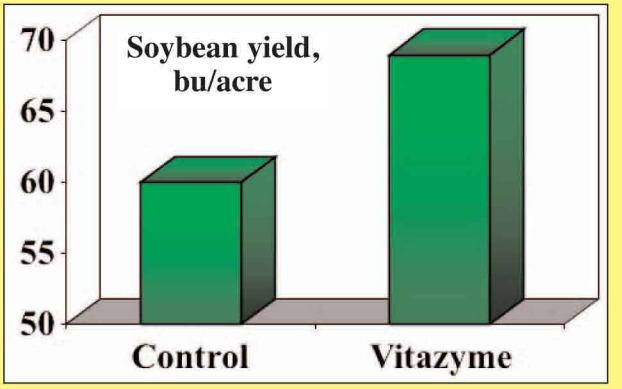
Experimental design: A soybean field was divided into Vitazyme treated (with the herbicide) and the untreated areas to determine the effects of the product on bean yield.

1. Control **2. Vitazyme**

Fertilization: unknown
Vitazyme application: 13 oz/acre with the herbicide, 21 days after planting
Harvest date: November 13, 2009
Yield results:

Treatment	Yield	Yield change
	bu/acre	
Control	60	—
Vitazyme	69	9 (15%)

Increase in soybean yield with Vitazyme: 15%



Conclusions: In this Missouri study, Vitazyme applied along with a herbicide increased soybean yield by 15% over the untreated control.

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2009 Crop Results

Vitazyme on Soybeans

Researcher: Nathan Temples *Farm cooperator*: Halford farms *Location*: Bell City, Missouri
Variety: Crows 4817 *Soil type*: gumbo (high clay) *Planting rate*: 150,000 seeds/acre
Planting date: June 3, 2009 *Row-spacing*: 30 inches *Irrigation*: none

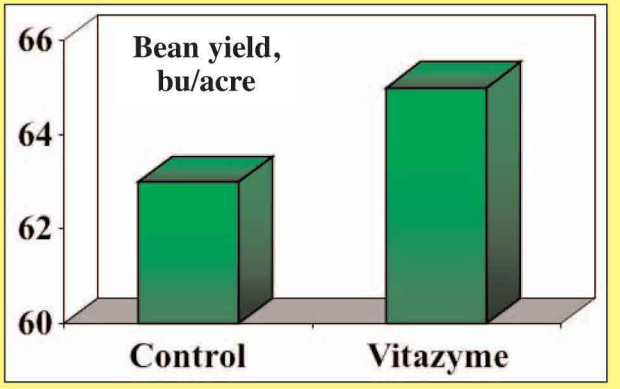
Experimental design: A 40-acre soybean field had 24 rows in the middle of the field treated with Vitazyme directly in the seed row. The objective was to evaluate the potential of this product to increase bean yields.

1. Control **2. Vitazyme**

Fertilization: unknown
Vitazyme application: 8 oz/acre on the seeds at planting
Harvest date: October 15, 2009
Yield results: Yields were determined by combining a strip in the 24 treated rows and an adjacent untreated strip.

Treatment	Yield	Yield change
	bu/acre	
Control	63	—
Vitazyme	65	2 (3%)

Increase in soybean yield with Vitazyme: 3%



Conclussions: This Missouri study proved that Vitazyme, applied at 8 oz/acre to the seeds at planting, increased yield by 3%.

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2009 Crop Results

Vitazyme on Soybeans

Researcher: Nathan Temples
Location: Arbor, Missouri
Planting rate: 140,000 seeds /acre
Planting date: May 20, 2009
Farm cooperators: Donnie and Chris Wondel, D and C Farms
Variety: Asgrow 4922
Row-spacing: 30 inches
Soil type: gumbo (high clay)
Irrigation: none

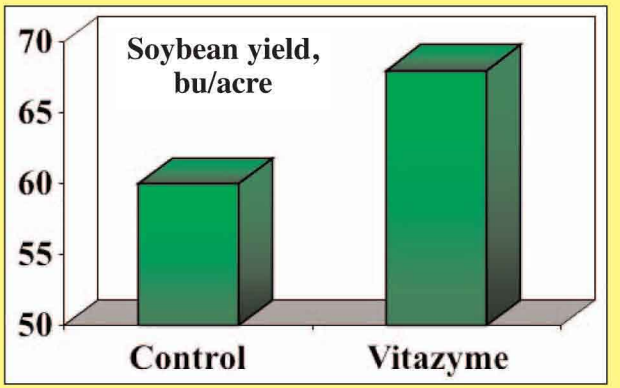
Experimental design: In a 55-acre soybean field, 24 rows were treated with Vitazyme on the seeds at planting, in an effort to evaluate the product's effects on soybean yield.

1. Control **2. Vitazyme**

Fertilization: unknown
Vitazyme application: 8 oz/acre on the seeds at planting
Harvest date: October 20, 2009
Yield results:

Treatment	Yield	Yield change
	---------bu/acre	----------
Control	60	—
Vitazyme	68	8 (13%)

Increase in soybean yield with Vitazyme: 13%



Conclusions: This Missouri soybean study, with Vitazyme applied to the seeds at planting at 8 oz/acre, resulted in a substantial 8 bu/acre yield increase (+13%). This increase occurred in spite of a very high bean yield, showing that even with maximum yield the product works very well.

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2007 Crop Results

Vitazyme on Soybeans

Researchers: Fred Vaughn and Greg Wilson
Organization: Vaughn Agricultural Research Services
Location: Branchton, Ontario, Canada
Variety: Pioneer 91M80
BBCH Scale: BSOY
Planting rate: 101 kg/ha
Planting depth: 3.5 cm
Row spacing: 76 cm
Planting date: May 24, 2007
Seedbed conditions: dry, fine
Soil temperature at planting: 28.6°C
Soil: silt loam (31.9% sand, 53.7% silt, 14.4% clay), 6.2 pH, 14.2 meq/100 g CEC, good fertility
Field preparation: cultivation twice
Previous crops: 2005, potatoes (with Dual + Sencor); 2006, winter wheat (with Cobutox 600)
Experimental design: A uniform site was divided into plots that were 3x6 meters (six rows), using four treatments with six replications in a randomized complete block design. The objective of the study was to determine Vitazyme's ability to improve soybean yield with two applications. The treatments were as follows:

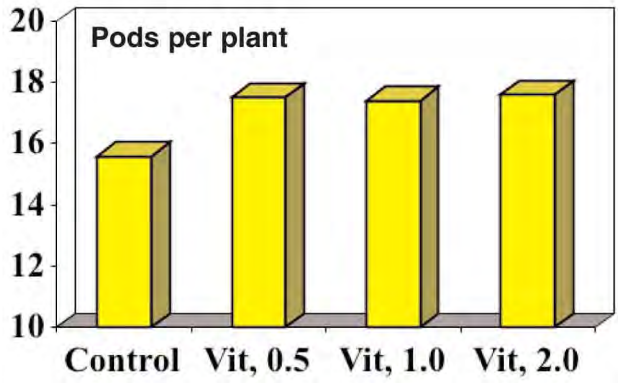
Treatment	At planting	Early bloom
	liters/ha	
1. Control	0	0
2. Vitazyme, 50%	0.5	0.5
3. Vitazyme, 100%	1.0	1.0
4. Vitazyme, 200%	2.0	2.0

Fertilization: 240 kg/ha of 6-24-24% N-P_2O_5-K_2O dry fertilizer spread over the trial site before planting
Vitazyme application: All rates were applied to appropriate plots on May 24 (to the seeds in the row) and June 26 (over the leaves and soil, using a 100 l/ha sprayer rate).
Crop emergence date: May 30, six days after planting
Weed control: Roundup (glyphosate) at 1 liter/ha on June 13, and at 1.5 liters/ha on July 19
Weather conditions: hot and dry during the middle and late part of the growing season
Harvest date: October 12, 2007. An area of 1.52 x 6.00 meters (the two center rows) was harvested for each plot.
Yield results: There were no significant differences in moisture content or bushel weight among the four treatments, so those values are not included here.

Pod Counts

Treatment	Pods/Plant*	Pod change
	pods	pods
1. Control	15.6 b	—
2. Vitazyme, 0.5 l/ha	17.5 a	1.9 (+12%)
3. Vitazyme, 1.0 l/ha	17.4 a	1.8 (+12%)
4. Vitazyme, 2.0 l/ha	17.6 a	2.0 (+13%)
LSD (P = 0.05)	1.7	
CV	8.24	
Bartlett's X2	3.899	
P (Bartlett's X2)	0.273	
Replicate F	5.022	
Replicate Prob (F)	0.0067	
Treatment F	2.626	
Treatment Prob (F)	0.0885	

*Average of 20 plants



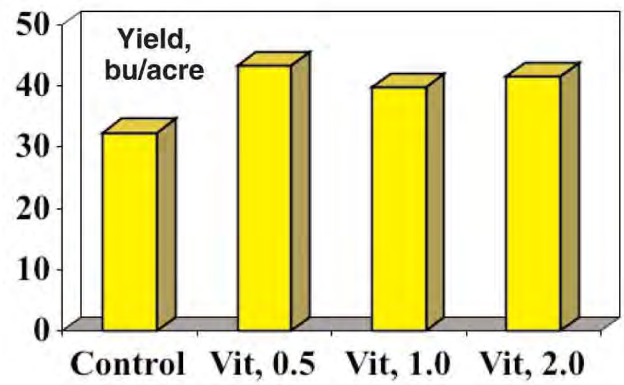
Increase in pod count

Vitazyme, 0.5 l/ha 12%
Vitazyme, 1.0 l/ha 12%
Vitazyme, 2.0 l/ha 13%

Vitazyme caused a 12 to 13% increase in pods per plant for the three treatment levels, which were significant at P = 0.05.

Soybean Yield

Treatment	Yield	Yield change
	bu/acre	bu/acre
1. Control	32.4 b	—
2. Vitazyme, 0.5 l/ha	43.3 a	10.9 (+34%)
3. Vitazyme, 1.0 l/ha	39.8 a	7.4 (+23%)
4. Vitazyme, 2.0 l/ha	41.5 a	9.1 (+28%)
LSD (P = 0.05)	3.68	
CV	7.63	
Bartlett's X2	1.472	
P (Bartlett's X2)	0.689	
Replicate F	2.146	
Replicate Prob (F)	0.1156	
Treatment F	15.358	
Treatment Prob (F)	0.0001	



Increase in soybean yield

Vitazyme, 0.5 l/ha 34%
Vitazyme, 1.0 l/ha 23%
Vitazyme, 2.0 l/ha 28%

All three Vitazyme treatments provided an increase in yield of from 23 to 34%, all of which were significantly different at 0.001%.

Income results: At a soybean price of $9.00/bushel, the increased income for the treatments is as follows:

Treatment	Yield increase	Income increase
	bu/acre	bu/acre
Vitazyme, 0.5 l/ha	10.9	98.10
Vitazyme, 1.0 l/ha	7.4	66.60
Vitazyme, 2.0 l/ha	9.1	81.90

Conclusions: Vitazyme applied to soybeans in this Canadian study, at 0.5, 1.0, and 2.0 liters/ha applied at planting and early bloom, brought about an excellent yield enhancement at all application levels: 23 to 34%. These yield increases resulted in improved crop income of from $66.60 to $98.10/acre, excellent increases for very nominal extra input costs. This study shows the great potential for Vitazyme to enhance the production of soybeans across the southern areas of Canada where this crop is grown.

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2006 Crop Results

Vitazyme on Soybeans

Agricultural Custom Research Education Services

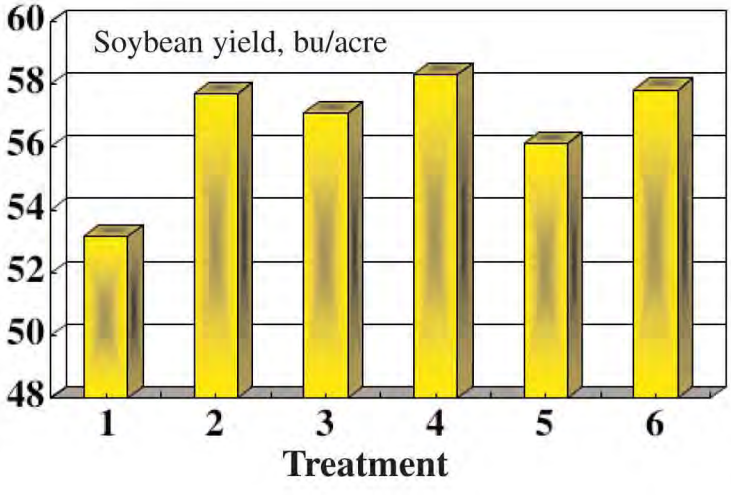
Researcher: Bert Schou, Ph.D. *Location*: Cedar Falls, Iowa *Variety*: Pioneer 92M72 (non-GMO)
Soil type: Floyd loam (pH 6.8, organic matter 4.2%, CEC 15.7, good fertility)
Previous crop: corn *Planting depth*: 1.5 inches *Planting rate*: 47 lb/acre
Row spacing: 30 inches *Planting date*: May 8, 2006 *Tillage*: conventional
Experimental design: A randomized complete block design with six replicates and six treatments was set up in a uniform area having 6-row plots of 15 x 40 feet (0.0138 acre). The purpose of the trial was to discover the effect of Vitazyme, Actinovate, glucose, and combinations of these products on soybean yield and bean moisture content. The Student-Newman-Keuls test was used to separate treatment means.

Treatment	Product	Rate
1	None	0
2	Vitazyme	13 oz/acre x 2
3	Actinovate	1 oz/acre x 2
4	Actinovate + Vitazyme	1 oz/acre + 13 oz/acre x 2
5	Actinovate + Vitazyme + Glucose	1 oz/acre + 13 oz/acre + 2.5 lb/acre x 2
6	Vitazyme + Glucose	13 oz/acre + 2.5 lb/acre x 2

Fertilization: none
Vitazyme application: 13 oz/acre on the seeds at planting, and on the leaves and soil at 3.5 trifoliates on June 28
Actinovate: Actinovate SP is a formulation of *Streptomyces lydicus* WYEC 108 that will populate the root zone to elicit soil pathogen control (Pythium, Rhizoctonia, Phytophthora, Veticillium, Fusarium, and other fungi); 1 lb/acre mixed with Vitazyme on May 8 at planting, and again on June 28 for a soil/foliar application.
Glucose: a microbial stimulant, applied with Vitazyme and Actinovate for both applications at 2.5 lb/acre
Harvest date: October 8, 2006
Yield and bean moisture results: The two center rows of each plot were harvested with a plot combine, and the beans were weighed with an electronic scale. Bean moisture was also determined at harvest for each plot.

Treatment	Bean yield*	Change	Bean moisture*	Change
	bu/acre	bu/acre	%	%-points
1. Control	53.15 b	—	10.43 a	—
2. Vitazyme	57.70 a	4.55 (+9%)	10.35 a	-0.08
3. Actinovate	57.10 a	3.95 (+7%)	9.82 a	-0.61
4. Actinovate + Vitazyme	58.33 a	5.18 (+10%)	9.82 a	-0.61
5. Actinovate + Vita. + Glucose	56.10 ab	2.95 (+6%)	10.07 a	-0.36
6. Vitazyme + Glucose	57.83 a	4.68 (+9%)	9.80 a	-0.63
LSD (P=0.05)	3.28		1.04	
Standard deviation	2.76		0.87	
Coeff. of variation	4.86%		8.68%	

*Means followed by the same letter are not significantly different according to the Student-Newman-Keuls-Test.



Increase in Bean Yield With...

Vitazyme 9%
Actinovate 7%
Vitazyme + Actinovate 10%
Vitazyme + Glucose 9%

All treatments but Treatment 5 significantly increased soybean yield at P=0.05, with the increases ranging from 6 to 10% above the control. Vitazyme plus Actinovate gave the greatest increase (+10%), but this increase was only slightly more than Vitazyme alone, Bean moisture drydown was not significantly affected by the treatments because all of the beans were dry at harvest, although all of the treatments produced slightly dryer beans, from 0.08 to 0.63 percentage point..

Income results: At $6.00/bu for soybeans, the following income increases have been calculated.

Treatment	Product	Income increase
2	Vitazyme	$27.30/acre
3	Actinovate	$23.70/acre
4	Actinovate + Vitazyme	$31.08/acre
5	Actinovate + Vitazyme + Glucose	$17.70/acre
6	Vitazyme + Glucose	$28.08/acre

Conclusions: In this replicated soybean study in Iowa, all but one treatment produced significant yield increases (P=0.05) of from 2.95 to 4.68 bu/acre (6 to 10%). The greatest increase was with Vitazyme + Actinovate, although Vitazyme alone produced a 9% yield increase. These yield increases produced income increases of from $17.70 to $28.08/acre. Grain moisture did not vary significantly among the eight treatments because all of the grain was harvested when almost completely dry, although all treatments produced somewhat dryer beans at harvest than did the untreated control..

This study shows that Vitazyme alone produced nearly the greatest yield improvement, and other treatments or combinations did not significantly exceed this result. The use of Vitazyme is a highly profitable practice in Iowa, and has been proven to consistently increase soybean yields and profits since 1995.

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2005 Crop Results

Vitazyme on Soybeans

Researcher/Farmer: Dale Carter *Location*: Coatesville, Indiana *Variety*: Pioneer 93 B68
Planting date: May 10, 2005 *Soil type*: Fincastle silty clay loam *Previous crop*: corn
Population: 179,000 seeds/acre *Row spacing*: 15 inches *Tillage*: no-till

Experimental design: A soybean field was treated on one part, across the rows, with Vitazyme, and the other part was left untreated.

1. Control **2. Vitazyme**

Fertilization: none (residual fertility from corn last year)
Vitazyme application: 13 oz/acre on the soil surface about one week before planting
Weather: cooler than normal

Results: About August 26 the data shown below was collected. Forty plants from each field area, closely separated, were dug with a potato fork — four plants per dig with 10 digs — and trifoliate leaves and pods were counted for the 40 plants.

Treatment	Trifoliates	Change	Pods	Change	Roots	Biological activity
	number/40 plants					
Control	420	—	1,100	—	Standard roots structure	No fungi seen; few sowbugs*
Vitazyme	520	100 (+24%)	1,330	230 (+21%)	Long,stronger main roots More fine roots	More fungal threads on corn residue; many sowbugs*

*Fungi are the first organisms to begin crop residue breakdown. Sowbugs consume the organic material that is breaking down.

Increase in trifoliate leaves: +24%

Increase in pods: +21%

Conclusions: This Indiana soybean study revealed that only one Vitazyme application at planting increased the number of trifoliate leaves by 24%, while pods were increased by 21%. In addition, root growth and soil biological activity were enhanced. Unfortunately a yield check could not be made because the product was applied across the rows, making it impossible to keep treatments separate while combining down the field.

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2005 Crop Results

Vitazyme on Soybeans

Agricultural Custom Research Education Services

Researcher: Bert Schou, Ph.D. *Location*: Cedar Falls, Iowa *Variety*: Pioneer 92M72 (non-GMO)
Soil type: Floyd loam (pH 6.8, organic matter 4.2%, CEC 15.7, good fertility)
Previous crop: corn *Planting depth*: 1.5 inches *Planting rate*: 49 lb/acre
Row spacing: 30 inches *Planting date*: May 10, 2005 *Tillage*: conventional
Experimental design: A Latin square design with eight replicates and eight treatments was set up in a uniform area having 6-row plots of 15 x 40 feet (0.0138 acre). The purpose of the trial was to discover the effect of Vitazyme, a new Vitazyme variant (Product X), a possible synergist with Vitazyme (Product Y), and another possible synergist (Product Z) on soybean yield and bean moisture content. The Student-Newman-Keuls test was used to separate treatment means.

Treatment	Product	Rate
1	None	0
2	Vitazyme	13 oz/acre x 2
3	Vitazyme + Product Y	13 oz/acre each x 2
4	Vitazyme + Product Y	6.5 oz/acre each x 2
5	Product Y	13 oz/acre x 2
6	Product X + Product Y	6.5 oz/acre each x 2
7	Product Z	16 oz/acre x 2
8	Vitazyme + Product Z	13 oz/acre (Vita.) + 16 oz/acre (Z) x 2

Fertilization: none
Vitazyme application: 13 oz/acre pr 6.5 oz/acre on the seeds at planting, and on the leaves and soil at 3.5 trifoliates
Product X application: 6.5 oz/acre on the seeds at planting, and on the leaves and soil at 3.5 trifoliates
Product Y application: 13 oz/acre or 6.5 oz/acre on the seeds at planting, and on the leaves and soil at 3.5 trifoliates
Product Z application: 16 oz/acre on the seeds at planting, and on the leaves and soil at 3.5 trifoliates
Harvest date: October 4, 2005
Yield results: The two center rows of each plot were harvested with a plot combine, and the grain was weighed with an electronic scale

Treatment	Bean yield*	Change	Moisture*	Change
	bu/acre	bu/acre	%	%
1. Control	39.3 b	—	15.45 a	—
2. Vitazyme	45.0 a	5.7 (+15%)	15.67 a	+0.22
3. Vita + Prod Y	45.4 a	6.1 (+16%)	15.41 a	-0.04
4. Vita + Prod Y (1/2 rate)	45.0 a	5.7 (+15%)	16.15 a	+0.70
5. Product Y	43.4 a	4.1 (+10%)	15.51 a	+0.06
6. Prod X + Prod Y (1/2 rate)	44.7 a	5.4 (+14%)	15.51 a	+0.06
7. Product Z	44.1 a	4.8 (+12%)	15.95 a	+ 0.50
8. Vita + Prod Z	45.0 a	5.7 (+15%)	16.04 a	+0.59
LSD (P=0.05)	2.37		1.158	
Standard deviation	2.34		1.146	
Coeff. of variation	5.32%		7.3%	

*Means followed by the same letter are not significantly different according to the Student-Newman-Keuls-Test.

All treatments significantly increased soybean yield at P=0.05, with the increases ranging from 10 to 16% above the control. Vitazyme plus Product Y at the full rates gave the greatest increases (+16%) while Product Y alone gave the smallest increase (+10%). Grain moisture drydown was not significantly affected by the treatments, likely because all of the beans were dry at harvest.

Yield Changes

Vitazyme ..... +15%
Vitazyme + Product Y
Full Rate ..... +16%
Half Rate ..... + 15%
Product Y ..... +10%
Product X + Product Y
Half rate ..... +14%
Product Z ..... +12%
Vitazyme + Product Z ..... +15%

Income results: At $4.50/bu for soybeans, the following income increases have been calculated.

Treatment	Bean increase	Extra income
	bu/acre	$/acre
2. Vitazyme	5.7	25.65
3. Vita + Prod Y	6.1	27.45
4. Vita + Prod Y (1/2 rate)	5.7	25.65
5. Product Y	4.1	18.45
6. Prod X + Prod Y (1/2 rate)	5.4	24.30
7. Product Z	4.8	21.60
8. Vita + Prod Z	5.7	25.65

Conclusions: In this replicated soybean study in Iowa, all treatments produced significant yield increases (P=0.05) of from 4.1 to 6.1 bu/acre (10 to 16%). The greatest increase was with Vitazyme + Product Y, although Vitazyme alone produced a 15% yield increase. These yield increases produced income increases of from $18.45 to $27.45/acre. Grain moisture did not vary significantly among the eight treatments because all of the grain was harvested when completely dry.

This study shows that Vitazyme alone produced nearly the greatest yield improvement, and other treatments or combinations did not significantly exceed this result.

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2004 Crop Results

Vitazyme on Soybeans

A Testimonial on Emergence and Yield

Researcher: Dennis Parrett
Location: near Cecelia, Kentucky
Variety: NK 39Q4
Row spacing: drilled in 7.5-inch rows with a no-till planter
Soil type: Crider silty clay loam
Planting date: May 5, 2003
Experimental design: A soybean field was planted with seed treated with dry inoculant plus straight, undiluted Vitazyme put into a planter box. After the planter ran out of treated seed, the last part of the field was planted with untreated seed.
Fertilization: unknown
Vitazyme application: 6 oz/acre of straight undiluted Vitazyme on the seeds in the planter box together with dry rhizobium inoculant; this gave very good seed contact for both the Vitazyme and the inoculant.
Germination time: The treated seeds had emerged by May 9, four days after planting, despite cold soil temperatures, which was several days before the untreated beans.

Days to emergence: 4 days after planting

Yield results: 56.8 bu/acre in a dry year. Surrounding fields yielded less, though exact yields are not known.
Conclusions: Vitazyme applied straight to seeds at planting, stimulated soybean germination by a great degree over the untreated soybeans, despite cold soil temperatures, and resulted in higher bean yields despite a very dry growing season.

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2003 Crop Results

Vitazyme on Soybeans *(Foliar vs. Soil Application)*

Researcher: Paul W. Syltie, Ph.D.
Location: Vital Earth Resources Research Greenhouse, Gladewater, Texas
Variety: unknown *Planting rate*: 10 seeds/pot thinned to 3 plants/pot
Soil type: Bowie very fine sandy loam *Planting date*: March 13, 2003 *Pot size*: 1 gallon
Experimental design: A greenhouse study was established to discover the relative effect of soil versus foliar application of Vitazyme on soybean growth. Ten replicates were established for each treatment in a complete block design. Temperatures were maintained at 55° to 80°F during the study, with no artificial light.

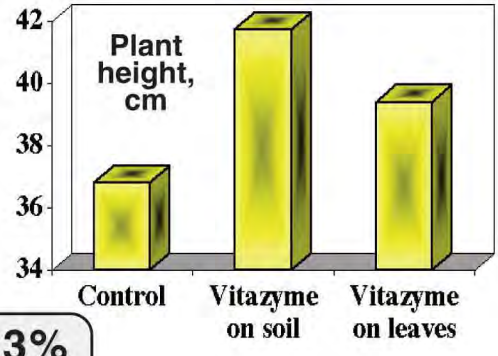
1. Control 2. Vitazyme on the soil 3. Vitazyme on the leaves

Fertilization: All plants were given 0.5 g/pot at planting of a 21-7-12% N-P_2O_5-K_2O pelleted, slow release fertilizer. This fertilizer gave an effective rate of 46 lb/acre of N, applied to the soil surface as a starter.
Vitazyme application: Vitazyme was applied to the soil surface only of Treatment 2 on March 27 when the first true leaves were fully expanded. It was also applied (a spray of a 1% solution) to the leaves of the plants of Treatment 3 on March 27; most of the spray beaded on the cotyledons and in the midrib of the undersides of the leaves. Care was taken to avoid applying any product to the soil surface.
Harvest date: April 23, 2003, 41 days after planting
Harvest results: The soybean roots were washed free of soil, the heights were measured, and then all plants were dried at about 115°F for one day, and weighed to the nearest 0.01 gram.

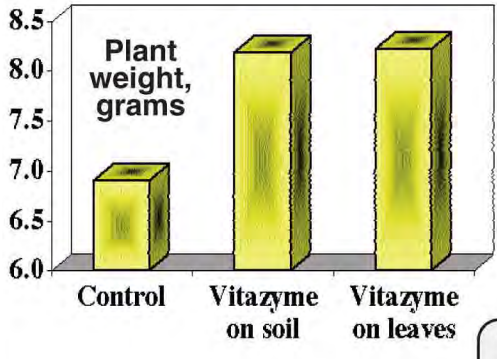
Plant Height

Treatment	Plant height*	Height change
	cm	cm
1. Control	36.8 b	—
2. Vitazyme on soil	41.7 a	4.9 (+13%)
3. Vitazyme on leaves	39.4 a	2.6 (+7%)

*Means followed by the same letter are not significantly different at P=0.10 according to the Tukey-Kramer Test. $LSD_{0.1}$=1.8 cm.



Plant height increase (soil applied): 13%



Plant Dry Weight

Treatment	Dry weight*	Weight change
	grams	grams
1. Control	6.90 b	—
2. Vitazyme on soil	8.18 a	1.28 (+19%)
3. Vitazyme on leaves	8.22 a	1.32 (+19%)

*Means followed by the same letter are not significantly different at P=0.1 according to the Tukey-Kramer Test. $LSD_{0.1}$=0.69 grams.

Dry weight increase (soil applied): 19%

Conclusions: Vitazyme applied to soybeans on either the foliage or soil in this greenhouse study showed a remarkably similar response for both methods. Both increases in dry matter accumulation were 19% above the control, and were highly significant. The increase in plant height was also highly significant for both soil and foliar applications of Vitazyme. It is concluded from this study that **either soil or foliar applied Vitazyme are equally effective in stimulating carbon fixation and plant growth of soybeans.** This study has given results similar to a parallel study on corn using soil or foliar applied product.

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2001 Crop Results

Vitazyme on Soybeans

Farmer: Blaine Nelson | *Location*: Wakefield, Nebraska | *Variety*: Rolling Meadows 279
Row spacing: 30 inches | *Population*: 150,000 seeds/acre | *Soil type*: silty clay loam
Planting date: May 15, 2001 | *Irrigation*: none | *Previous crop*: corn

Experimental design: A 94 acre field was treated entirely with Vitazyme except for one small 1 acre portion.

1. Control **2. Vitazyme**

Fertilization : none

Vitazyme treatment: 20 oz/acre sprayed over the leaves and soil along with Roundup Ultra herbicide on June 12, 28 days after planting

Growing season weather: hot and dry, especially during July and August, but with a very timely 3-inch rain in August

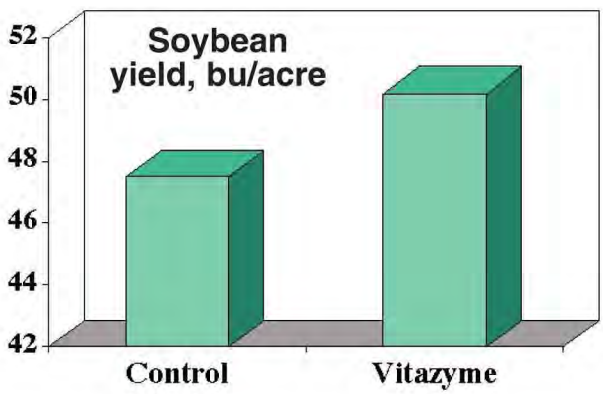
Harvest date: October 5, 2001

Growing season observations: **"Soon after applying Vitazyme it was obvious to notice that the treated plants were 2 to 3 inches taller, and were bigger and healthier."** — Blaine Nelson

Yield results: Areas were harvested and weighed on each side of the treatment boundary, and yields were calculated based on field measurements. Bean moisture contents were also determined.

	Control	Vitazyme	Change
		bu/acre	
Bean yield	47.5	50.2	2.7 (+6%)

Bean yield increase: 6%



Moisture content:

	Control	Vitazyme	Change
		% H_2O	
Bean moisture	11.6	11.2	0.4

Decrease in bean moisture: 0.4%

Income results: Estimated value of soybeans, before government payments: $4.20/bu. 2.7 bu/acre x $4.20/bu = **$11.34/acre more income**.

Conclusions: This Nebraska soybean study showed that only one application of Vitazyme can increase yield by 6% on a good year, which was very profitable. Two applications could have further increased the yield, especially during a year that is less than optimal.

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2000 Crop Results

Vitazyme on Soybeans (Organic)

Farmer: Mike Saeli *Location*: Savannah, New York *Variety*: Vinton (for tofu)
Planting date: *Row spacing*: 30 inches *Soil type*:
Experimental design: An area of a soybean field was treated with Vitazyme, while the rest of the field was left untreated.

1. Control **2. Vitazyme**

Fertilizer treatment: liquid fish with the seeds at 4 gal/acre
Vitazyme treatment: 13 oz/acre with the liquid fish on the seeds at planting
Harvest date: November 7, 2000
Leaf chlorophyll: On August 16, twenty leaves from each treatment were measured with a Minolta SPAD meter, and averaged

Leaf Chlorophyll

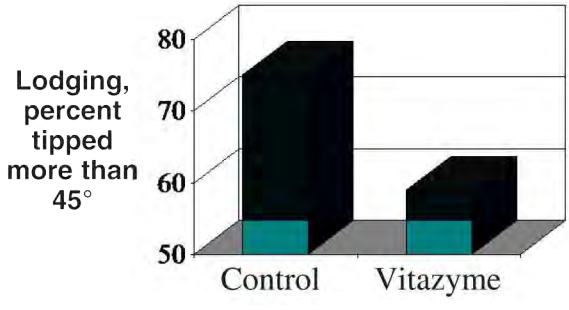
	Control	Vitazyme	Change
		SPAD units	
Leaf chlorophyll	46.9	49.2	+2.3

Leaf chlorophyll increase: 2.3 SPAD units

Lodging: At harvest time it was very apparent that the Vitazyme treatment had less lodging due to stronger stems. To evaluate lodging, a measurment was made from typical plants that were more or less than a 45 degree angle from the verticle.

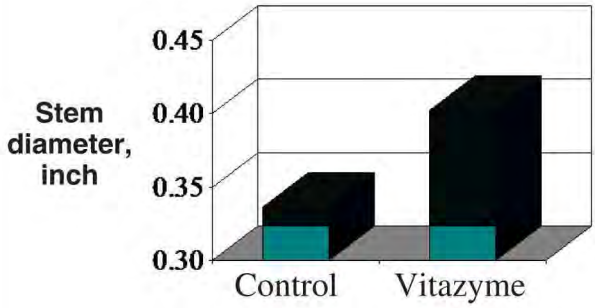
Lodging

	Control	Vitazyme	Change
		plants more than 45°	
Plants lodged	75%	59%	(–)16%



Decrease in lodging: 16%

Stem diameter: Since there was an obvious difference in stem diameter, seven typical plants from each treatment were measured.



Stem Diameter

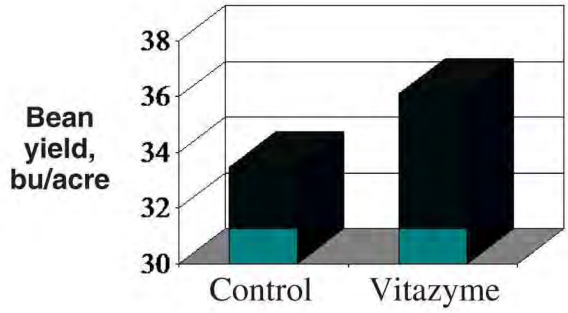
	Control	Vitazyme	Change
		inch	
Stem diameter	0.336 b	0.402 a	0.066(+20%)

Increase in stem diameter: 20%

Yield results: Fifteen rows that were 590 feet long were harvested from each treatment. The area harvested for each was 0.5079 acre.

Soybean yield

	Control	Vitazyme	Change
		lb	
Weight per test area	1,020	1,100	80(+8%)
		bu/acre	
	33.47	36.10	2.63(+8%)



Grain yield increase: 8%

Grain moisture content:

Grain Moisture

	Control	Vitazyme	Change
		%	
Grain moisture	14.70	14.45	0.25

Grain moisture decrease: 0.25%

Conclusions: Vitazyme applied to soybeans in this side–by–side field study produced more vigorous growth during the season, as a consequence of chlorophyll levels being higher due to a more active rhizosphere. Stem diameter was increased (by 20%), and as a result lodging was reduced (by 16%). Soybean yield increased by 2.63 bu/acre, which was sizable for this organic crop.

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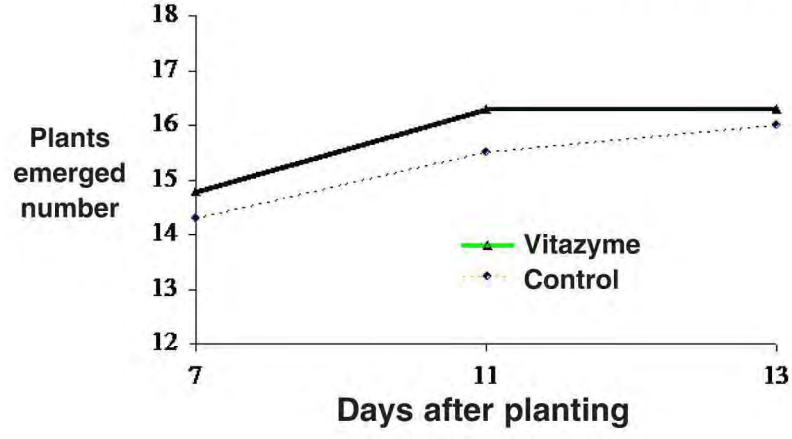
2000 Crop Results

Vitazyme on Soybeans (Tray Study)

Agricultural Custom Research and Educational Services

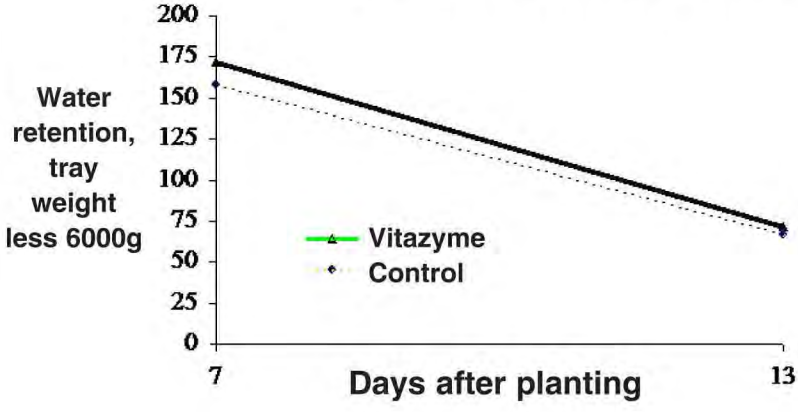
Researcher: Bertel Schou, Ph.D.
Location: Cedar Falls, Iowa
Variety: Unknown
Soil type: Maxfield silt loam, surface soil
Tray size and type: 10 x 21 inches, slotted tray inside a solid tray, and a paper liner below
Experimental design: Trays were placed under full-spectrum grow-lights that shone 14 hours per day, with an air temperature of 65 to 85°F. Each tray had 6,000 grams of the sieved silt loam soil, which formed a two-inch layer in which two furrows were made. Twenty seeds were placed every 2 inches in the two furrows and covered. Then a measured amount of water was added, first to obtain ideal planting conditions, and subsequent waterings were accounted for as well to give a net water usage. Typical field water loss is 0.25 to 0.35 in/day. Four replicates were used in the study. Measurements were taken 7, 11, and 13 days after planting.
Vitazyme application: The equivilant of 13 oz/acre Vitazyme was applied to the soil surface at planting.
Growth parameters measured:

Plants Emerged



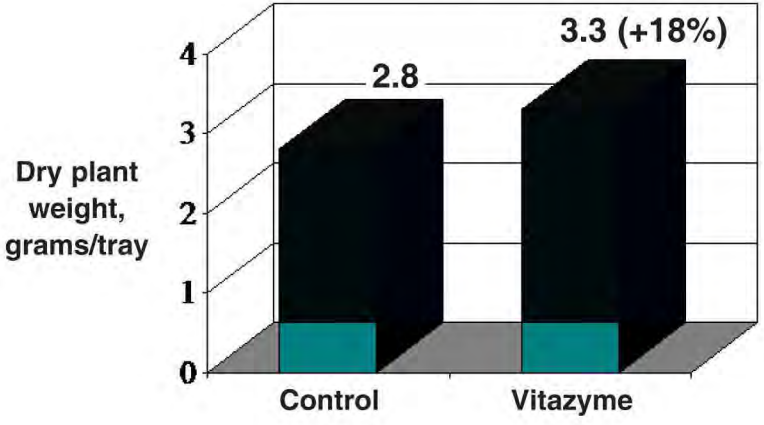
Vitazyme improved seed emergence and early growth vigor slightly throughout the 13-day growth period.

Soil and Plant Water Retention



The amount of water remaining in the trays, after additions were subtracted, was highest for the Vitazyme trays. This shows that Vitazyme reduced water loss from the soil and plants, and thus improved water use efficiency.

Dry Plant Weight – Day 13



At the conclusion of the study the Vitazyme treated seedlings had greater total weight, meaning their growth rate exceeded that of the control for the first 13 days after planting.

Dry weight increase: 18%

Conclusion: Vitazyme improved plant emergence in this soybean tray study. Also, these treated plants made more efficient use of water, and ended up producing greater dry matter (+18%) than the controls.

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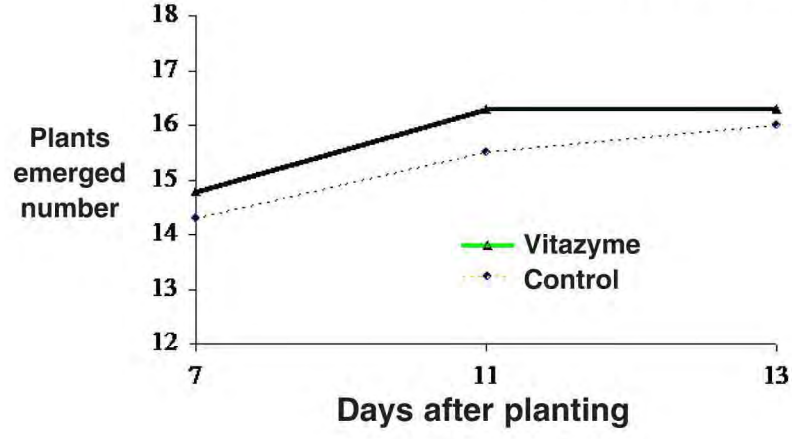
2000 Crop Results

Vitazyme on Soybeans (Tray Study)

Agricultural Custom Research and Educational Services

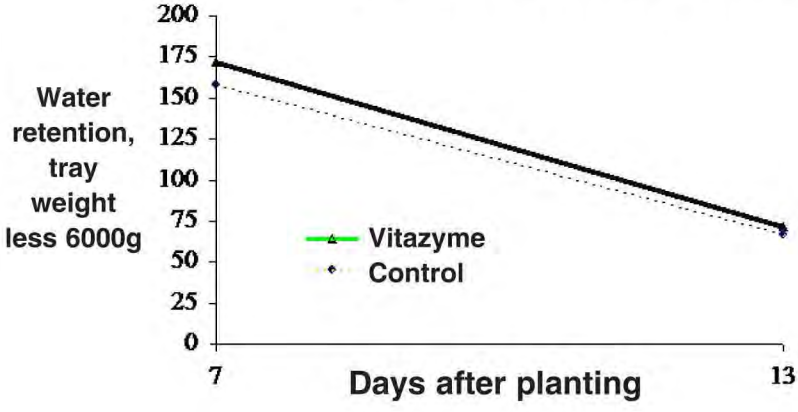
Researcher: Bertel Schou, Ph.D.
Location: Cedar Falls, Iowa
Variety: Kruger K 242 Roundup Ready
Soil type: Maxfield silt loam, surface soil
Tray size and type: 10 x 21 inches, slotted tray inside a solid tray, and a paper liner below
Experimental design: Trays were placed under full-spectrum grow-lights that shone 14 hours per day, with an air temperature of 65 to 85°F. Each tray had 6,000 grams of the sieved silt loam soil, which formed a two-inch layer in which two furrows were made. Twenty seeds were placed every 2 inches in the two furrows and covered. Then a measured amount of water was added, first to obtain ideal planting conditions, and subsequent waterings were accounted for as well to give a net water usage. Typical field water loss is 0.25 to 0.35 in/day. Four replicates were used in the study. Measurements were taken 7, 11, and 13 days after planting.
Vitazyme application: The equivilant of 13 oz/acre Vitazyme was applied to the soil surface at planting.
Growth parameters measured:

Plants Emerged



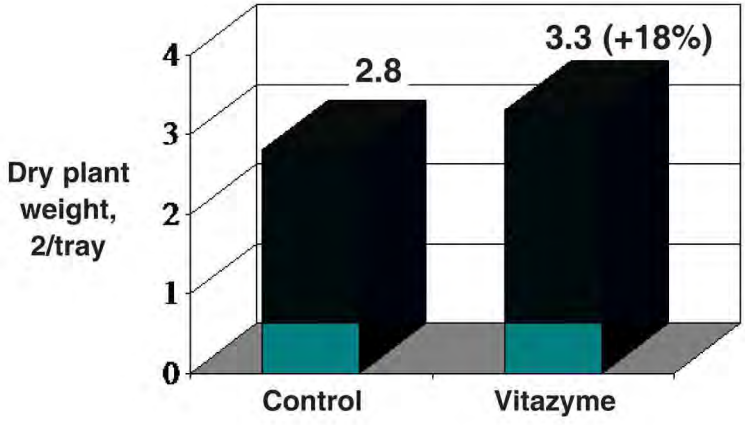
Vitazyme improved seed emergence and early growth vigor slightly throughout the 13-day growth period.

Soil and Plant Water Retention



The amount of water remaining in the trays, after additions were subtracted, was highest for the Vitazyme trays. This shows that Vitazyme reduced water loss from the soil and plants, and thus improved water use efficiency.

Dry Plant Weight – Day 13



At the conclusion of the study the Vitazyme treated seedlings had greater total weight, meaning their growth rate exceeded that of the control for the first 13 days after planting.

Dry weight increase: 18%

Conclusion: Vitazyme improved plant emergence in this soybean tray study. Also, these treated plants made more efficient use of water, and ended up producing greater dry matter (+18%) than the controls.

Income results: A corn price of $1.75/bu is estimated.

Conclusions: In this study evaluating Vitazyme and Actagro humic acids on corn yield and other parameters, grain yield was significantly increased with Vitazyme (+7%) and with humic acids (+8%), but not when the two products were combined. The grain per plant was also significantly increased with Vitazyme (+9%), showing that individual corn plants were larger and able to produce larger ears when treated with Vitazyme. This improvement did not occur with the other two treatments. Grain moisture at harvest, plant population, and grain test weight were not affected significantly by any of the treatments, though the product combination increased the test weight by 0.4 lb/bu over the control. Both Vitazyme and humic acids significantly improved corn production, but not a combination of the two, in this Iowa corn study. Vitazyme alone increased income by $13.65/acre.

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2000 Crop Results

Vitazyme on Soybeans

Farmer: Ron Stutzman, Brubaker Consulting Group Arkport, New York
Location: Stutzman Research Farm,
Variety: Golden Harvest 2170 Roundup Ready
Planting date: June 1, 2000
Soil type: silt loam
Row spacing: 30 inches
Planting population: 196,000 seeds/acre

Experimental design: A randomized complete block design was set up using a plot size of 10 x 50 ft. (0.0115 acre). Three treatments with four replicates (12 total plots) were selected.

1. Control **2. Vitazyme on seeds** **3. Vitazyme foliar**

Fertilization: Unknown

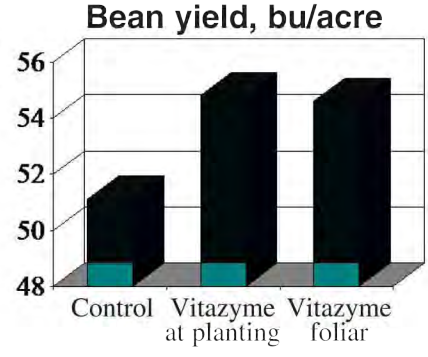
Vitazyme treatments: The seed treatment (Treatment 2) received 13 oz/acre concentrated on the seed row, and the foliar treatment (Treatment 3) was sprayed over the leaves and soil at a plant height of 15 inches.

Harvest date: November 3, 2000

Yield results: The test weight and grain moisture content of the soybeans did not vary much amongst the three treatments. Thus, these data are not included in this report. The soybeans were harvested with a plot combine.

	Control*	Vitazyme at planting*	Vitazyme foliar*
		bu/acre	
Soybean yield	51.1 a	54.8 a (+7%)	54.6 a (+7%)

* Means followed by the same letter are not significantly different at P=0.10 according to Tukey's Honestly Significance Difference Test. $LSD_{0.10}$=8.25.



Soybean yield increase (on seeds): 7%

Soybean yield increase (on leaves/soil): 7%

Income results: A price of $5.00/bu is estimated.

	Control	Vitazyme at planting	Vitazyme foliar
		$/acre	
Soybean yield	255.50	274.00	273.00

Income increase (on seeds): $18.50/acre

Income increase (on leaves/soil): $17.50/acre

Conclusions: Vitazyme at 13 oz/acre applied one time to the seeds, or to the leaves and soil at 15 inches plant height, produced nearly equal yield increases (7%, or about 3.6 bu/acre). This increase was highly profitable, the cost:benefit ratio being about 3.5:1. If the two applications had been made to the same treatments it is very likely the results would have been significantly better than either of Treatments 2 or 3.

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2000 Crop Results

Vitazyme on Soybeans

A testimonial

Farmer: Joe Ike
Researcher: Jake Gephart, Agway, Inc.
Variety: Asgrow Roundup Ready
Seeding rate: unknown
Location: Interlaken, New York
Soil type: unknown
Planting date: May 5, 2000
Row width: 30 inches
Experimental design: Vitazyme was applied on a portion of a 75-acre soybean field, while the rest of the field was left untreated.
Fertilization: unknown
Harvest date: November 3 and 4, 2000
Vitazyme application: 13 oz/acre with fertilizer, banded beneath the seeds

Yellow streaks developed early on in the plants across the field due to some sort of fungal attack during the cold, wet season. Later, Joe Ike noticed that the streaks in the field were gone where Vitazyme had been applied. **Vitazyme apparently produced a positive nutritional response with these soybeans that translated into disease resistance for whatever fungal organism was attacking these soybeans.**

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2000 Crop Results

Vitazyme on Soybeans

A testimonial

Farmer: Jim Clise
Researcher: Jake Gephart, Agway, Inc.
Varieties: Apk 25b Roundup Ready; Apk 198 Roundup Ready
Location: Waterloo, New York
Soil type: variable
Row width: 30 inches
Experimental design: All fields listed below were totally treated with Vitazyme
Fertilization amount: 250 lb/acre of 6-24-24% N-P_2O_5-K_2O, applied pre-plant, and incorporated
Vitazyme application: 13 oz/acre with Roundup (glyphosate) herbicide, just before canopy row closure

Field	Area	Planting date	Harvest date	Yield
	acres			bu/acre
1	50	June 26	November 13	65
2	25	June 14	November 11	44
3	14	June 14	November 12	23
4	100	June 15	November 14	53
5	12	June 17	November 16	30

Conclusions: According to Jake Gephart, **"Although the beans suffered white mold disease, the Vitazyme helped save the bean crop." This benefit was achieved because Vitazyme gave the beans a very vigorous start, enabling them to better resist the mold early on.** The very cool and wet growing season gave ample opportunity for fungal diseases to attack the crop in 2000.

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1999 Crop Results

Vitazyme on Soybeans

Farmer: John Smucker
Variety: APK 190 (Roundup Ready)
Planting date: May 17, 1999
Soil type: gravelly loam
Location: Leicester, New York
Supervisor: Harold Upton, Agway Inc.
Harvest date: November 5, 1999
Seeding rate: 190,000/acre (30-inch rows)

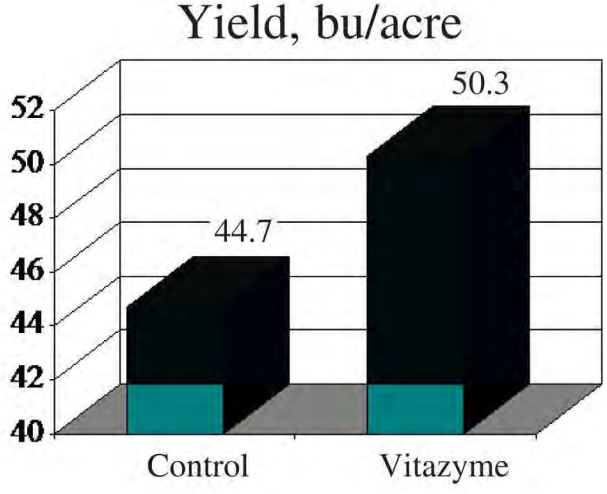
Experimental design: An 18-acre field was split into two equal parts, one half receiving Vitazyme and the other half receiving no treatment. At harvest, 0.7 acre was harvested from the treated side and 0.9 acre from the control side.

1. Control **2. Vitazyme**

Fertility treatments: 225 lb/acre 7-20-28 N-P_2O_5-K_2O, 0.35 lb/acre Mn, and 0.35 lb/acre Zn applied preplant
Vitazyme treatment: 13 oz/acre sprayed on the leaves and soil with Roundup (glyphosate) at early bloom
Yield results:

Treatment	Yield	Increase
	bu/acre	bu/acre
Control	44.7	---
Vitazyme	50.3	5.6 (+13%)

Yield increase: 13%



Income increase: A price of $5.50/bu is estimated.

Income increase: $30.80/acre

Comments: In spite of a hot and dry summer the soybean yield increase with Vitazyme was substantial, amounting to $30.80/acre at a price of $5.50/bu for soybeans. Mr. Smucker commented, "I don't know what that stuff is, but next year I want to use a lot of it." Within a few days of applying Vitazyme the sprayed leaves turned darker green, compared to the control soybean leaves.

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1998 Crop Results

Vitazyme on Soybeans (Organic)

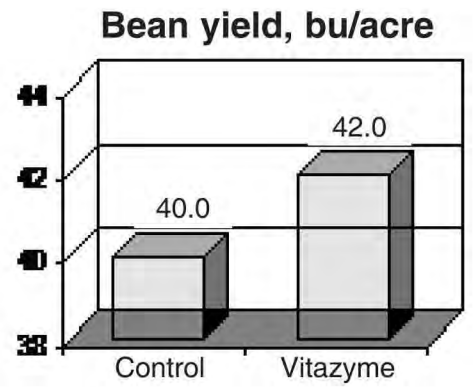
Farmer: Robin Hermanson *Location*: Garretson, South Dakota *Variety*: Ramy
Seeding rate: unknown *Previous crop*: spring wheat *Planting date*: unknown
Experimental design: A soybean field was divided into two portions, having the following treatments:

1. **Control**
2. **Vitazyme**

Fertilizer treatments: At planting, 1 gal/acre of liquid fish, an herbal blend, and 2 oz/acre of Nutrapathis Soil Conditioner were applied in an 8-inch band on the soil above the seed, and below the seed row in a band. Ten gallons of solution were used in each band.
Vitazyme applications: (1) 13 oz/acre along with the planting solution at planting, and (2) 7 oz/acre over the leaves and soil at early bloom.
Harvest date: unknown
Yield results:

	Control	Vitazyme	Increase
Yield, bu/acre	40.0	42.0	2 (+5%)

Yield Increase: 5%



Income results: The organic soybean price obtained by this grower is $19.00/bu.

	Control	Vitazyme	Increase
Total income	$760.00/acre	$798.00/acre	$38.00/acre

Income increase: $38.00/acre

Comments: Although the yield increase due to Vitazyme in this study was not remarkable, it was highly profitable. Quality parameters for the organically grown beans were not evaluated in this study. On August 28, chlorophyll readings using the Minolta SPAD meter on 20 randomly selected plants for each treatment showed 50.0 for Vitazyme and 49.2 for the control.

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1997 Crop Results

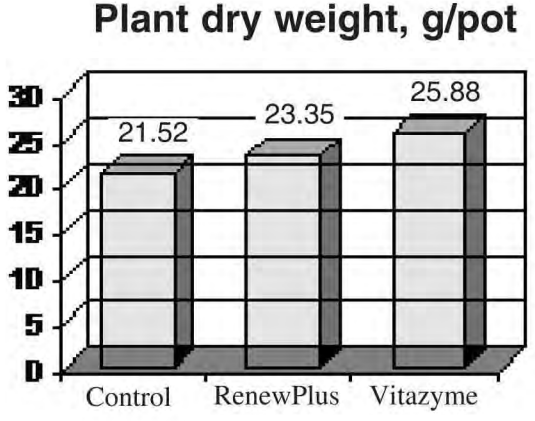
A Comparison of RenewPlus with Vitazyme on Soybeans

Researcher: Paul W. Syltie *Location*: Gladewater, Texas (Vital Earth Resources Research Center)
Variety: Pioneer 9592 *Seeding rate*: 10 seeds/pot, thinned to 3 plants/pot
Soil type: sandy loam (from Arkansas) *Planting date*: February 12, 1997 *Pot type:* one gallon
Vitazyme and RenewPlus treatments: 0.1% solution, 100 ml applied to each pot after planting and thorough watering *Harvest date*: April 8, 1997
Data collected: The roots were washed free of soil, and the plants were dried at about 115 degrees F in a drying oven, after which weights were taken.

Treatment	Dry weight*
Control	21.52 c
RenewPlus	23.35 b
Vitazyme	25.88 a
$LSD_{0.05}$	1.70

*Means followed by the same letter are not significantly different at P=0.05.

Yield Increase: 20%



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1998 Crop Results

Vitazyme on Soybeans

Iowa State University of Science and Technology

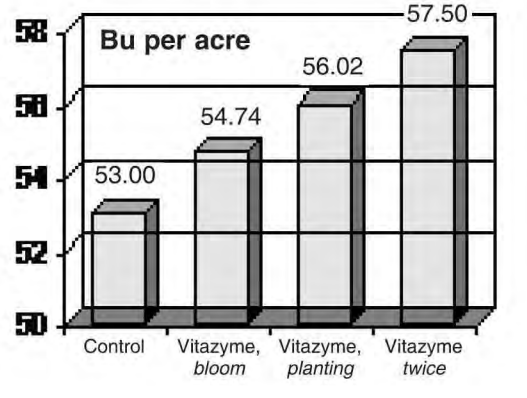
Researcher: Ivan E. Anderson, Ph.D. *Location*: Berkey Research Farm, Ames, Iowa
Seeding date: May 13, 1998 (adequate moisture) *Variety*: Prairie Brand B246
Seeding rate: 140,000 plants/acre *Row spacing and depth*: 30 inches, 1.5 inches deep
Experimental design: A randomized complete block design with six replications was set up on a Clarion loam, with plots 10 feet wide and 40 feet long (0.009183 acre; four rows per plot). Four treatments were used:

1. **Control (no Vitazyme)**
2. **Vitazyme at early bloom**
3. **Vitazyme on the seed at planting**
4. **Vitazyme on the seed at planting, and at early bloom**

Fertility and tillage treaments: Phosphorus and potassium levels were maintained above medium soil test levels.
Vitazyme applications: Vitazyme was applied to the seed row at planting at 15 oz/acre, and on the leaves and soil at early bloom at 15 oz/acre, to appropriate plots.
Harvest date: September 29
Yield results:

OVERALL RESULTS

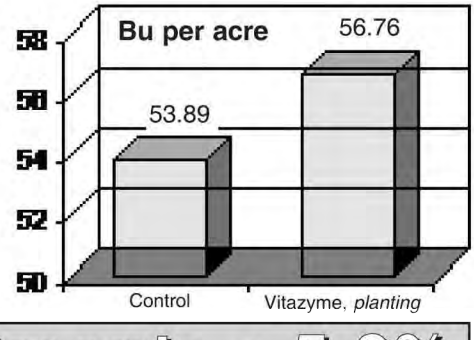
Treatment	Bean yield, bu/acre	Increase
1. Control	53.00	--
2. Vitazymeat bloom	54.74	1.74 (+3.3 %)
3. Vitazyme at planting	56.02	3.02 (+5.7 %)
4. Vitazyme twice	57.50	4.50 (+8.5 %)



Yield increase, Vitazyme twice: + 8.5%

SEED TREATMENT RESULTS

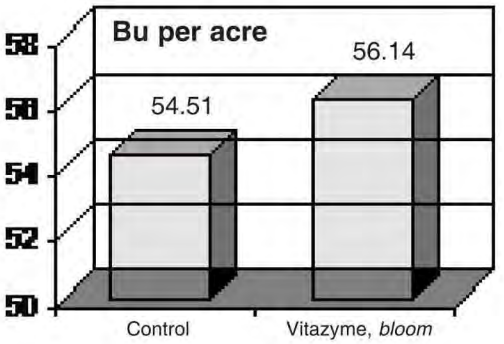
Treatment	Bean yield, bu/acre	Increase
1. Control	53.89	--
2. Vitazyme at planting	56.76	2.87 (+5.3 %)



Yield increase, seed treatment: + 5.3%

FOLIAR TREATMENT RESULTS

Treatment	Bean yield, bu/acre	Increase
1. Control	54.51	—
2. Vitazyme at bloom	56.14	1.63 (+3.0%)



Yield increase, foliar treatment:

Income results: "Overall results" are used here. Average soybean value in Iowa: about $6.00/bu.

Treatment	Income	Increase
1. Control	$318.00/acre	--
2. Vitazyme twice	$328.44/acre	$10.44/acre
3. Vitazyme at planting	$336.12/acre	$18.12/acre
4. Vitazyme at bloom	$345.00/acre	$27.00/acre

Income increase, Vitazyme twice: $27.00/acre

Conclusions: Vitazyme significantly increased soybean yields in central Iowa when applied on the foliage at early bloom, on the seeds at planting, and on both the seeds and foliage. The greatest increase was with both the seed and foliar applications. This dual application translated to a 4.5 bu/acre increase, or an increase in income of $27.00/acre. Vitazyme is therefore viewed as a highly profitable amendment for soybeans in central Iowa, as has been demonstrated in several other tests in the state as well.

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1997 Crop Results

Vitazyme on Soybeans

Researcher: William (Bill) Goodell
Location: Shortsville, New York
Seeding rate: 57 lb/acre
Seeding date: May 20, 1997
Row width: 7 inches
Variety: Terra 200
Experimental design: A field was split, half treated with Vitazyme and half left untreated.

1. **Control (no Vitazyme)**
2. **Vitazyme at planting**

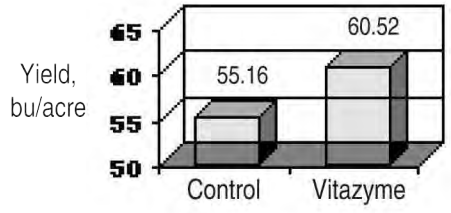
Fertility treatments: All of the field received 5.4 gal/acre 9-18-9 plus 2.6 gal/acre 0-0-30 on the seeds at planting.
Vitazyme application: 12 oz/acre along with the fertilizer at planting.
Soil: Ontario loam, 3 to 10% slope; 7.8 mg/100 g cation exchange capacity.
Tillage: conservation tillage (chisel plow)
Previous crop: corn
Harvest date: October 8, 1997
Yield results:

	Control	Vitazyme	Increase with Vitazyme
Soybean yield	55.16 bu/acre	60.52 bu/acre	5.36 bu/acre

Yield Increase: 10%

Income results: The price of corn in New York is about $7.00/bu.

	Control	Vitazyme
Soybean income	$386.12/acre	$423.64/acre



Income Increase: $37.52/acre

Leaf chlorophyll increase: An average chlorophyll value for 20 leaves was obtained for each treatment on July 13, 1997, using a Minolta SPAD meter.

	Control	Vitazyme
SPAD units of chlorophyll	41.7	43.8

Chlorophyll increase: 2.1 SPAD units

Comments: The cropping year was very favorable. Vitazyme treated plants were noticably bigger on July 13 than the control plants.

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1997 Crop Results

Vitazyme on Soybeans

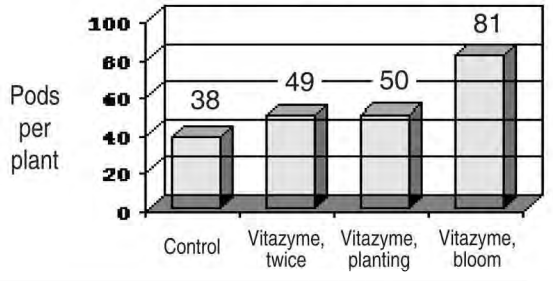
Researcher: Dan Easton, Easton Agri-Consulting, Inc
Seeding date: June 4, 1997 (adequate moisture) *Location*: Bagley, Iowa *Variety*: Pioneer RR soybeans
Seeding rate: 80,000 plants/acre *Row spacing and depth*: 30 inches, 1.5 inches deep
Experimental design: A randomized complete block design with six replications was set up on a Clarion loam, with plots 10 feet wide and 40 feet long (0.009183 acre).

Four treatments were used:

1. **Control (no Vitazyme)**
2. **Vitazyme on the seed at planting, and at early bloom**
3. **Vitazyme on the seed at planting**
4. **Vitazyme at early bloom**

Fertility and tillage treatments: Soils were sampled before planting and after harvest for analysis of basic soil parameters. No fertilizers were applied. The field was chisel plowed in the fall and disked in the spring.
Vitazyme applications: Vitazyme was applied to the seed row at planting at 13 oz/acre, and on the leaves and soil at early bloom (July 21) at 13 oz/acre, to appropriate plots.
Harvest date: October 20, 1997
Bean pod count results: Bean pods on representative plants from each treatment were counted on September 25.

Treatment	Average pods/plant	Increase
1. Control	38.0	—
2. Vitazyme twice	49.0	+29%
3. Vitazyme at planting	50.0	+32%
4. Vitazyme at bloom	81.0	+113%

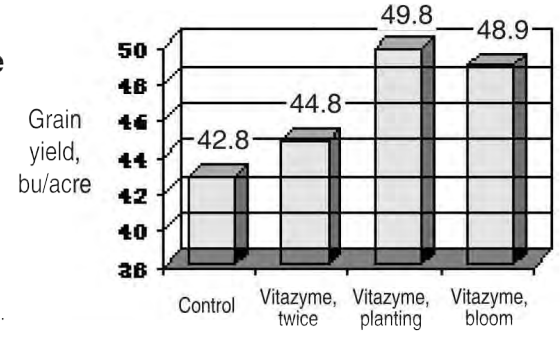


Pod increase (bloom application): 113%

Yield results:

Treatment	Grain yield*	Increase
	bu/acre	bu/acre
1. Control	42.8 c	—
2. Vitazyme twice	44.8 b	2.0 (+5%)
3. Vitazyme at planting	49.8 a	7.0 (+16%)
4. Vitazyme at bloom	48.9 a	6.1 (+14%)

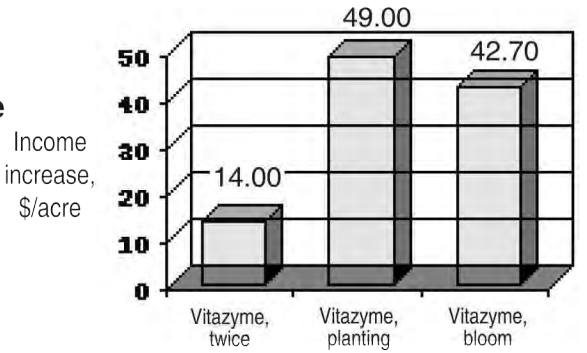
*Means followed by the same letter are not significantly different at P=0.05 (Duncan's Multiple Range Test).



Yield increase (planting application): 16%

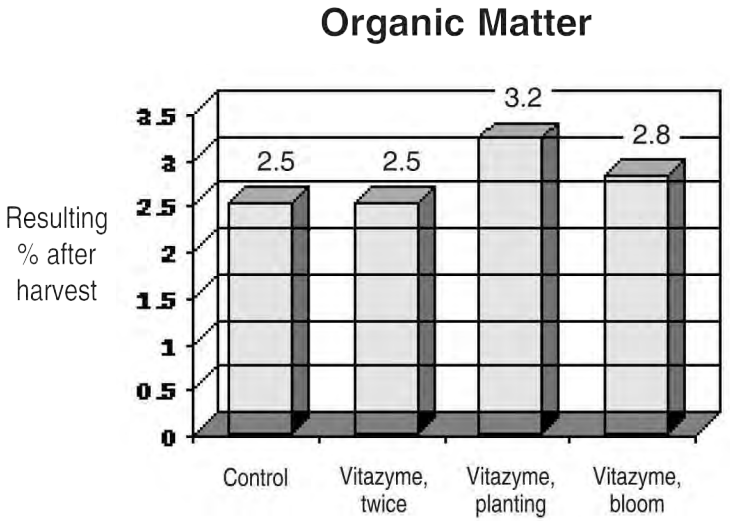
Income results: Average soybean value in Iowa: about $7.00/bu

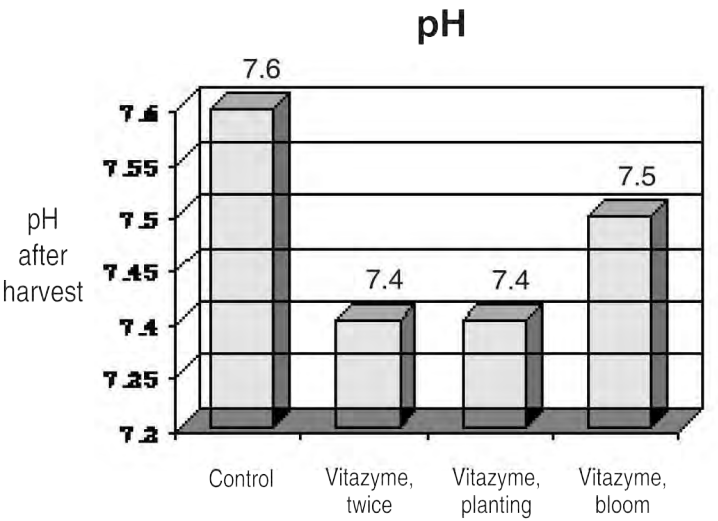
Treatment	Income	Increase
1. Control	$299.60/acre	—
2. Vitazyme twice	$313.60/acre	$14.00/acre
3. Vitazyme at planting	$348.60/acre	$49.00/acre
4. Vitazyme at bloom	$342.30/acre	$42.70/acre



Income increase (planting application): $49.00/acre

Soil test results: Changes in soil parameters from before planting to after harvest were similar for all treatments for P, K, Mg, Ca, and cation exchange capacity. Nitrate-N ended up slightly higher for all three Vitazyme treatments, but organic matter and pH levels showed greater differences.





Comments: The cropping year was excellent in central Iowa during 1997 despite a cool and wet spring.

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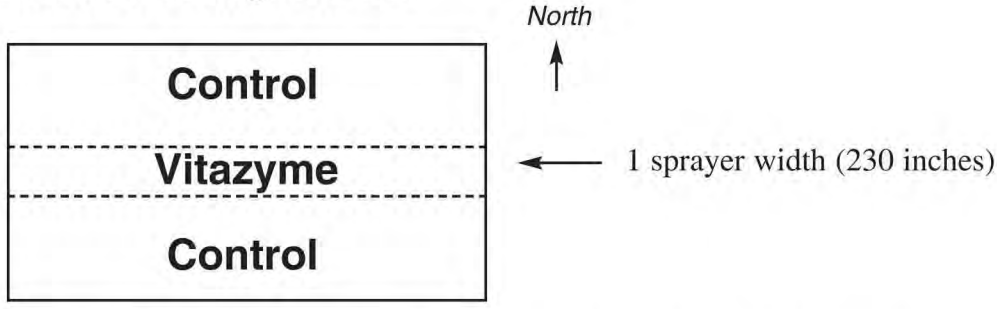
1997 Crop Results

Vitazyme on Soybeans

Researcher: Gerald Yoder
Location: Wellman, Iowa
Variety: Pioneer 9306
Seeding rate: 230,000 seeds/acre
Seeding date: May 1, 1997
Previous crop: corn
Row width: 7.5 inches
Tillage method: no-till
Experimental design: Two treatments were evaluated:

1. **Control (no Vitazyme)**
2. **Vitazyme sprayed once on the foliage and soil**



Vitazyme application: Vitazyme was applied to the foliage and soil at 13 oz/acre along with a herbicide spray when the soybeans were about one foot high.
Harvest date: October 2, 1997
Yield results: A weigh wagon was used to determine bean weights for strips harvested on both sides of the the applied Vitazyme strip.

	Control	Vitazyme
Soybean yield, north strip	67.62 bu/acre	69.82 bu/acre
Soybean yield, south strip	65.03 bu/acre	67.07 bu/acre
Average yield	**66.33 bu/acre**	**68.45 bu/acre (+2.12 bu/acre)**

Soybean yield increase: 4%

Income results: Farmgate value of soybeans, mid-Iowa: $7.00/bu

	Control	Vitazyme
Value of soybeans:	**$464.3/acre**	**$479.15/acre**

Income increase: $14.84/acre

Note: No sprayer cost is calculated, since Vitazyme was applied along with a herbicide.

Moisture at harvest:

	Control	Vitazyme
North strip	10.7%	10.2%
South strip	10.8%	10.0%
Average moisture	**10.8%**	**10.1%**

Moisture decrease: 0.7 percentage point

Leaf chlorophyll on August 17: An SPAD meter was used.

	Control	Vitazyme
SPAD units of chlorophyll (20 plants for each treatment)	**46.0**	**47.7**

Chlorophyll increase: 1.7 units

Pods: Five random plants from each treatment were selected, and pods were counted.

	Control	Vitazyme
Total pods	**166**	**250**

Pod number increase: 51%

Other observations and comments: Because the Vitazyme treated soybeans were drier at harvest, it may be presumed that they matured faster than the control beans. During August it was possible to view the field and pick out the treated strip due to a darker green color. The cropping year was excellent.

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1997 Crop Results

Vitazyme on Soybeans

Researcher: Waymond Lipsey, Agri-Research
Location: Danville, Iowa
Variety: Pioneer 9281 *Seeding date*: May 30, 1997
Seeding rate: 150,000 seeds/acre *Row width*: 30 inches
Experimental design: Four treatments were evaluated, in a completely randomized design having six seplications. Plots were 10 x 40 feet (0.0091827 acre).

1. **Control (no Vitazyme)**
2. **Vitazyme at 13 oz/acre at planting**
3. **Vitazyme at 13 oz/acre at early bloom**
4. **Vitazyme at 13 oz/acre at planting and at early bloom**

2	1	1	4	3	4
3	4	2	3	1	3
4	2	1	4	2	3
1	3	2	4	1	2

North ↑

Fertility treatments: none *Fertility level*: high *Tillage*: conventional
Soil type: Mahaska silty clay loam (pH = 6.8; cation exchange capacity = 20.8 meq/100 g.
Vitazyme application: Vitazyme was applied at 13 oz/acre at planting (directly on the seeds), at early bloom, or at both times.
Harvest date: October 1, 1997
Yield results: A plot combine was used to harvest the plots.

	Soybean yield	
Treatment	**lb/plot***	**bu/acre***
Control	24.0 c	43.56 c
13 oz/acre at planting	24.6 b	44.65 b
13 oz/acre at early bloom	25.5 a	46.28 a
13 oz/acre at planting and early bloom	25.8 a	46.83 a

*Means followed by the same letter are not significantly different at P=0.05.

Yield increase
At planting: 3%
At early bloom: 6%
At both times: 8%

Income results: The price of soybeans in Iowa is about $7.00/bu.

Treatment	**Soybean value**	**Increase in Value**
Control	$304.92/acre	0
13 oz/acre at planting	$312.55/acre	$7.63/acre
13 oz/acre at early bloom	$323.96/acre	$19.04/acre
13 oz/acre at planting and early bloom	$327.81/acre	$22.89/acre

Income increase
13 oz/acre
at early bloom
$19.04/acre

Comments: The year was very favorable for soybean yields.

Corn, Soybeans *with Vitazyme*

Glyphosate and AMPA Persistence and Distribution in Soils Under Field Conditions in the Midwestern USA

A University of Missouri Multi-Year Study, condensed from a Virtual Annual Meeting of the American Society of Agronomy, the Crop Science Society of America, and the Soil Science Society of America

Researchers: Robert Kremer, Division of Plant Sciences, University of Missouri, Columbia, Missouri. Timothy Reinbott, School of Natural Resources, University of Missouri, Columbia, Missouri. Manjula Nathan, Division of Plant Sciences, University of Missouri, Columbia, Missouri. Kelly Nelson, Division of Plant Sciences, University of Missouri, Columbia, Missouri. Paul Syltie, Vital Earth Resources, Inc., Gladewater, Texas. Xiaowei Pan, Agricultural Development Group, Eltopia, Washington. John Fagan, HRI Labs, Fairfield, Iowa.

Background Information

Many recent studies report persistent glyphosate and aminomethylphosphonic acid (AMPA) residues in field soils.

- Soil with >5-year glyphosate application history in Argentina, average concentrations of glyphosate and AMPA were 2300 and 4200 ug/kg, respectively; 25 to 1000 ug/kg soil in various soils.

Note the superior development of the corn ears on the right treated with Vitazyme.

Very limited information on effects of residual glyphosate/AMPA on soil biological activity or plant growth.

- Germination and early biomass accumulation in oat, faba bean, turnip rape decreased in greenhouse and field plot studies.
- "Low dose glyphosate" (ppb) in the presence of rhizosphere microbiome inhibits seedling growth.

"… the extensive use of glyphosate and the environmental risks associated with it warrant awareness among its user about its judicious utilization, and necessitate further intense investigations to mitigate, avoid, or remove the problems resulting from its use".

This Pioneer variety responded well to Vitazyme, as can be seen by the ear fill and degree of root development.

Management Considerations

- Residual glyphosate/AMPA effects on soil biology and non-genetically engineered (GE) crops when transitioning from GE with many years of Roundup herbicide applications to non-GE cropping systems with no Roundup.
- Practices for suppressing residual glyphosate/AMPA effects on crop growth.

Research studies performed by the University of Missouri involved the measurement of residual glyphosate/AMPA in soils

1. Use of a biostimulant to improve maize growth, soil health, and tolerance to glyphosate stress (field plots)
2. Mitigation of potential adverse effects of GE crop production for long-term improvement of soil health (farmer fields)

Research Objectives

1. Determine the impacts of residual glyphosate/AMPA on soil health after transition from a GE cropping system to a non-GE cropping system.
2. Determine the effects of a biostimulant (Vitazyme) on rhizosphere biology and crop growth in soils with residual glyphosate contents.

Plants treated with Vitazyme typically possess greater leaf area and more chlorophyll, both characteristics which are evident in this comparison. Note also more available nitrogen as evidenced by more leaves on the lower stalk.

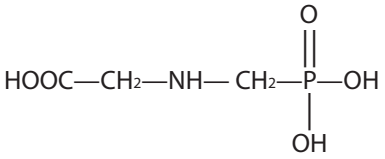
EXPERIMENTAL DESIGN

Sites, Soils, and Management:
Knox County, MO 2016, 2017
Soils: Mexico silt loam (fine, smectitic, mesic, Aeric Vertic Epiaqualfs)
Crops: Maize, soybean
Tillage: minimal, fertilizer based on soil test
Each field had received glyphosate-based herbicides in years prior to the study in 2016 and 2017. Half the plots received no glyphosate. Half the plots received brassinosteroid biostimulant (Vitazyme) at planting and foliar in the vegetative stage

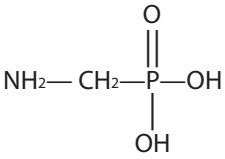
Delaware County, IA-2014-2019
Soils: Bassett-Olin Variant-Bertram-Lilah association- sandy loams
Crops: Maize, soybean
Minimum tillage: fertilizer based on soil test
Fields continuously cropped to GE varieties with annual applications of glyphosate-based herbicides for 19 years prior to transition to non-GE crops and termination of glyphosate use in 2016.

Soil & Rhizosphere Property Measurements
- Root Fusarium colonization
- Rhizosphere pseudomonad rhizobacteria
- Rhizosphere indole-acetic acid producing rhizobacteria
- Rhizosphere Mn transforming bacteria
- Soil glucosidase activity (soil microbial activity)
- Soil microbiome—phospholipid fatty acid (PFLA) profiles
- Soil microbial biomass ("Total PLFA")
- Soil organic C and active C
- Root biomass

Glyphosate Analysis
- Soil samples extracted with ethanol-acetonitrile
- Soil extracts injected into liquid chromatograph—tandem mass spectrometer for detection of glyphosate and AMPA product
- Limit of detection was <1.0 ng/g soil



Glyphosate

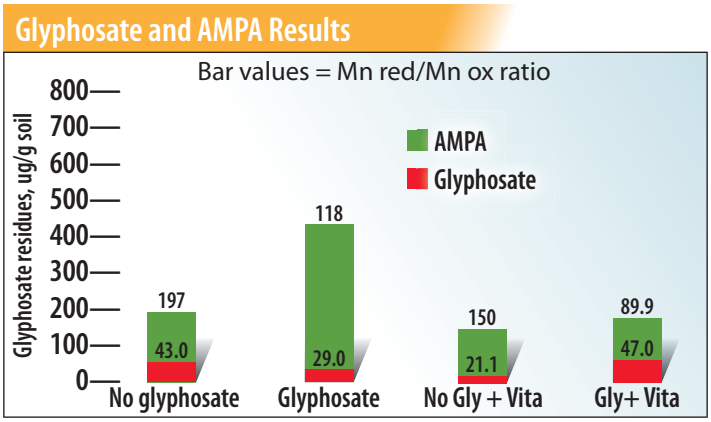


AMPA

The Vitazyme treated soybeans in Missouri have more leaf area and height, plus a higher chlorophyll content, indicative of a greater potential yield

Note the excellent pod formation along the entire stems of these Vitazyme treated soybeans, giving an excellent 60.1 bu/acre yield.

Glyphosate and AMPA results with Vitazyme at a Novelty, Missouri, test site.
Glyphosate and AMPA residues detected in soils of maize plots, averaged over treatments applied in 2017 at Greenley Memorial Research Center, Novelty, MO. Numbers above bars indicate standard deviation. Gly, Glyphosate: Glv+Bs, Glyphosate + Biostimulant

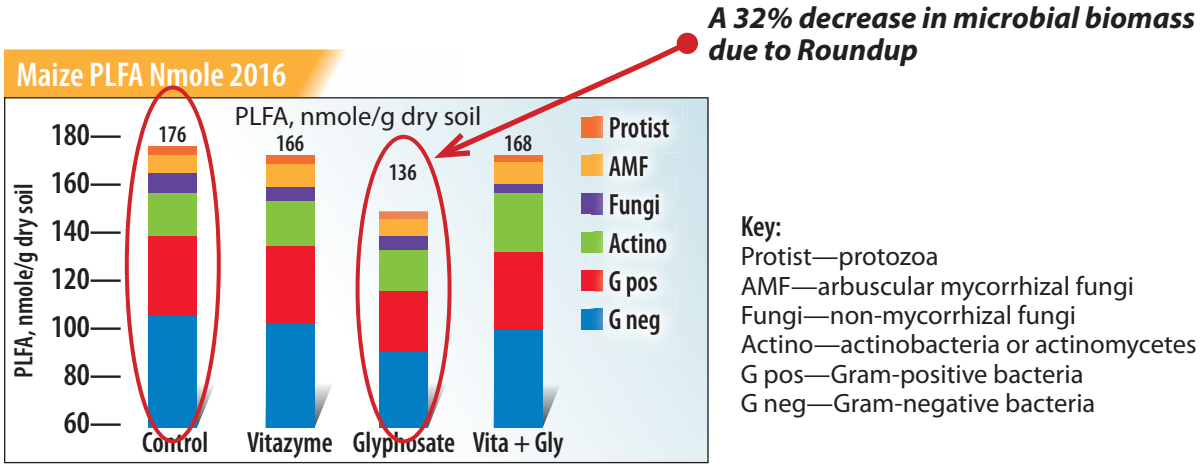


The mean soil glyphosate and AMPA concentrations for each treatment were associated with very high standard deviations, indicating considerable variable distribution within the experimental area regardless of application dosages or times of application.

Considerations from the Novetly, Missouri, field plot study:

- Vitazyme as a treatment to alleviate plant stress caused by glyphosat was confounded by residual herbicide in all plot soils.
- We assumed that glyphosate applied during the growing season interacted with root and rhizosphere microbiomes due to the systemic movement of the herbicide toward the root system, and its release into the rhizosphere.
- However, effects on microbiological activities cannot be correlated to soil glyphosate concentrations due to the unknown quantities of residual glyphosate and AMPA present in the rhizosphere in all plots from previous applications over the years.

Impact of Glyphosate on Rhizosphere Microbial Community (Diversity)



Key:
Protist—protozoa
AMF—arbuscular mycorrhizal fungi
Fungi—non-mycorrhizal fungi
Actino—actinobacteria or actinomycetes
G pos—Gram-positive bacteria
G neg—Gram-negative bacteria

Note potential protective effects of Vitazyme on microbiome diversity from the detrimental impact of glyphosate. Reduced microbial abundance = reduced degredation potential or rate.

Conclusion:

- Glyphosate persists in soils as a parent compound, and AMPA as well in fields receiving many applications and for years after termination.
- Distribution of glyphosate residues in soils is very heterogenous.
- The soil microbiome may mediate only one degradation pathway, resulting in the accumulation of the AMPA metabolite.
- Glyphosate residues may impact soil health and soil biology.
- Many soil factors (pH, SOM, nutrient concentrations, etc.) and management practices may confound overall effects of glyphosate.
- Management to avoid or overcome detrimental effects of persistent glyphosate residues in soils includes:
  - Build up soil organic matter (cover crops, organic amendments)
  - Utilize conservation practices including grass waterways
  - Use Vitazyme to enhance root growth
  - Enhance soil microbial diversity (cover crops, crop rotation)

Soybeans *with Vitazyme application*

Researcher: Jonathan Jaschen ***Research organization:*** Heritage Ag Research, Fairbank, Iowa
Trial location: Fairbank, Iowa ***Variety:*** P25A16E ***Planting date:*** May 13, 2023
Planting depth: 1.25 inches ***Row spacing:*** 30 inches ***Rows per plot:*** 6
Planting rate: 1,400,000 seeds/acre ***Soil type:*** unknown ***Tillage:*** conventional ***Previous crop:*** corn
Experimental design: A soybean field was divided into plots of 15 x 30 feet (450 ft^2/plot). Five replications of eight treatments using Vitazyme biostimulant were arranged to determine the effect of various timings to effect the greatest yield enhancement of the product.

Treatment	Seed treatment	In-furrow	Foliar, V3	Foliar, R1
	5% v/v	oz /acre	oz /acre	oz /acre
1. Control	o	o	o	o
2.Vitazyme 1x	x	o	o	o
3. Vitazyme 1x	o	13	o	o
4. Vitazyme 1x	o	o	13	o
5. Vitazyme 1x	o	o	o	13
6. Vitazyme 2x	x	o	o	13
7. Vitazyme 2x	o	13	o	13
8. Vitazyme 3x	o	13	13	13

Fertilization: none
Vitazyme applications:
Seed treatment: A 5% Vitazyme solution was applied to the seeds before planting, making sure that the seeds were well-coated.
In-furrow treatment: A 13 oz/acre application was made in-row during planting, on May 13.
Foliar V 3 treatment: A 13 oz/acre spray was applied at the V 3 stage.
Foliar R 1 treatment: A 13 oz/acre spray was applied at the R 1 stage.
Weed control: herbicides for broadleaf and grass weed control
Growing season: warmer and dryer than normal
Plant growth results: Yield results were unable to be collected, but plant growth parameters were evaluated: plant vigor, plant height, and plant weight.
Harvest date: October 3, 2023, using an Almaco plot combine. Two rows in the center of each plot were harvested, for 30 feet (150 ft^2, or 0.00344 acre).
Crop vigor results: Crop vigor was evaluated on June 8, 2023, using a scale of 0 to 10. All plots received a score of 9, so there were no significant differences among the eight treatments.

Plant size, chlorophyll development, pod number, and root growth were visibly enhanced with Vitazyme applied to the soybeans on the right. The V3 application yielded 6.13 bu/acre more than the control.

Notice the superior size of the soybean plants on the right, indicative of the significantly greater yield harvested from Vitazyme applied at 13 oz/acre to the plants at V3.

Pods removed from the plants in the accompanying photo show the remarkable enhancement of crop yield potential with Vitazyme applied to the leaves in this study. The greatest yield increase was with application at the V3 stage.

Bean test weight results:

Treatment	Bean test weight*	Weight change
	lb/bu	lb/bu
1. Control	58.22 b	—
2. Vita on seeds	58.26 b	+0.04
3. Vita in-furrow	58.14 b	-0.08
4. Vita foliar early	57.84 b	-0.38
5. Vita foliar late	59.04 a	+0.82
6. Vita seeds + late	58.20 b	-0.02
7. Vita in-furrow + early	58.12 b	-0.10
8. Vita in-furrow + early + late	58.22 b	0
LSD (P = 0.10)	0.72	—
CV	1.16	—
Replicate (F) probability	0.856	—
Treatment (F) probability	0.287	—

*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman -Keuls Test.

All of the eight treatments did not differ significantly in bushel weight, except for Treatment 5, when Vitazyme was applied late, at the R 1 stage. That weight was 0.82 lb/bu heavier than the control weight, or 1.4% heavier.

Bean yield:

Treatment	Soybean moisture*	Yield change
	bu/acre	bu/acre
1. Control	52.81 b	—
2. Vita on seeds	52.30 b	-0.51 (-1%)
3. Vita in-furrow	53.73b	+0.92 (+2%)
4. Vita foliar early	58.94 a	+6.13 (+12%)
5. Vita foliar late	52. 27 b	-0.54 (-1%)
6. Vita seeds + late	51.37 b	-1.44 (-3%)
7. Vita in-furrow + early	53.28 b	+0.47 (+1%)
8. Vita in-furrow + early + late	53.11 b	+0.30 (+1%)
LSD (P = 0.10)	4.26	—
CV	7.41	—
Replicate (F) probability	0.0016	—
Treatment (F) probability	0.1451	—

*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls Test.

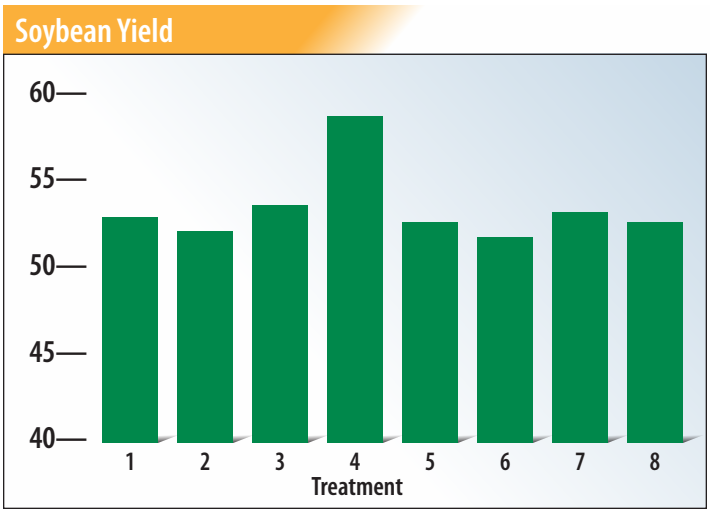
Bean moisture results: Though the bean moisture varied little among the eight treatments, there were some minor differences.

Treatment	Bean moisture*	Moisture change
	%	%
1. Control	8.35 abc	—
2. Vita on seeds	8.40 ab	+0.05
3. Vita in-furrow	8.29 bcd	-0.06
4. Vita foliar early	8.07 d	-0.28
5. Vita foliar late	8.51 a	+0.16
6. Vita seeds + late	8.18 bcd	-0.17
7. Vita in-furrow + early	8.16 bcd	-0.19
8. Vita in-furrow + early + late	8.36 abc	+0.01
LSD (P = 0.10)	0.26	—
CV	2.9	—
Replicate (F) probability	0.451	—
Treatment (F) probability	0.125	—

*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman- Keuls Test.

The highest moisture content soybeans at harvest were those of Treatment 5, (Vitazyme applied to the leaves at R 1), while the lowest moisture was for Treatment 4 (Vitazyme applied to the leaves at V 3).

Increase in soybean yield with Vitazyme applied foliar at V3: 12%



Seven of the treatments gave statistically equal yield, but Treatment 4 — Vitazyme applied at V 3 — gave a major 6.13 bu/acre yield increase, 12% above the control and 10% above any other Vitazyme treatment.

Conclusions: A replicated small-plot soybean trial in east-central Iowa, using seven different Vitazyme application regimes, showed that there were some significant effects. The bean test weight was significantly improved above all other treatments when Vitazyme at 13 oz/acre was sprayed foliar at R 1 (late). This weight was 0.82 lb/bu more than the untreated control. Vitazyme sprayed on the leaves at V 3 (early), however, gave the driest beans at harvest, being 0.28 percentage-point less than the untreated control. These more mature soybeans of the early (V3) foliar application also gave the highest yield — 58.94 bu/acre — which was 6.13 bu/acre greater than the control yield. The other Vitazyme treatments were statistically less than this V 3 application. The reason for this excellent response with the V 3 application is not known, for the other two treatments that received V 3 applications did not respond as much; these two had at least one more 13 oz/acre treatment besides the V 3 spray. The complex interplay of internal growth regulars tied to timely summer rains during a dry year may have influenced the responses noted. In any case, a foliar application at 13 oz/acre at V 3 is shown to be a highly effective treatment in this east-central Iowa study.

Soybeans *with Vitazyme application*

Researcher: V. V. Plotnikov
Research organization: Agro Expert International, Kaharlyk, Ukraine, and Plant Designs International, Rochester, New York
Location: PE Meleshkin, Kozyatyn District, Vinnytsia Region, Zhurbyntsi Village, Ukraine; central Ukraine (440-590 mm of rain per year)
Variety: Kansas, F 2 ***Planting date:*** May 11, 2023
Planting rate: 550,000 seeds/ha ***Previous crop:*** winter wheat
Tillage: disking to 8-10 cm, plowing to 23-25 cm, harrowing, cultivation to 4-5 cm
Soil type: podzolic black soil (3.9% organic matter)
Experimental design: A soybean field was selected for the evaluation of the effectiveness of Vitazyme biostimulant on this legume crop. The field was divided into an untreated control and a treated area to evaluate the bean yield differences.

❶ ***Control*** ❷ ***Vitazyme***

Fertilization: none
Vitazyme application: 1 liter/ha sprayed on the leaves and soil at the fifth trifoliate leaf stage, on June 23, 2023

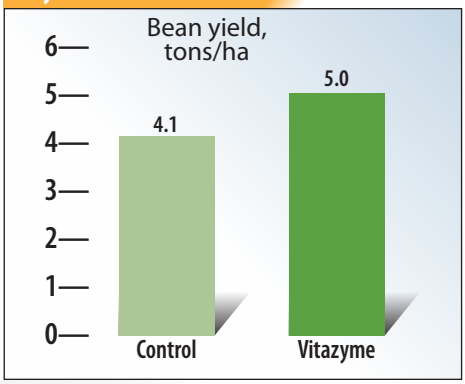
Income results: The 0.9 ton/ha soybean yield increase resulted in a net income increase of $292/ha.

Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
1. Control	4.1	—
2. Vitazyme	5.0	0.9 (+22%)

Yield increase in bean yield with Vitazyme: 22%

Soybean Yield



The Vitazyme treated soybeans show considerably greater biomass at this stage of development, leading to a 22% yield increase at harvest.

Conclusions: This field-scale Ukraine soybean trial, comparing an untreated control with a 1 liter/ha Vitazyme application at the fifth trifoliate stage, revealed a major yield increase of 0.9 ton/ha (+22%) with this biostimulant. This result proves the substantial effectiveness of the product when used on soybeans in central Ukraine. A net income increase of $292/ha was also achieved in this study.

Soybeans *with Vitazyme application*

Researcher: Graig Reicks
Research organization: South Dakota Soybean Association, Brookings, South Dakota
Farm cooperator: Luke Holzwarth, Hazel, South Dakota
Location: Hazel, South Dakota
Variety: unknown
Experimental design: A soybean field was treated with Vitazyme in three alternate strips, with the intervening strips serving as untreated controls. The purpose of the trial was to evaluate the effect of this product on soybean yield.

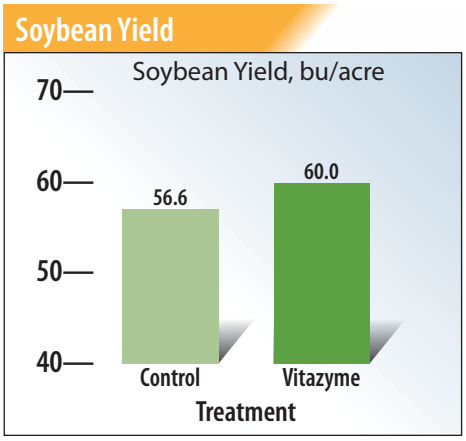
1 *Control* 2 *Vitazyme*

Vitazyme application: 13 oz/acre (1 liter/ha) at planting in the starter fertilizer

Yield results:

Field Strip	Bean yield		Yield change
	Control	Vitazyme	
	bu/acre	bu/acre	lb/acre
1	55.3	58.5	3.2 (+6%)
2	56.1	59.5	3.4 (+6%)
3	58.4	61.9	3.5 (+6%)
Average	56.6	60.0	3.4* (+6%)

*Significantly greater than the control at P=0.05.



Increase in bean yield with Vitazyme: 6%

The Vitazyme treated soybeans on the right in this photo reveal enhanced maturity right to the dividing line.

Soybean pods stripped from 10 representative plants from each treatment revealed not only a greater number of pods with Vitazyme, but enhanced maturity, as seen in the field photo above.

The Vitazyme treated soybean plants were taller, had more leaf area, and contained more pods, as can be clearly seen in this photo.

Conclusions: This South Dakota field-strip soybean trial, utilizing Vitazyme in alternating strips, resulted in a 3.4 lb/acre (6%) yield increase, revealing the efficacy of this simple program to boost soybean yields.

Soybeans *with Vitazyme Bio (Organic Vitazyme) application after hail damage*

Researchers: Vadim V. Plotnikov
Research organization: Agro Expert International, Kaharlyk, Ukraine, and Plant Designs International, Rochester, New York
Location: PE "Meleshkin," Kuzyatyn District, Vinnytsia Region, Zhurbyntsi Village, Ukraine; central Ukraine (440-590 mm of rain per year)
Variety: Kansas, F3 ***Planting date:*** May 21, 2022
Planting rate: 0.55 million seeds/ha
Previous crop: winter wheat
Tillage: disking to 8-10 cm, plowing to 23-25 cm, harrowing, cultivation to 4-5 cm
Soil type: podzolized chernozem (3.9% organic matter)
Experimental design: A soybean field that had been hail damaged on June 30, with 50% leaf loss, was divided into a Vitazyme Bio treated portion, while the remainder of the field was left untreated. The purpose of the trial was to evaluate the effect of Vitazyme Bio on soybeans to bring recovery from the hail damage and produce a good yield.

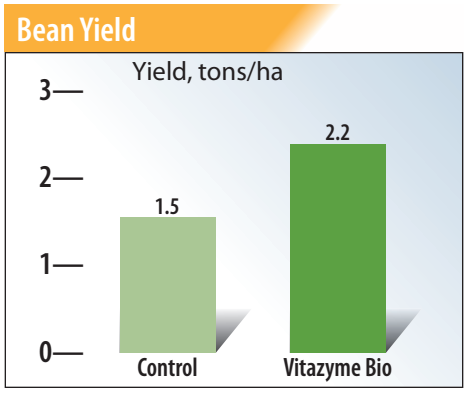
A hailstorm devastated this soybean test field on June 30, and was treated with Vitazyme Bio to help rejuvenate the crop.

❶ *Control* ❷ *Vitazyme Bio foliar*

Fertilization: 35 kg/ha of N broadcast and harrowed in before planting
Vitazyme Bio application: 1 liter/ha sprayed over the leaves, which had lost 50% of the leaf canopy, at the third trifoliate stage on July 30.
Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
1. Control	1.5	—
2. Vitazyme Bio	2.2	0.7 (+47%)

Yield increase with Vitazyme Bio: 47%



Income results: A great yield increase of 47% above the control treatment gave an income increase of $180/ha.
Conclusions: A soybean trial in Ukraine was initiated on a field which had been severely damaged by a hail storm (50% leaf loss) on June 30, 2022. A portion of the field was treated at the third trifoliate stage 30 days after the storm, with 1 liter/ha, which substantially aided crop recovery to produce a 47% yield increase. This increase translated to an income improvement of $180/ha, showing the great value of Vitazyme to aid in crop recovery after damage from hail.

The superiority of the soybeans that were treated with Vitazyme Bio after severe hail damage is clear in this photo, where the treated soybeans yielded 47% more than the control, a great recovery of yield

Soybeans *with Vitazyme application*

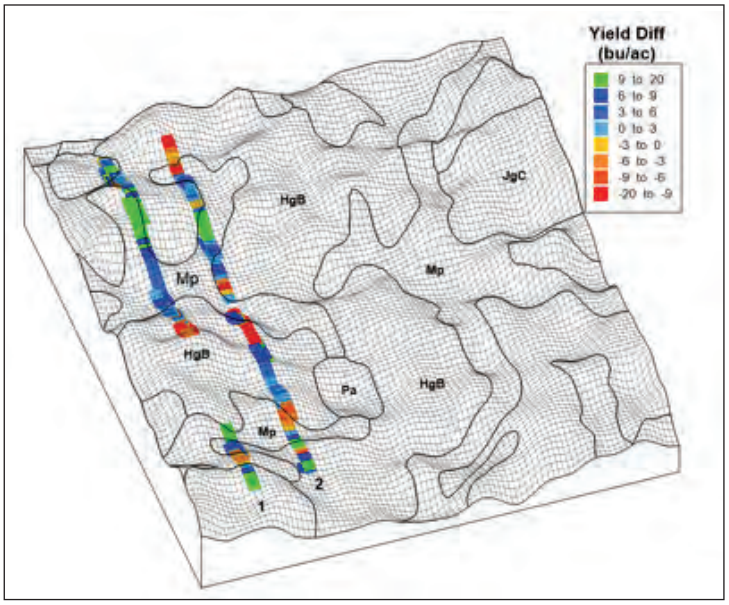
Note the greater biomass, greater pod number, and greener pods of the Vitazyme treated soybean plants, and the considerably better root system versus the untreated control.

Pods removed from two typical plants from each treatment show the greater number of pods and more four-bean pods with Vitazyme treatment.

Researchers: Graig Reicks and Cory Strom
Research organization: South Dakota Soybean Association and South Dakota State University, Brookings, South Dakota
Location: Kimball, South Dakota
Variety: 16 x 628 Mustang
Plant population: 138, 507 seeds/acre
Planting date: May 16, 2021
Row spacing: 30 inches
Soil type: Chernozem (Mollisol); Plankinton silt loam, Mobridge—Plankintion silt loams, Highmore-Java Complex, and Java-Glenham loams (6-9% slopes)
Experimental design: A soybean field was treated in one portion with Vitazyme applied in-furrow to evaluate the effect of this biostimulant on the yield of soybeans.

1 ***Control*** **2** ***Vitazyme***

Fertilization: (1) broadcast pre-plant, 100 lb/acre of 11-52-0 % N-P_2O_5-K_2O + 20 lb/acre AMS; (2) in-furrow, 2.5 gal/acre of 7-23-0-1.5-0.5% N-P_2O_5-K_2O-S-Zn
Vitazyme application: 13 oz/acre (1 liter/ha) mixed with the starter fertilizer, in-furrow at planting
Growing season weather: dry and hot; 10.9 inches of rain all year vs. 17.4 inches average for 10 years.
Harvest date: September 22 and 23, 2021
Yield results:

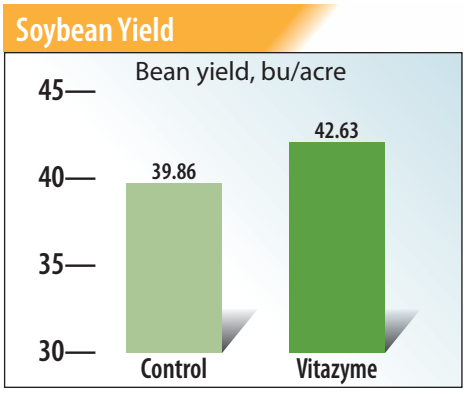


Yields were determined for a comparison of the two treatments using combine monitor data in adjacent strips.

Treatment	Yield	Yield change
	bu/acre	bu/acre
Control	39.86	—
Vitazyme + Others	42.63	2.77 (+7%)
Treatment F*	0.11	

*Two-tailed paired t-test.

Increase in bean yield with Vitazyme: 7%



Conclusions: A split-field soybean trial in central South Dakota, using Vitazyme as an in-furrow treatment along with liquid starter fertilizer, produced a 2.77 bu/acre (7%) yield increase. This increase occurred in spite of extremely hot and dry conditions throughout the summer.

Soybeans *with Vitazyme application*

Chris Fischbach stands in the Vitazyme treated section of the trial field of soybeans.

The pods removed from three average plants for each treatment show a considerable advantage for the Vitazyme treated plants.

Researchers: Graig Reicks and Chris Fischbach
Research organization: South Dakota Soybean Association and South Dakota State University, Brookings, South Dakota
Location: Mansfield, South Dakota
Variety: REA RX1529
Seeding rate: 150,000 seeds/acre
Planting date: May 17, 2021 ***Row spacing:*** 30 inches
Soil type: silt loam, Chernozem (Mollisol)
Experimental design: A soybean field was selected to receive Vitazyme applied in-furrow in strips, alongside untreated areas, to determine the effect of this biostimulant on the yield of soybeans.

1 ***Control*** **2** ***Vitazyme***

Fertilization: none
Vitazyme application: 13 oz/acre (1 liter/ha) in-furrow at planting on May 17
Growing season weather: sparse but timely rains, and very warm June to August
Harvest date: September 23, 2021
Yield results: A field combine with a yield monitor was used. Three replications as strips were used for a statistical analysis.

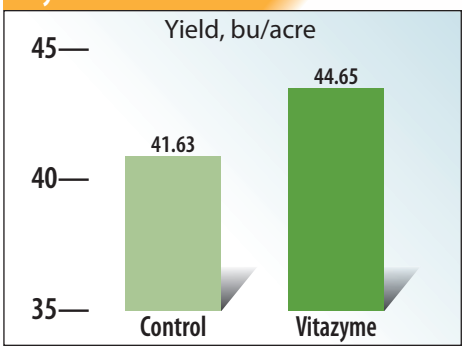
The Vitazyme treated plants show greater mass in both the roots and the tops, as well as a greater stem diameter and pod number. Note the greener leaves at this late stage of development.

Note how the pods are filled to the tips of the treated plants in the Fischbach soybean trial.

Treatment	Rep 1	Rep 2	Rep 3	Average*	Yield change
	bu/acre	bu/acre	bu/acre	bu/acre	bu/acre
Control	37.55	41.69	45.64	41.63 b	—
Vitazyme	41.90	43.71	48.33	44.65 a	3.02 (+7%)

*The yield difference was significant at P=0.02 using a one-tailed paired t-test.

Soybean Yield



Increase in bean yield with Vitazyme: 7%

Conclusions: In this South Dakota soybean trial, where Vitazyme was applied in-furrow at 13 oz/acre (1 liter/ha) at planting, the yield was increased significantly (P=0.02) by 3.02 bu/acre during a year having very warm temperatures. This represented a 7% yield increase, showing the highly profitable value of this simple application for soybean production in South Dakota.

Soybeans *with Organic Vitazyme application*

Researchers: Graig Reicks and B.J. McNeil
Research organization: South Dakota Soybean Association and South Dakota State University, Brookings, South Dakota
Location: Siegling South field, Miller, South Dakota ***Variety:*** LS 1380HP
Planting date: June 7, 2021 ***Row spacing:*** 30 inches
Soil type: Chernozem (Mollisol); Tetonka silt loam (0-2 % slopes), Houdek-Prosper loams (0-2% slopes), Houdek-Prosper loams (1-6% slopes), Dudley silt loam, nearly level
Experimental design: An organic soybean field was divided into Organic Vitazyme and untreated areas, in an effort to determine the effect of this biostimulant on soybean yield.

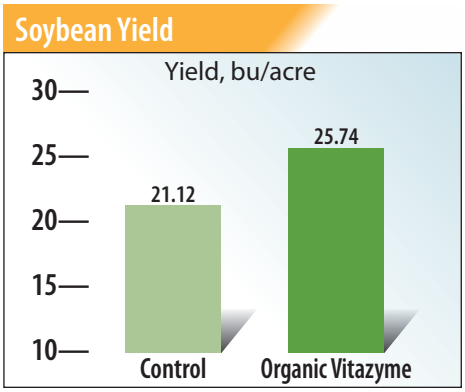
1 ***Control*** **2** ***Organic Vitazyme***

Fertilization: unknown
Vitazyme application: 13 oz/acre applied by air on July 16, 2021, at 9:30 a.m., using a spray rate of 5 gal/acre on 12 acres
Growing season weather: very hot and dry; 16.5 inches of precipitation to December of 2021. This caused slow germination.
Harvest date: October 7, 2021

Note the greater abundance of pods and superior rooting and nodulation of the Vitazyme treated plants from the McNeil farm on the right.

Yield results:

Treatment	Yield	Yield change
	bu/ha	bu/ha
1. Control	21.12	—
2. Organic Vitazyme	25.74	4.62 (+22%)



Increased bean yield with Organic Vitazyme: 22%


The soybeans on the Siegling farm were well-filled to the top of the plants, giving good yields in spite of the heat and drought.

The Vitazyme treated soybeans at the McNeil farm displayed greater overall plant growth and root development, leading to more pods and a higher final yield.

Conclusions: A field-scale soybean trial in central South Dakota proved that Organic Vitazyme, at 13 oz/acre (1 liter/ha) applied in-furrow at planting, increased soybean yield by 4.62 bu/acre, a 22% increase. These results show the potential for Organic Vitazyme to be a major contributor to soybean production in South Dakota, especially with organic production programs.

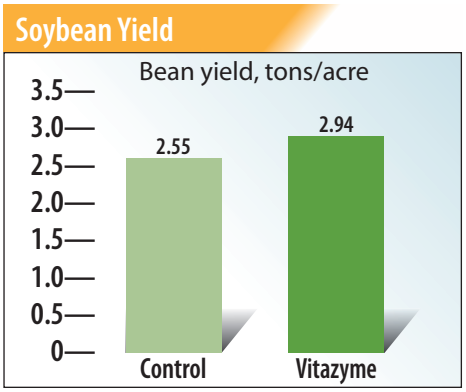
Soybeans *with Vitazyme application*

Researcher: V.V. Plotnikov
Research organization: Agro Expert International, Kaharlyk, Ukraine, and Plant Designs International, Rochester, New York
Location: Cherkasy Research Station of Bioresources, Zolotonosha District, Cherkasy Region, Draboro-Bariatynske Village, Ukraine; central Ukraine (440-590 mm of rain per year:
Variety: Aurelina, F1 ***Planting date:*** May 11, 2021 ***Planting rate:*** 0.55 million seeds/ha ***Previous crop:*** winter wheat
Tillage: disking to 8-10 cm, deep loosening to 28-30 cm, cultivations to 8-10 cm, harrowing to 4-5 cm
Soil type: Chernozem (3.9% organic matter)
Experimental design: A soybean field was divided into a Vitazyme treated portion, with an untreated portion left as a control, to evaluate the effect of this product on bean yield. The first application was made at the time of herbicide application to minimize herbicide stress.

1 ***Control*** **2** ***Vitazyme***

Fertilization: 8-24-24 kg/ha of N- P_2O_5-K_2O before planting
Vitazyme application: 0.5 liter/ha sprayed on the leaves and soil at the 5th trifoliate on June 25, 2021; 0.5 liter/ha foliar at early bloom
Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
Control	2.55	—
Vitazyme	2.94	0.39 (+15%)



Increase in bean yield with Vitazyme: 15%

Income results: An additional 0.39 ton/ha with Vitazyme produced $237/ha more income versus the untreated control.
Conclusions: This soybean field-scale trial in Ukraine, using Vitazyme sprayed at 0.5 liter/ha at the 5th trifoliate to reduce herbicide stress, and 0.5 liter/ha at early bloom, resulted in a 0.39 ton/ha (15%) yield increase. This increase netted the farmer $237/ha more income versus the untreated control, showing the value of this program for soybean growers in Ukraine.

Soybeans *with Vitazyme application*

Researchers: Graig Reicks and Chris Fischbach
Research organization: South Dakota Soybean Association, Siouz Falls, South Dakota
Location: Fischbach Farms, Mansfield, South Dakota
Variety: unknown ***Planting date:*** unknown
Soil type: Harmony-Beotia silty clay loams, 0-2% slopes, Great Bend-Beotia silt loams, 0-2% slopes, and Harmony-Aberdeen silty clay loams, 0-2% slopes
Experimental design: A soybean field was treated with Vitazyme in 90-foot sprayer strips, and compared with untreated control strips between them to evaluate the effect of the biostimulant on soybean yield. Four replicated strips were used.

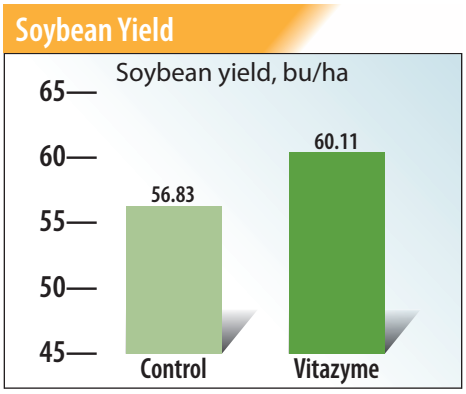
1 ***Control*** **2** ***Vitazyme***

Fertilization: unknown
Vitazyme application: (1) 13 oz/acre in-furrow at planting; (2) 13 oz/acre sprayed on the plants and soil at early bloom
Yield results: Several strips were harvested using a combine-mounted yield monitor, with treated and untreated adjoining strips compared.

These soybeans from northeastern South Dakota show excellent growth and maturity with Vitazyme use.

Replicate	Control	Vitazyme	Yield change
	bu/acre	bu/acre	bu/acre
1	57.50	61.40	3.90
2	57.29	60.71	3.42
3	55.20	58.95	3.75
4	57.34	59.39	2.05
Mean	56.83	60.11*	3.28 (+6%)

*Significantly greater than the control at P = 0.05.



Note the excellent pod formation along the entire stems of these Vitazyme treated soybeans, giving an excellent 60.1 bu/acre yield.

Increase in soybean yield with Vitazyme: 6%

Conclusions: This northeastern South Dakota field scale soybean trial, where Vitazyme applications was compared to an untreated control, revealed that the product significantly increased bean yield by 3.28 bu/acre, or 6%. This increase shows the efficacy of Vitazyme for soybean production in South Dakota.

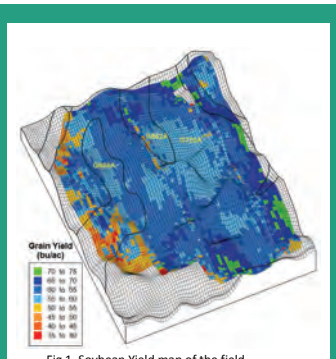


Fig 1. Soybean Yield map of the field

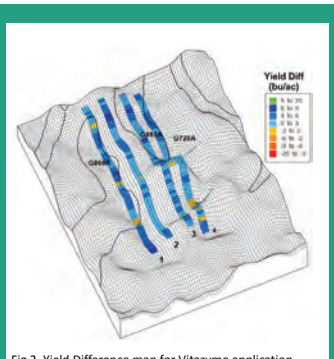


Fig 2. Yield Difference map for Vitazyme application

Compared to the control plants, the Vitazyme treated plants display greater height, leaf area, root growth, srem diameter, pod number, and leaf chlorophyll content.

Soybeans *with Vitazyme application*

Researcher: Dr. Bruce Kirksey ***Research organization:*** Agricenter International, Memphis, Tennessee
Location: Memphis, Tennessee ***Variety:*** GoSoy 4912LL ***Planting date:*** June 17, 2020 ***Planting depth:*** 1 inch
Seeding rate: 140,000 seeds/acre ***Row width:*** 30 inches ***Rows per plot:*** 4
Soil: Falaya and Waverly soil series; silt loam; organic matter = 1.8%, pH = 6.5, cation exchange capacity = 7.8% meq/100g of soil
Fertility level: excellent ***Soil drainage:*** good ***Soil moisture at planting:*** excellent

Experimental design: A small-plot soybean trial, arranged in a randomized complete block design with four replications, the plots being 10 x 30 feet (300 ft^2), was established in order to evaluate the effects of Vitazyme, a silicon product, and OCC emulsion on the yield of soybeans. Vitazyme and silicon were applied alone and in combination, while OCC was applied in combination with Vitazyme.

Treatment	Vitazyme	Silicon	OCC
1	o	o	o
2	x	o	o
3	x	o	x
4	o	x	o
5	x	x	o

Fertilization: unknown

Vitazyme application: (1) 13 oz/acre in-furrow at planting on June 17; (2) 13 oz/acre sprayed on the soil and leaves on July 24 at early bloom. Vitazyme was mixed with silicon for Treatment 5.

Silicon application: (1) 6 oz/acre in-furrow at planting on July 17; (2) 6 oz/acre sprayed on the soil and leaves on July 24 at early bloom. Silicon was mixed with Vitazyme for Treatment 5.

OCC application: OCC is a plant-based emulsion that can be applied alone, or along with nutrients or biostimulants to encourage better growth, higher nutrient efficiency, better crop quality, and reduced pesticide appllications. It was applied at 0.0125% v/v of the sprayer capacity at early bloom, over the leaves and soil, on July 24 mixed with Vitayme.

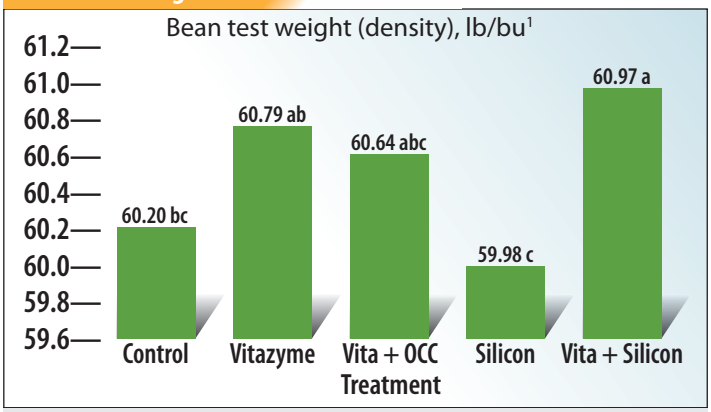
Growing season conditions: good

Harvest date: December 1, 2020. An Almaco plot combine harvested an area of 5 x 30 feet (150 ft^2) from each plot; this area encompassed the middle two rows of each plot.

Bean moisture results: The soybean moisture levels varied from 13.00 to 13.19 % among the five treatments, and were not significantly different.

Bean test weight results: Soybean test weight varied within a narrow range for the five treatment—59.98 to 60.97 lb/bu—and was significant at P = 0.070.

Bean Test Weight



[1]Means followed by the same letter are not significantly different at P = 0.05.

LSD (P = 0.05)	0.75
CV	0.81
Replicate F	0.299
Treatment F	0.070

Bean yield results:

Treatment	Yield[1]	Yield change
	bu/acre	bu/acre
1. Control	63.1 b	—
2. Vitazyme	66.9 a	3.8 (+6%)
3. Vitazyme + OCC	66.1 a	3.0 (+5%)
4. Silicon	63.3 b	0.2 (<1%)
5. Vitazyme + Silicon	65.8 a	2.7 (+4%)
LSD (P = 0.05)	2.2	
CV	2.17	
Replicate F	0.657	
Treatment F	0.007	

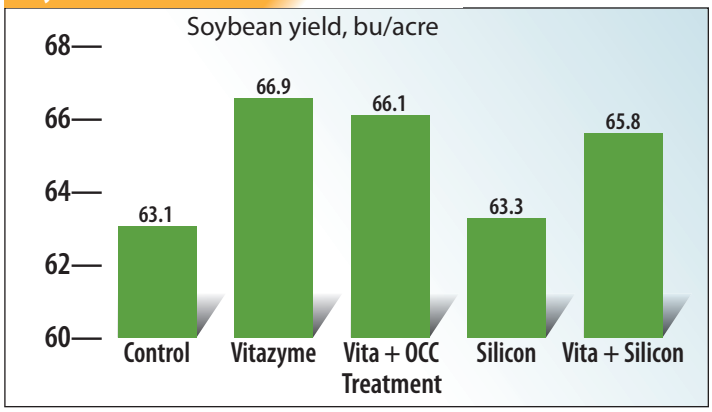
[1]Means followed by the same letter are not significantly different at P = 0.05.

Increase in test weight

Vitazyme alone..... 0.59 lb/bu
Vitazyme + OCC ..... 0.44 lb/bu
Vitazyme+ Silicon... 0.77 lb/bu*

*This increase is significantly greater than the control at P = 0.07.

Soybean Yield



Conclusions: This small-plot soybean trial in western Tennessee revealed a number of conclusions.

- Vitazyme applied in-furrow and at early bloom at 13 oz/acre each application, in all cases significantly increased the soybean yield by from 4 to 6%. The greatest increase was with Vitazyme alone.
- Silicon applied alone did not increase soybean yield, nor did it improve yield when combined with Vitazyme.
- OCC did not improve soybean yield compared to Vitazyme applied by itself.
- Vitazyme, alone or mixed with silicon or OCC, increased the bushel weight of the soybeans, and significantly above the control for Vitazyme plus silicon.

Increase in bean yield	
Vitazyme alone	*6%*
Vitazyme + OCC	*5%*
Vitazyme+ Silicon	*4%*

These results indicate that the significant yield increases of this study were obtained with Vitazyme alone, while neither silicon nor OCC caused any yield enhancement. Vitazyme also increased bushel weight, and silicon along with Vitazyme improved that weight significantly above the control. Vitazyme is shown in this study to be an excellent yield and bean density enhancer for soybean growers in the mid-South of the United States.

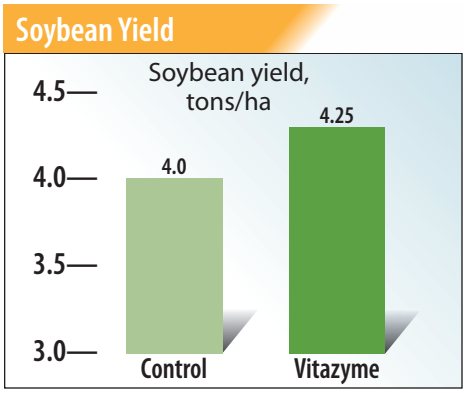
Soybeans *with Vitazyme application*

Researcher: V. V. Plotnikov
Research organizations: Plant Designs International, Rochester, New York, and Agro Expert International, Kaharlyk, Ukraine
Location: PE AF "Dzvony", Peremyshl District, Lviv Region, Bolotnya Village, Ukraine; western Ukraine (550-750 mm of rain per year)
Variety: Kuban, F1 ***Planting date:*** May 1, 2019 ***Planting rate:*** 0.8 million seeds/ha ***Previous crop:*** winter wheat
Previous crop: winter wheat ***Tillage:*** disking to 6-8, heavy cultivation to 30 cm, cultivation to 4-5 cm
Soil type: dark-gray podzolic (2.2% organic matter)
Experimental design: A soybean field was partitioned to an untreated control area and a Vitazyme treated area, using a seed treatment, to evaluate the effect of this product on soybean yield.

1 ***Control*** **2** ***Vitazyme***

Fertilization: 100kg/ha of K_20 in the fall of 2018; 16-27-7 kg/ha of N-P_20_5-K_20 in-furrow at planting
Vitazyme application: 1.0 liter/ton of soybean seeds before planting
Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
1. Control	4.0	—
2. Vitazyme	4.25	0.25 (+6%)



Increase in soybean yield with Vitazyme: 6%

Income results: The yield increase of 6 % (0.25 ton/ha) resulted in an income increase of $137/ha.
Conclusions: A soybean trial of field scale was conducted in western Ukraine in 2019, using a Vitazyme seed treatment of 1 liter/ton to compare the yield of soybeans to the adjoining untreated control. The yield increase was 6% (0.25 ton/ha) with Vitazyme, resulting in greater net income of $137/ha, showing this program to be a very good management practice for soybean growers in western Ukraine.

Soybean *with Vitazyme application*

Researchers: E. Bruce Kirksey, Ph.D.
Research organization: Agricenter International, Memphis, Tennessee
Location: Memphis, Tennessee ***Variety:*** P4255RR2X ***Planting date:*** July 12, 2019 ***Planting rate:*** 140,000 seeds/acre
Planting depth: 1.0 inch ***Row spacing:*** 30 inches
Soil type: Falaya silt loam, pH = 6.3, organic matter = 2.4%, fertility level = good, drainage = good
Experimental design: A small-plot soybean trial was established, using 10 x 30-foot plots (300 ft.^{2}) and five treatments with four replications in a randomized complete block design.

Treatment	Bio Seed application		Vitazyme applicaton[1]	
	On seed	In-furrow	In-furrow	foliar
1. Control	0	0	0	0
2. Bio Seed	136 g/cwt	0	0	0
3. Bio Seed	0	50 g/acre	0	0
4. Bio Seed + Vitazyme in-furrow	0	50 g/acre	13 oz/acre	0
5. Bio Seed + Vitazyme in-furrow and foliar	0	50 g/acre	13 oz/acre	13 oz/acre

[1]13 oz./acre = 1 liter/ha

Bean pods removed from three plants of both the Vitazyme and Bio Seed treatment and the control reveal more pods and potential yield for the treated plants...up to 40% more yield for Treatment 5.

Fertilization: none
Vitazyme application: 13 oz/acre (1 liter/ha) in-furrow at planting for treatments 4 and 5; 13 oz/acre (1 liter/ha) sprayed foliar 30 days after planting at early bloom.
Bio Seed application: Bio Seed is a formulation of bacteria and fungi that stimulates rhizosphere microbial populations. 136 g/100 lb of seed applied before planting for Treatment 2; 50 g/acre in-furrow at planting for Treatments 3, 4, and 5.
Harvest date: November 5, 2019, of the middle two rows of each plot with an Almaco plot combine
See moisture: There were no significant differences in seed moisture content (8.13 to 8.48%).
Seed Test weight: There were no significant differences among treatments for test weight (55.98 to 58.32 lb/bu).

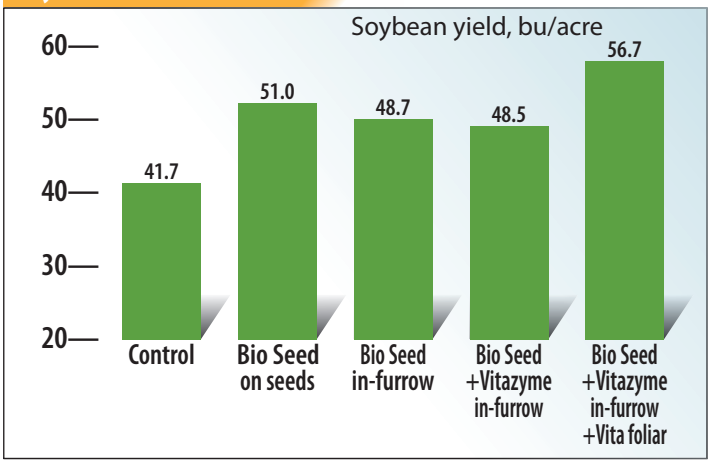
This soybean trial with Vitazyme and Bio Seed produced excellent and highly significant responses in a small plot setting.

Yield results:

Treatment	Yield	Yield change
	bu/acre	bu/acre
1. Control	41.7 c	—
2. Bio Seed on seeds	51.0 b	9.3 (+22%)
3. Bio Seed in-furrow	48.7 b	7.0 (+17%)
4. Bio Seed in-furrow +Vitazyme in-furrow	48.5 b	6.8 (+ 16%)
5. Bio Seed in-furrow +Vitazyme in-furrow +Vitazyme foliar	56.7 a	15.0 (+40%)
LSD (P=0.05)	3.68	
CV	4.85	
Treatment F -value	0.0001	

Notice the taller, stronger soybean plants on the right that have received Vitazyme and Bio Seed. Their leaf area is greater, root development is more extensive, and leaf chlorophyll level is better than for the untreated control.

Soybean Yield



Income results: Income increase data is given for Treatments 1, 4, and 5.

Treatment	Extra income	Extra costs	Net increase
	----------U.S. $/acre----------		
1. Control	—	—	—
4. Bio Seed in-furrow +Vitazyme in-furrow	63.72	21.13	42.58
5. Bio Seed in-furrow +Vitazyme in-furrow +Vitazyme foliar	140.55	29.77	110.78

Increase in soybean yield

Bio Seed on seeds 22%
Bio Seed in-furrow..... 17%
Bio Seed + Vitazyme in-furrow 16%
Bio Seed + Vitazyme in-furrow + Vitazyme foliar..... 40%

Conclusion: A small-plot soybean study conducted with Bio Seed and Vitazyme in Memphis, Tennessee, revealed that, while test weight and seed moisture at harvest were not significantly affected, Bio Seed seed pre-treatment and in-furrow treatment increased the yield by 22 and 17%, respectively. When Vitazyme was applied together with Bio Seed in-furrow, the yield improved by 16%, which was statistically the same as the Bio Seed treatments alone at P=0.05. However when a foliar Vitazyme treatment was added to the in-furrow Bio Seed and in-furrow Vitazyme treatment, the yield shot up to 40% greater than the control. These results show the great efficacy of Bio Seed alone either pre-treated on the seeds or in-furrow, but epecially Vitazyme applied foliar along with Bio Seed and Vitazyme added in-furrow. Income was increased by up to $110.78/acre with Bio Seed and Vitazyme.This experiment reveals the great value of the products for soybean growers.

Corn and Soybeans *with Vitazyme application*

A Summary of Research at the University of Missouri: From a paper presented at the Fourth International Congress on Biostimulants—Barcelona, Spain, November, 2019

Vitazyme Improves Plant Growth, Soil Health, & Tolerance to Glyphosate Stress

Authors: Manjula V. Nathan, Robert J. Kremer, Paul W. Syltie, Timothy M. Reinbott, Kelly A. Nelson, and Xiaowei Pan
Research organization: Division of Plant Sciences, University of Missouri, Columbia, Missouri, USA

Objectives:

- Determine effects of Vitzazyme on selected soil health indicators
- Determine effects of Vitazyme on rhizosphere biology in transgenic soybean and maize treated with glyphosate

Experimental Methods:

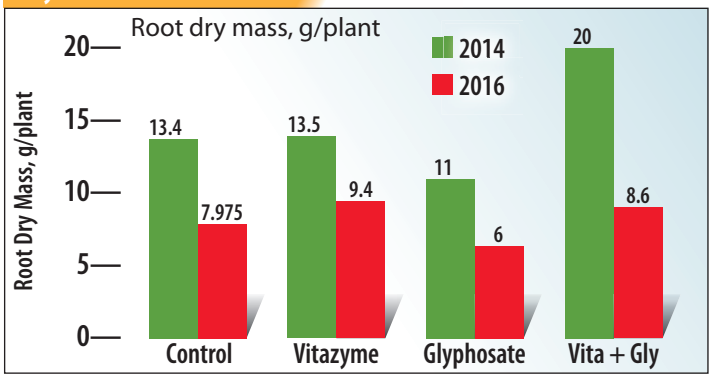
- Field trials conducted at Columbia (2014) and Novelty (2016-17) Missouri on Mexico silt soil (fine, smectitic, mesic Vertic Epiaqualfs)
- Maize and soybean planted conventionally using minimum tillage; plants and soils collected at R2 soybean & V10 maize growth stage
- Root-colonizing *Fusarium* assessed by selective culture technique (Levesque et al. 1993)
- Rhizosphere pseudomonads determined using S1 agar medium (Gould et al. 1985)
- Indoleacetic acid-producing (IAA) bacteria detected on nitrocellulose membranes reacted with Salkowski reagent for color development (Bric et al. 1991)
- Mn-transforming bacteria detected on Gerretsen's medium (Huber & Graham 1992)
- Glucosidase activity detected using enzyme assay of Eivazi & Tabatabai (1988)
- Soil microbial components and biomass determined using phospholipid fatty acid (PLFA) analysis (Buyer & Sasser 2012; Pritchett et al. 2011)

Root growth results: Vitazyme improved soil health indicators and overcame glyphosate effects on maize and soybean

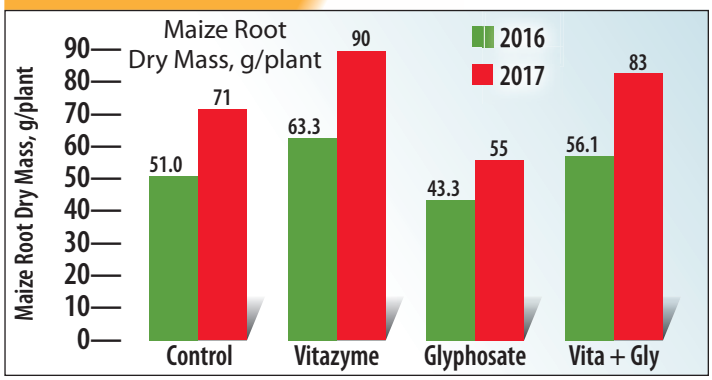
Soybean root biomass enhanced by Vitazyme

Maize root biomass enhanced by Vitazyme

Soybean Root Biomass



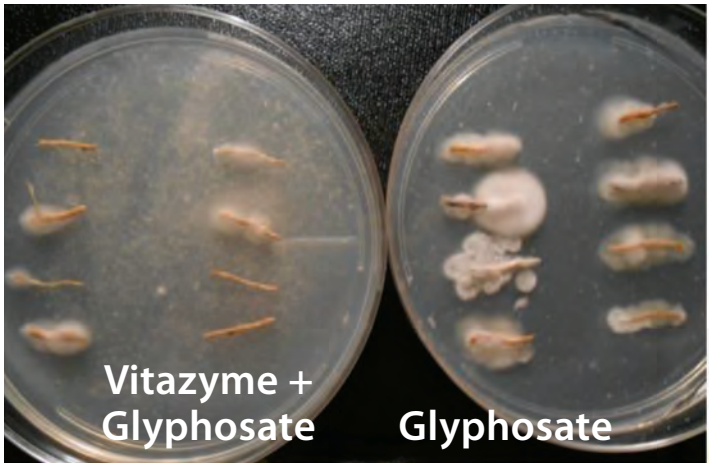
Maize Root Biomass



Biostimulant improved root biomass in both soybean and maize each year relative to no treatment. Biostimulant overcame detrimental effects of glyphosate on root growth in both crops.

Root Fusarium colonization results: Vitazyme significantly reduced colonization of roots by potentially pathogenic *Fusarium* fungal species.

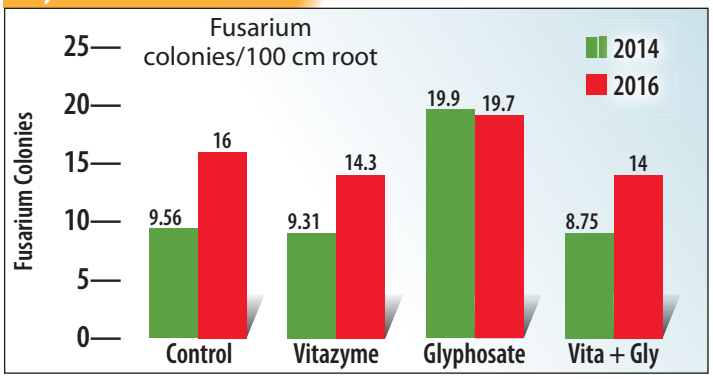
Soybean root colonization by Fusarium spp.



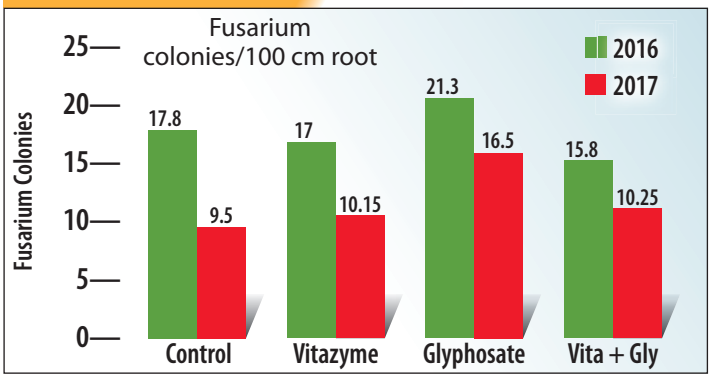
Maize root colonization by Fusarium spp.

Note reduced fungal growth density on field-collected root by Vitazyme treatment compared with roots from plants receiving glyphosate herbicide. Glyphosate induces colonization and infection of roots of both transgenic and non-transgenic crops by soilborne pathogenic fungi (Johal & Huber 2009; Kremer & Means 2009)

Soybean Fusarium



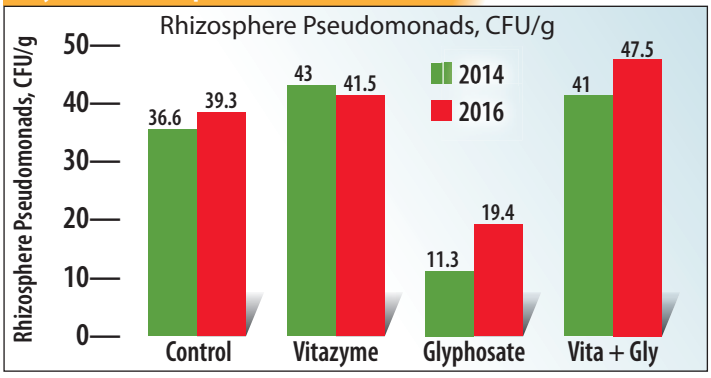
Maize Fusarium



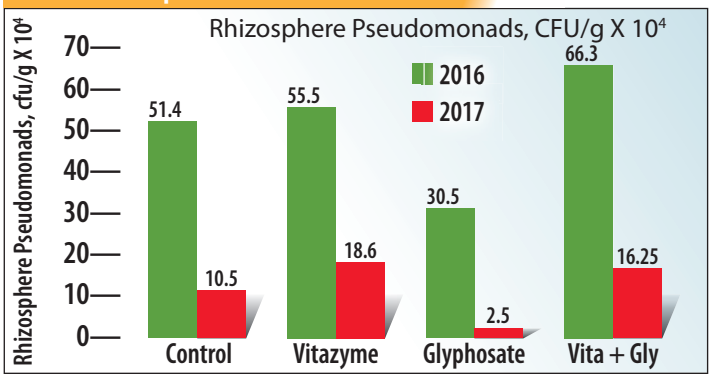
Vitazyme reduced *Fusarium* colonization of roots on both soybean and maize each year relative to no treatment. Vitazyme overcame detrimental effects of glyphosate in reducing root *Fusarium* in both crops. Values above bars are colonization density per 100 cm root or % colonization.

Rhizosphere Fluorescent Pseudomonad results: Vitazyme improved rhizosphere fluorescent pseudomonads, which are soil bacteria that contribute beneficial plant growth-promoting functions, and were significantly increased in both glyphosate-treated crops

Soybean Rhizosphere Pseudomonads

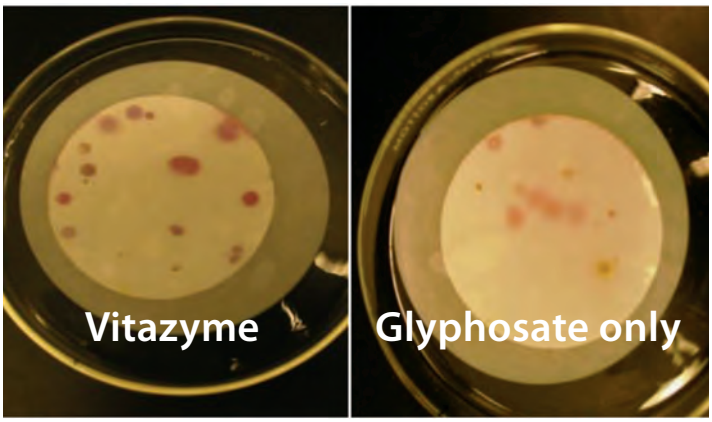


Maize Rhizosphere Pseudomonads



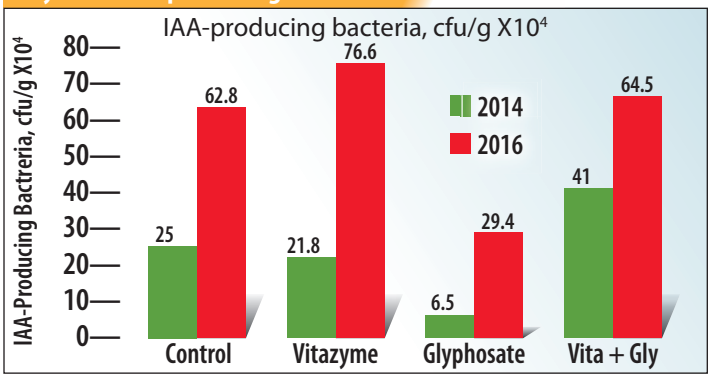
Vitazyme improved rhizosphere pseudomonads. Vitazyme was very effective in overcoming detrimental effects of glyphosate on pseudomonad abundance.

Rhizosphere IAA-producing bacteria results: Vitazyme improved rhizosphere indole-acetic acid producing (IAA) rhizobacteria, which are soil bacteria that provide IAA for various plant functions including root growth stimulation.

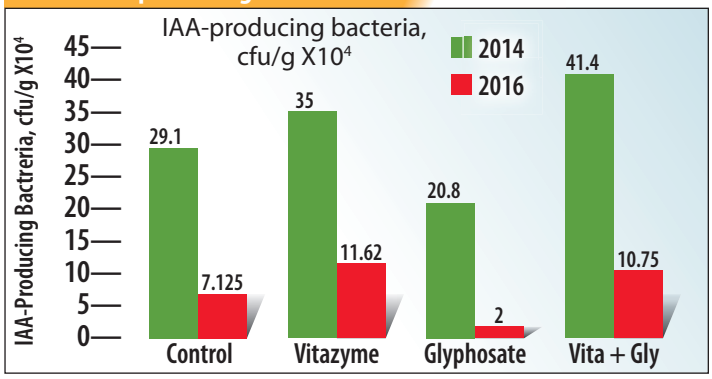


Bacterial colonies attached to membrane show IAA production detected via pink color reaction with Salkowski reagent saturated in the membrane. Instensity of color also indicates IAA concentration.

Soybean IAA-producing Bacteria



Maize IAA-producing Bacteria

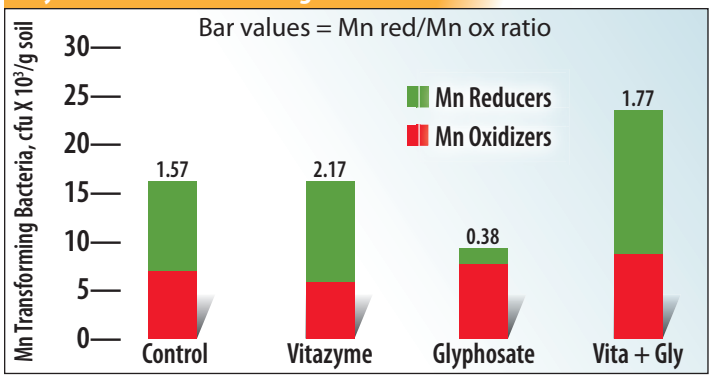


Vitazyme enhanced rhizosphere IAA bacteria abundance on both soybean and maize. Vitazyme was very effective in overcoming detrimental effects of glyphosate on IAA-producing rhizobacteria.

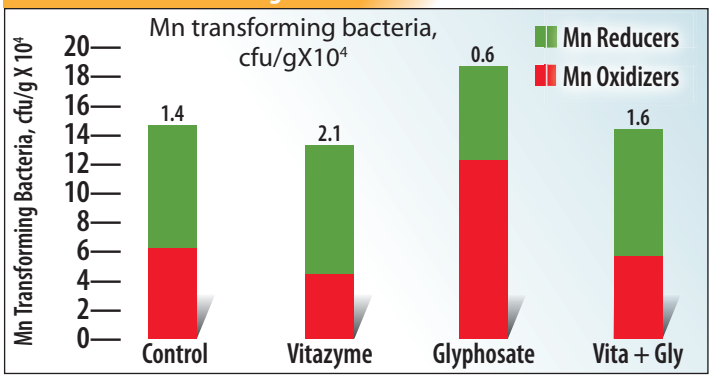
Rhizosphere Mn-transforming bacteria results: Mn-reducing microorganisms provide available Mn (reduced) for plant and microbial uptake. Glyphosate increases Mn-oxidizing microorganisms and limits Mn availability in the rhizosphere.

Mn-transforming bacteria on selective medium; Mn oxidizers appear black; Mn reducers are white and form halos.

Soybean Mn Transforming Bacteria



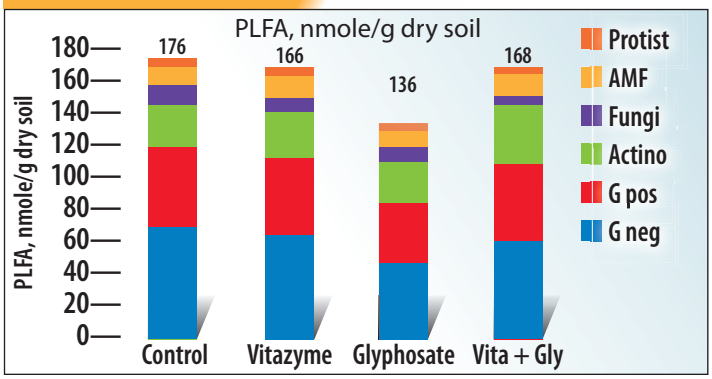
Maize Mn Transforming Bacteria



For soybean and maize, Mn reducers and Mn-reducer: Mn-oxidizer ration increased with Vitazyme; Mn-reducers significantly decreased by glyphosate; Vitazyme overcame glyphosate effects—increasing Mn-reducers and the ratio.

Soil microbial community results: Vitazyme maintained soil microbial community composition (phospholipid fatty acid [PLFA] groups) and total microbial biomass in glyphosate-treated crops.

Maize PLFA Nmole 2016

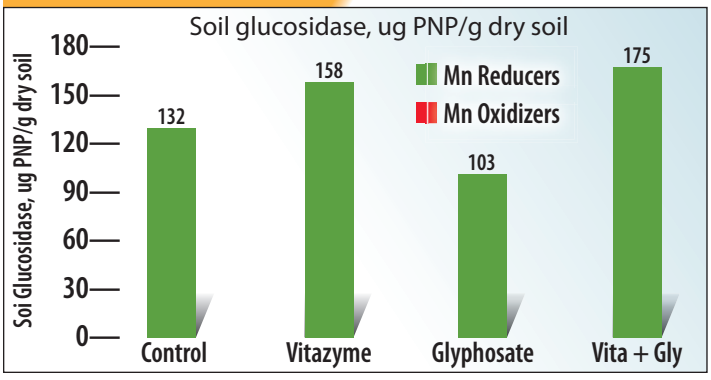


Key:
Protist—protozoa
AMF—arbiscular mycorrhizal fungi
Fungi—non-mycorrhizal fungi
Actino—actinobacterial or actinomycetes
G pos—Gram-positive bacteria
G neg—Gram-negative bacteria

Maize rhizosphere soil microbial diversity. Vitazyme significantly increased diversity of microbial groups and total microbial biomass in the glyphosate treatment. Abundance of mycorrhizae, the symbiotic fungi involved in P and water translocation, was improved with Vitazyme. NOTE: Values above each bar = Total PLFA (representative of microbial biomass)

Soil glucosidase activity results: Vitazyme enhanced glucosidase activity, a bioindicator of soil health and soil biological activity, in both control and glyphosate treatments.

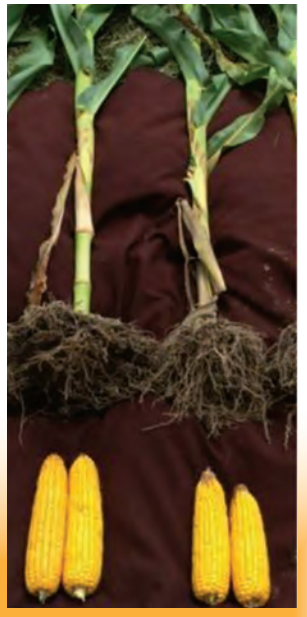
Maize Soil Glucosidase 2016



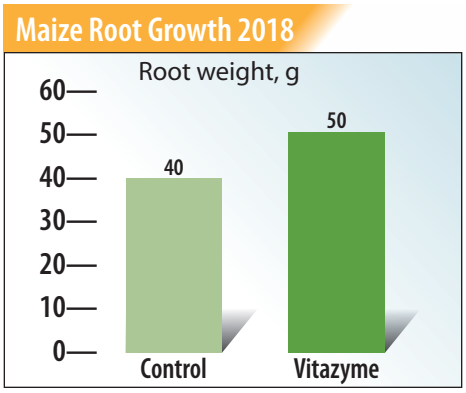
Soybean rhizosphere soil microbial activity indicated by soil glucosidase, a carbon -cycling enzyme.

Conclusions: Vitazyme supplements soil health function and plant growth.

Control Vitazyme



Vitazyme Control



Root mass of Pioneer hybrid: 25% Increase with biostimulant (2018)

- Multiple assessments of sensitive biological indicators of soil health successfully evaluated Vitazyme as a factor in suppressing effects of glyphosate on root growth and rhizosphere biology in transgenic cropping systems and improving soil health.
- Soil microbial diversity (PLFA groups) was restored by Vitazyme in soils planted to maize and soybean treated with glyphosate. High soil microbial diversity is essential to maintain a stable ecosystem and crop productivity.
- Vitazyme use can be a major mangement factor for addressing productivity problems and declining soil health associated with transgenic crops in current crop production systems.

References:

Bric, J.M. Bostock, R.M., Silverstone, S.E., 1991. Rapid in situ assay for indoleacetic acid production by bacteria immobilized on a nitrocellulose membrane. Applied & Environmental Microbiology 57:535-538.

Buyer, J.S., Sasser, M., 2012. High throughput phospholipid fatty acid analysis of soils. Applied Soil Ecology 61:127-130.

Eivazi, F., Tabatabai, M.A., 1988. Glucosidases and galactosidases in soils. Soil Biology & Biochemistry 20:601-606.

Gould, W.D., Hagedorn, C., Bardinelli, T.R., Zablotowicz, R.M., 1985. New selective medium for enumeration and recovery of fluorescent pseudomonads from various habitats. Applied & Environmental Microbiology 49:29-32.

Huber, D.M., Graham, R.D., 1992. Techniques for studying nutrient-disease interactions. In Singleton, L.L. et al. (eds.), Methods for Research on Soilborne Phytopathogens, APS Press, St. Paul, MN. pp. 204-214.

Kremer, R.J., Means, N.E. 2009. Glyphosate and glyphosate-resistant crop interactions with rhizosphere microorganisms. European Journal of Agronomy 31;153-161.

Levesque, C.A., Rahe, J.E., Eaves, D.M., 1993. Fungal colonization of glyphosate-treated seedlings using a new root-plating technique. Mycological Research 97:299-306.

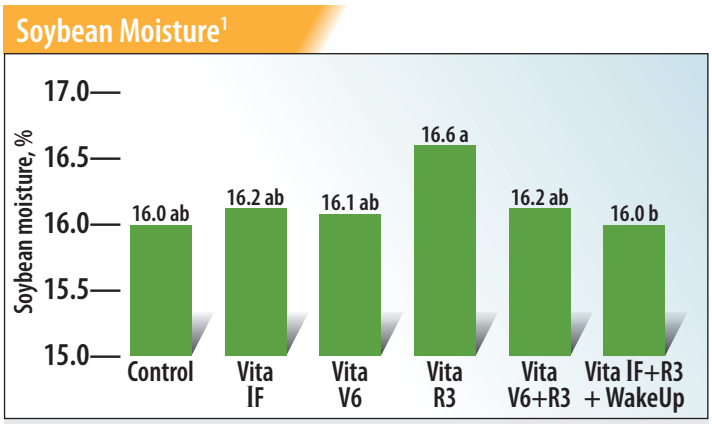
Pritchett, K.A., Kennedy, A.C., Cogger, C.G., 2011. Management effects on soil quality in organic vegetable systems in western Washington. Soil Science Society of America Journal 75:605-615.

Soybeans *with Vitazyme application—A Study on Synergism with WakeUp*

Researchers: Steve Schmidt
Research organization: ACRES Research, Cedar Falls, Iowa
Location: Denver, Iowa ***Variety:*** Emerge 1993 ***Planting date:*** May 22, 2018
Planting rate: 130,000 seeds/acre ***Planting depth:*** 1.5 inches
Row spacing: 30 inches ***Plot size(harvested area):*** 7.5 x 60 feet ***Tillage:*** strip-till
Soil type: Sparta loamy fine sand (1.5% organic matter, 6.2 pH, 6.5 meq/100 grams cation exchange capacity.
Experimental design: A small-plot soybean trial, using four replications and six treatments, was prepared in east-central Iowa in order to evaluate the effect of Vitazyme, applied at different times, on the yield of soybeans. In addition, a treatment utilizing WakeUp adjuvant was added to investigate possible synergisms with Vitazyme.

Treatment	Vitazmye			WakeUp	
	In-furrow	V6	R3	Spring	Summer
	oz/acre	oz/acre	oz/acre	oz/acre	oz/acre
1. Control	0	0	0	0	0
2. Vitazyme in-furrow	13	0	0	0	0
3. Vitazyme foliar/soil V6	0	13	0	0	0
4. Vitazyme foliar R3	0	0	13	0	0
5. Vitazyme foliar/soil V6 + R3	0	13	13	0	0
6. Vitazyme + WakeUp Spring in furrow + Vitazyme + Wake Up Summer R3	13	0	13	4	4

Fertilization: starter mix of 3 gal/acre MPK (0-52-34% N-P_2O_5-K_20), 1 quart/acre humate, and 4 oz/acre Super Trace
Vitazyme application: (1) 13 oz/acre in-furrow (Treatments 2 and 6); (2) 13 oz/acre to the leaves and soil at V6 June 28 (Treatments 3 and 5), and 13/oz/acre to the leaves at R3 (Treatments 4, 5, and 6).
WakeUp Spring application: 4 oz/acre in-furrow (Treatment 6)
WakeUp Summer application: 4 oz/acre to the leaves at R3 (Treatment 6)
Herbicide application: Pre-emergence: 6 oz/acre Zidua Pro, 24 oz/acre Roundup, 16 oz/acre 2, 4-D, 2 lb/acre AMS. Postemergence (first): 10 oz/acre Outlook, 10 oz/acre Arrow, 2.5 lb/acre AMS. Postemergence (second): 16 oz/acre Flexstar, 8 oz/acre Select Max, 4 oz/acre MSO, 3 oz/acre Fultec
Soybean moisture results:



[1]Means followed by the same letter are not significantly different at P=0.05.

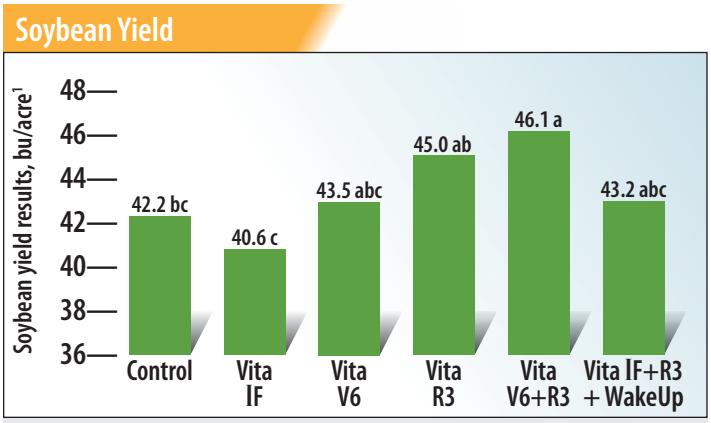
Only the Vitazyme application at R3 caused a significantly higher bean moisture content at harvest than the control.

Vitazyme applied foliar at V6 and R3 gave a significant yield response of 9% in this Iowa replicated study.

Statistics

LSD (P=0.05) 0.6%
Standard deviation 0.1%
CV..... 0.93
Replicate F 0.569
Treatment F 0.434

Soybean yield results:



Means followed by the same letter are not significantly different at P=0.05 .

Statistics	
LSD (P=0.05)	3.7 bu/acre
Standard deviation	2.9 bu/acre
CV	6.4
Replicate F	0.044
Treatment F	0.065

Increase in yield	
Vitazyme at V6	(+3%)
Vitazyme at R3	(+7%)
Vitazyme at V6 + R3	(+9%)
Vitazyme in-furrow + R3 +WakeUp in-furrow + R3	(+2%)

Conclusion: A small-plot soybean trial in east-central Iowa, using three application times for Vitazyme and WakeUp adjuvant, revealed that soybean moisture at harvest varied little, but soybean yield was improved significantly (9%) with Vitazyme applied at the V6 and R3 stages. In addition, the R3 application alone increased yield by 7%, and V6 application by 3%. The in-furrow application did not produce a yield increase, which is contrary to most soybean studies in past years. WakeUp did not produce a significant interaction with Vitazyme when both were applied in-furrow and at the R3 stage. This trial reveals the potential great efficacy of Vitazyme application at the R3 (early pod) stage of plant development.

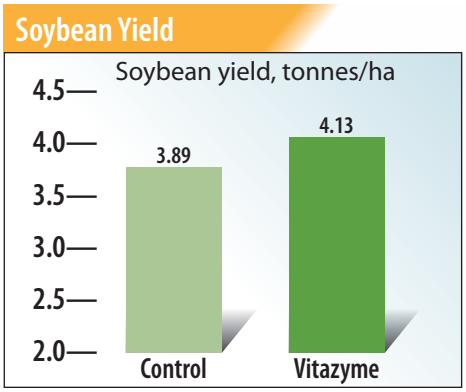
Soybeans *with Vitazyme application*

Researcher: V.V. Plotnikov
Research organization: Plant Designs, Inc., Rochester, New York, and Agro Expert International, Kaharlyk, Ukraine
Location: Gorohiv District, Volyn Region, Ugryniv Village, LTD Shevchenko, Ukraine
Variety: Cassidi, first generation
Planting date: May 1, 2018
Previous crop: winter wheat
Soil type: soddy podzolic (humus = 1.5%)
Planting rate: 500,000 seeds/ha
Field preparation: disking to 6-8 cm, plowing to 20-22 cm, cultivation to 4-5 cm
Experimental design: A soybean field in western Ukraine was treated in part with one application of Vitazyme, while the rest of the field was left untreated to serve as a control. The purpose of the trial was to determine the effectiveness of this product on soybean yield and income.

1 ***Control*** **2** ***Vitazyme***

Fertilization: none
Vitazyme application: 1 liter/ha sprayed on the soil before planting, on April 30, 2018

Yield results:



Yield increase with Vitazyme: 6%

Income results: This soybean yield increase of 0.24 tonne/ha gave an increased income of $86/ha.
Conclusions: A single 1liter/ha Vitazyme application for this western Ukraine soybean trial resulted in a respectable income increase of $86/ha. The yield increase was 6% (0.24 tonne/ha), showing the benefit of this program for soybean growers in Ukraine.

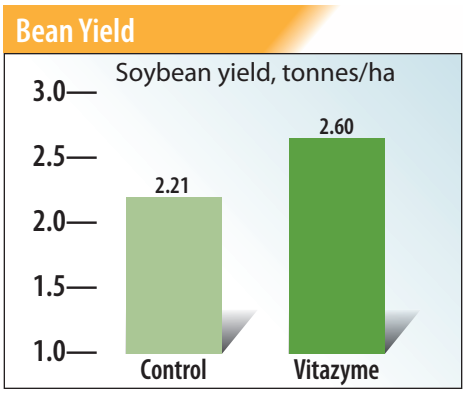
Soybeans *with Vitazyme application*

Researcher: V.V. Plotnikov
Research organization: State Enterprise "Scientific Innovation Center of the Institute of Feeding and Agriculture of Podillia of the National Academy of Agrarian Sciences of Ukraine"
Location: Vinnytsia District, Vinnytsia Region, Agronomichne Village, Ukraine
Variety: Diadema, elite
Planting date: May 5, 2018
Previous crop: spring wheat
Soil type: dark-brown podzolic (humus = 2.2%)
Planting rate: 0.75 million seeds/ha
Field preparation: disking 6-8 cm, plowing to 20-24 cm, cultivation to 4-5 cm
Experimental design: A soybean field was divided into a Vitazyme treated and untreated area to determine the effects of this product on crop yield and income.

V.V. Plotnikov writes field notes for a soybean trial. The program has revealed excellent yield improvements with Vitazyme consistently over the years.

❶ *Control* ❷ *Vitazyme*

Fertilization: none
Vitazyme application: (1) 0.5 liter/ha foliar spray on July 10, at bud formation, and (2) 0.5 liter/ha on August 4 at "green beans" stage
Yield results: (See bar graph to the right)
Income results: The increased yield of 0.39 tonne/ha provided $140/ha more income.
Conclusions: A soybean trial in Ukraine, using Vitazyme at 0.5 liter/ha at bud formation and when the beans had developed significantly, revealed a 17% yield improvement, plus $140/ha greater profitability, showing the great efficacy of this program for soybean growers in Ukraine.



Increase in soybean yield with Vitazyme: 17%

Soybeans *with Vitazyme application—A Greenhouse Study*

Researcher: Robert Kloepper, Ph.D.
Research organization: Plant Science Research Center, Auburn University, Auburn, Alabama
Location: Auburn, Alabama
Soil type: field soil
Experimental design & results: Two experiments were conducted in the greenhouse to discover the effects of Vitazyme on plant height, dry shoot weight, dry root weight, and mineral and nitrogen content.

Experiment 1. Early growth promotion and root morphology over two weeks. Containers, 2.5 inches in diameter and 10 inches deep, were filled with the same weight of field soil to 0.5 inch from the rim.

- **Treatments:** (1) Control, (2) 0.1% Vitazyme, (3) 0.01% Vitazyme (4) 0.001% Vitazyme.
- **Vitazyme application:** 30 ml of each solution were applied at planting.
  Data collection: At two weeks after planting, shoots were cut at the base, and the roots were carefully washed with tap water. Plant height, dry shoot weight, and dry root weights were recorded, and root morphology was evaluated using an Epson WinRhizo XL 10000 scanner.
- **Data analyses:** All data were analyzed using ANOVA and Tukey's HSD in RStudio.
- **Results:** No significant differences were detected in early growth parameters, nor were there any significant differences in root morphology (total length, surface area, and average root diameter).

Experiment 2. Growth promotion and root morphology over five weeks.Containers, 7.75 inches in diameter and 7 inches deep (c400), were filled with the same weight of field soil, to 0.5 inch from the rim. No fertilizer was added.

- **Treatments:** (1) Control, (2) 0.1% Vitazyme, (3) 0.01% Vitazyme, (4) 0.001% Vitazyme
- **Vitazyme application:** 100 ml of each treatment were applied at planting.
- **Data collection:** At five weeks after planting, shoots were cut off at the base, and roots were carefully washed with tap water. Plant height, dry shoot weight, and dry root weight were recorded, and root morphology was evaluated using an Epson WinRhizo XL 10000 scanner. Nutrient analyses were made by Waters Agricultural Lab in Georgia.
- **Data analyses:** All data were analyzed using ANOVA and Tukey's HSD on RStudio.
- **Results:** The 0.1% Vitazyme showed a significant increase in height compared to all other treatments.

Note the greater height of the Vitazyme treated soybeans with a 0.1% application rate (30 ml/pot) in this Auburn University soybean greenhouse study.

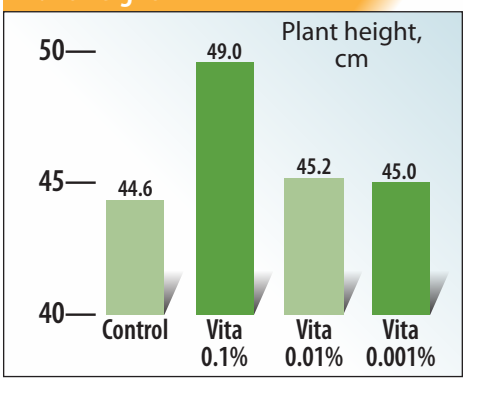
Treatment	Plant height[1]	Yield change
	cm	cm
1. Control	44.6 b	—
2. Vitazyme, 0.1%	49.0 a	44 (+10%)
3. Vitazyme, 0.01%	45.2 b	6 (+1%)
4. Vitazyme, 0.001%	45.0 b	4 (+1%)

[1]Means followed by the same letter are not significantly different at P=0.01, according to Tukey's HSD.

Increase in plant height with 0.1% Vitazyme: 10%

Conclusions: A greenhouse pot trial at Auburn University, using field soil and Vitazyme applications of 0.1, 0.01, and 0.001%, resulted in no significant growth effects in a 2-week study, but highly significant increases in height at the 0.1% application rate for the 5-week study. These results illustrate the ability of Vitazyme, at very lower application levels, to improve plant phenotypic expression for soybeans. These effects normally will translate into higher crop yields in field situations.

Plant Height



Soybeans *with Vitazyme application*

Researcher: Graig Reicks
Research organization: South Dakota Soybean Association
Location: Brookings County, South Dakota
Variety: unknown
Relative maturity: 1.9
Row spacing: 30 inches
Planting rate: 140,000 seeds/acre
Tillage: strip tilled after corn harvest in 2015, and field cultivated in the spring
Soil type: silty clay loam to sandy loam complexes of 1-6%
Seed treatment: fungicide and insecticide
Previous crop: corn
Experimental design: A soybean field received three alternate strips of Vitazyme treatment in-furrow, with the associated strips serving as controls. The purpose of the study was to evaluate the effects of the product on soybean yield.

1 ***Control*** **2** ***Vitazyme***

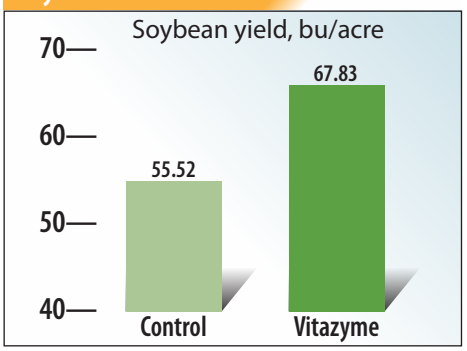
Fertilization: 3 gal/ha of 10-34-0% $N\text{-}P_2O_5\text{-}K_2O$ in-furrow at planting
Vitazyme application: 13 oz/acre (1 liter/ha) in-furrow at planting
Growing season weather: favorable: 9.36 inches of rain, and 1,844 growing degree days from June 1 through August 31 (average is 10.6 inches of rain and 1,668 growing degree days)

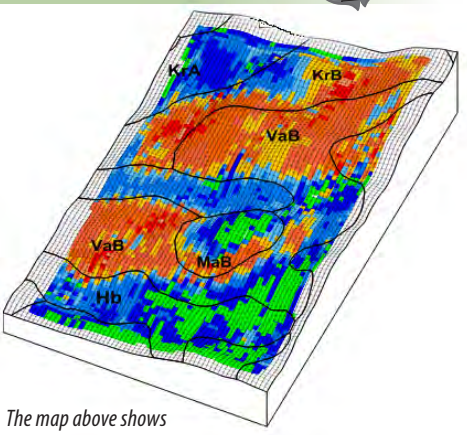
Yield results:

Treatment	Bean yield	Yield change
	bu/acre	bu/acre
1. Control	55.52	—
2. Vitazyme	67.83*	12.31 (+22%)

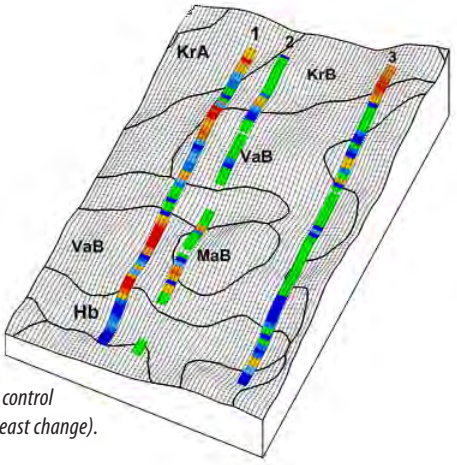
*Significantly greater than the control at P=0.05.

Increase in soybean yield with Vitazyme: 22%





The map above shows the soybean yield (green=highest, red=lowest).



This map shows yield change from the adjacent control (green=greatest change, red=least change).

Conclusions: This soybean trial in eastern South Dakota showed that a single 13 oz/acre (1 liter/ha) in-furrow application of Vitazyme can increase yield by 22%, a great and highly profitable increase. The field had substantial white mold and brown stem rot, so the active agents in the product apparently helped the plants overcome growth stresses. These results show the program's ability to significantly boost soybean yields with little added cost in South Dakota.

Soybeans *with Vitazyme application*

Researcher: Graig Reicks
Research organization: South Dakota Soybean Association
Location: Brookings County, South Dakota
Variety: unknown
Relative maturity: 1.9
Row spacing: 30 inches
Planting rate: 140,000 seeds/acre
Tillage: strip tillage after corn harvest in 2015, and field cultivation
Previous crop: corn
Planting date: May 19, 2016
Soil type: silty clay loam, loam, and sandy loam complexes of 0-6% slope
Seed treatment: fungicide, insecticide, and *Bacillus japonicum*
Experimental design: A soybean field was planted with three alternating strips of Vitazyme treatment in-furrow, with adjacent and intervening strips serving as controls. The objective of the study was to determine the effect of Vitazyme on soybean yield.

1 ***Control*** **2** ***Vitazyme***

Fertilization: 3 gal/ha of 10-34-0% $N\text{-}P_20_5\text{-}K_20$ in-furrow at planting
Vitazyme application: 13 oz/acre (1 liter/ha) in-furrow at planting
Growing season weather: favorable: 9.36 inches of rain, and 1,844 growing degree days from June 1 through August 31 (average is 10.6 inches of rain and 1,668 growing degree days)

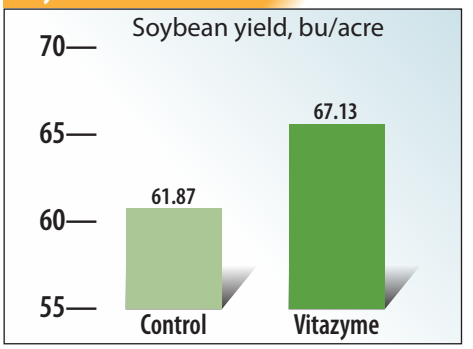
Yield results:

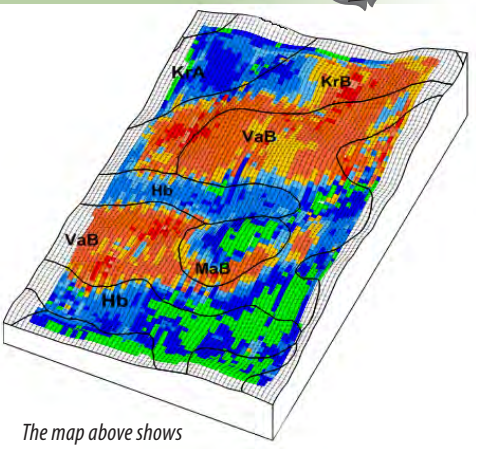
Treatment	Bean yield	Yield change
	bu/acre	bu/acre
1. Control	61.87	—
2. Vitazyme	67.13*	5.26 (+9%)

*Significantly greater than the control at P=0.05.

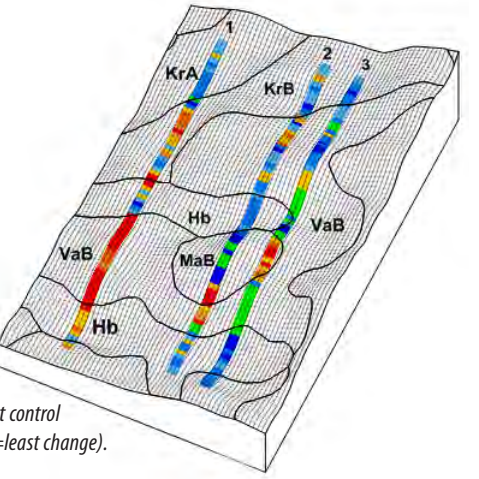
Increase in soybean yield with Vitazyme: 9%

Soybean Yield





The map above shows the soybean yield (green=highest, red=lowest).



This map shows yield change from the adjacent control (green=greatest change, red=least change).

Conclusions: A soybean strip study in Brookings, using three repetitions in a normal field setting, resulted in a 9% (5.26 bu/acre) yield increase with Vitazyme applied in-furrow at planting at 13 oz/acre (1 liter/ha). This result shows the great utility of this program for soybean production in eastern South Dakota.

Soybeans *with Vitazyme application*

Researcher: Graig Reicks
Research organization: South Dakota Soybean Association
Location: Kingsbury County, South Dakota
Variety: AG 1935
Relative maturity: 1.8
Row spacing: 30 inches
Planting rate: 150,000 seeds/acre
Tillage: conventional
Previous crop: soybeans
Planting date: May 9, 2015
Soil type: Poinsett-Buse Complex, 2-6% slopes; Poinsett-Waubay silty loams, 1-6% slope; Poinsett-Buse-Forman, 5-9% slope
Seed treatment: fungicide, insecticide
Experimental design: A soybean field was planted in three alternating strips of in-furrow Vitazyme applications, the intervening strips serving as controls. The objective of the study was to discover if Vitazyme would increase soybean yield.

1 ***Control*** **2** ***Vitazyme***

Fertilization: none
Vitazyme application: 13 oz/acre (1 liter/ha) in-furrow at planting
Growing season weather: favorable: 16.3 inches of rain, and 1,698 growing degree days from June 1 through August 31

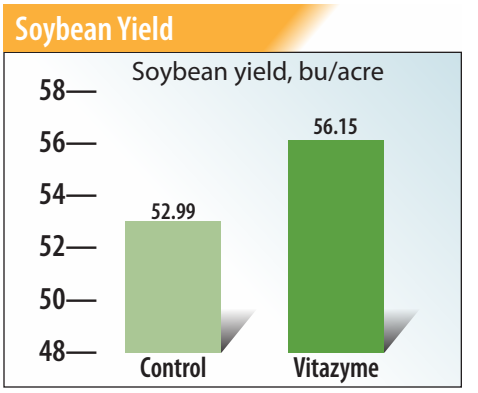
Note the thicker stems and greater leaf canopy of the Vitazyme treated soybeans in this South Dakota Soybean Association replicated field trial. The yield improvement was substantial.

Yield results:

Treatment	Bean yield	Yield change
	bu/acre	bu/acre
1. Control	52.99	—
2. Vitazyme	56.15*	3.16 (+6%)

*Significantly greater than the control at P=0.05.

Yield increase in soybean yield with Vitazyme: 6%



Conclusions: This soybean trial in South Dakota produced a 3.16 (6%) yield increase with Vitazyme, displaying the product's ability to stimulate highly profitable yield increases with a single in-furrow application of 13 oz/ha (1 liter/ha).

Soybeans *with Vitazyme application*

Researcher: Vadim Plotnikov
Research organization: LLC "Zlagoda", Ukraine
Location: Onufryevsky District, Kirovograd Region, Vishnivtsi Village, Ukraine
Variety: EU Mentor (generation 1)
Seeding rate: 600,000 seeds/ha
Planting date: May 5, 2017
Previous crop: winter wheat
Soil type: dark gray, humus=2.6%
Seedbed preparation: disking to 6-8 cm, plowing to 22-24 cm, harrowing, and cultivation to 4-5 cm
Experimental design: A field of soybeans was partitioned into an untreated control area and a Vitazyme treated area to evaluate the effect of Vitazyme on soybean yield and growth.

1 ***Control*** **2** ***Vitazyme***

Fertilization: Preplant, 21 kg/ha of N ; starter in-row at planting, 8-21-21 kg/ha N-P_2O_5-K_2O.
Vitazyme application: (1) 0.5 liter/ha at the first flower pod stage on July 5, 2017; (2) 0.5 liter/ha at the mid-pod stage on July 31, 2017. Both treatments were broadcast sprayed.
Growing season weather: dry

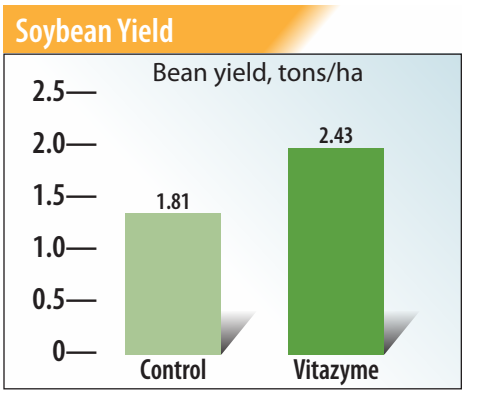
Note the improved plant size, superior root development, and increased pod set with the Vitazyme treated plants, leading to an impressive 34% yield increase.

Vadim Plotnikov displaying some of the excellent response obtained from Vitazyme applied to soybeans in Ukraine. Two foliar applications were used.

Yield results:

Treatment	Bean yield	Yield change
	tons/ha	ton/ha
1. Control	1.81	—
2. Vitazyme	2.43	0.62 (+34%)

Yield increase in soybean yield with Vitazyme: 34%



Income increase: The extra yield of soybeans gave an increased income of $250/ha.
Conclusions: This Ukrainian soybean study revealed that only two 0.5 liter/ha Vitazyme applications, one at flower pod formation and another at mid-pod filling, gave an excellent bean yield increase of 34%. This yield enhancement translated to an income increase of $250/ha, revealing the great efficacy of this product for soybean culture in Ukraine.

Soybeans *with Vitazyme application*

Researcher: Vadim Plotnikov
Research organization: PJSC "Zlagoda", Ukraine, Plant Designs, New York, USA, and Agro Expert International, Ukraine
Location: Onufriivka District, Kirovograd Region, Vyshnivtsi Village, Ukraine
Variety: ES Mentor (generation 1)
Seeding rate: 0.6 million seeds/ha
Planting date: May 5, 2017
Previous crop: wheat
Soil type: dark-brown podzolic; humus=2.6%
Soil preparation: disking to 6-8 cm, plowing to 22-24 cm, harrowing to 4-5 cm
Experimental design: A soybean field was divided into Vitazyme treated and untreated control areas to determine the efficacy of this product in promoting yield increases.

1 ***Control*** **2** ***Vitazyme***

Fertilization: 21 kg/ha of nitrogen broadcast before planting, and 8-21-21 kg/ha of N-P_2O_5-K_2O in-furrow starter at planting
Vitazyme application: 0.5 liter/ha sprayed on the leaves and soil at flower bud formation (July 5), and 0.5 liter/ha sprayed on the leaves at mid-pod development (July 31)
Growing season weather: dry

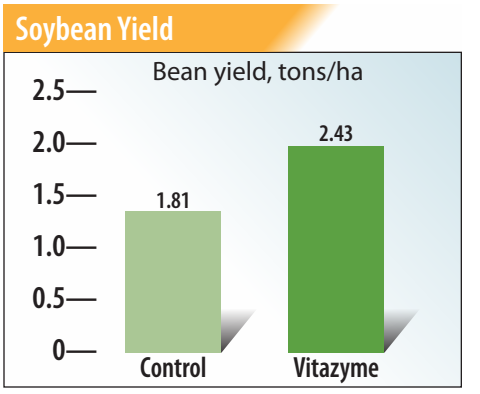
A Ukrainian soybean field displays excellent growth and yield potential after Vitazyme application.

These Ukrainian soybean Rhizobium nodules reveal excellent nodulation, as indicated by the red color (leghemoglobin). Vitazyme assists nodule development and N-fixation.

Yield results:

Treatment	Bean yield	Yield change
	tons/ha	ton/ha
1. Control	1.81	—
2. Vitazyme	2.43	0.62 (+34%)

Yield increase in soybean yield with Vitazyme: 34%



Income results: At a price of $403.23/ton of soybeans, the added 0.62 ton/ha gave an additional $250/ha income.
Conclusions: This soybean field-scale experiment in central Ukraine, during a dry year, using two 0.5 liter/ha foliar applications, revealed an excellent 34% yield increase of 0.62 ton/ha. With this increase bringing the farmer $250/ha more income, the considerable value of the program is readily apparent.

Corn and Soybeans *with Vitazyme application*

Research organization: University of Missouri, School of Natural Resources and Division of Plant Sciences, Columbia, Missouri, USA

Researchers: Robert J. Kremer, Manjula V. Nathan, Paul W. Syltie, Tim Reinbott, Kelly Nelson, and Xiaowei Pan

Introduction: Biostimulants enhance nutrient uptake and crop quality; however, knowledge of effects on soil health is limited (Kremer 2017a). The biostimulant Vitazyme provides several modes of action mediated by multiple active brassinosteroids. Attributes of brassinosteroid-based biostimulants include enhanced root development, improved nutrient uptake efficiency, disease suppression, and environmental stress tolerance (Hayat & Ahmad 2011). Limited research has shown that brassinosteroids may regulate pesticide metabolism in plants (Zhou et al. 2015); however, no information is available on the potential for overcoming stress of the herbicide glyphosate on rhizosphere biology in transgenic (genetically-modified, [GM]) cropping systems. Glyphosate affects rhizosphere microbial diversity and activity, increased fungal root conlonization, decreased beneficial bacterial components, and detrimental effects on crop root growth (Kremer & Means 2009; Wagner et al. 2003). Vitazyme was applied in soybean and maize field trials in Missouri USA during 2014-2017, with and without glyphosate application.

Objectives:

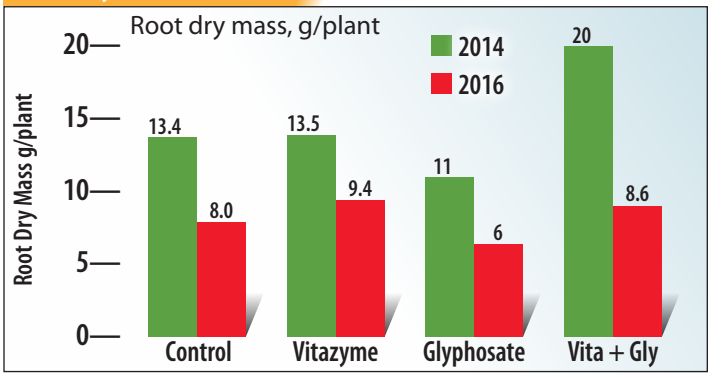
- Determine effects of Vitazyme on selected soil health indicators
- Determine effects of Vitazyme on rhizosphere biology in transgenic soybean and maize receiving glyphosate in field trials
- Determine potential effects of Vitazyme on crop growth in soils with residual glyphosate contents

Experimental design:

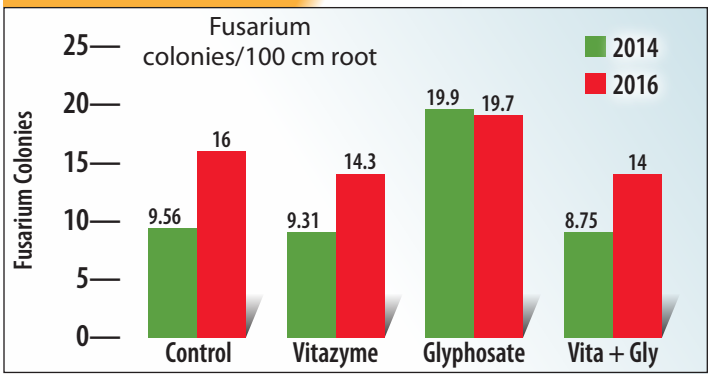
- Field trials conducted at Columbia (2014) and Novelty (2016-17), Missouri, on Mexico sil soil (fine, smectitic, sesic Vertic Epiaqualfs), maize and soybean planted conventionally using minimum tillage; plants and soils collected at R2 soybean and V10 maize growth stage
- Root-colonizing Fusarium assessed by selective culture technique (Levesque et al. 1993)
- Rhizosphere pseudomonads determined using S1 agar medium (Gould et al. 1985)
- Indoleacetic acid-producing (IAA) bacteria detected on nitrocellulose membranes reacted with Salkowski reagent for color development (Bric et al. 1991)
- Mn-transforming bacteria detected on Gerretsen's medium (Huber & Graham 1992)
- Glucosidase activity detected using enzyme assay of Eivazi & Tabatabai (1988)
- Soil microbial components and biomass determined using phospholipid fatty acid (PLFA) analysis (Buyer & Sasser 2012; Pritchett et al. 2011)

Soybean Results:

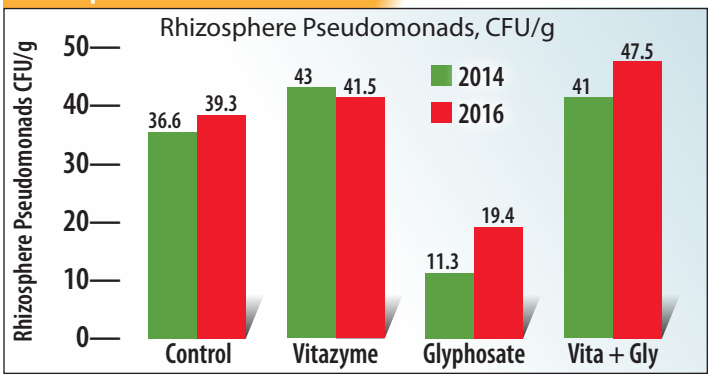
Root Dry Mass



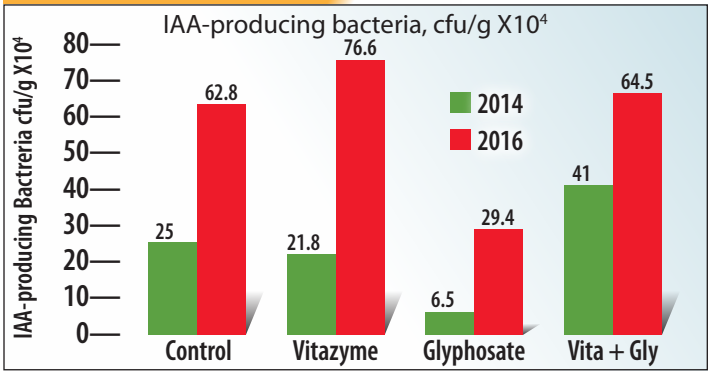
Fusarium

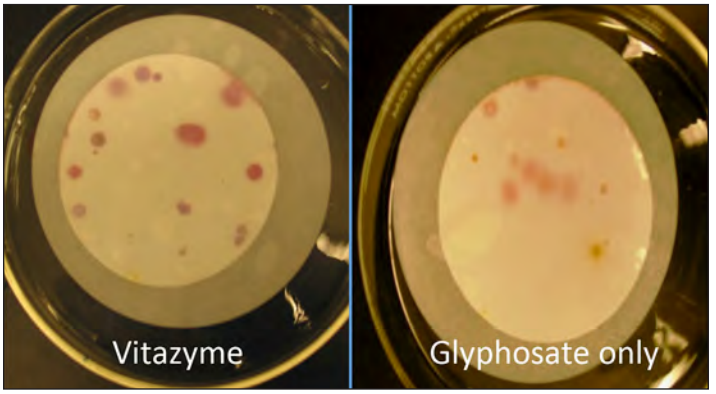


Rhizosphere Pseudomonads



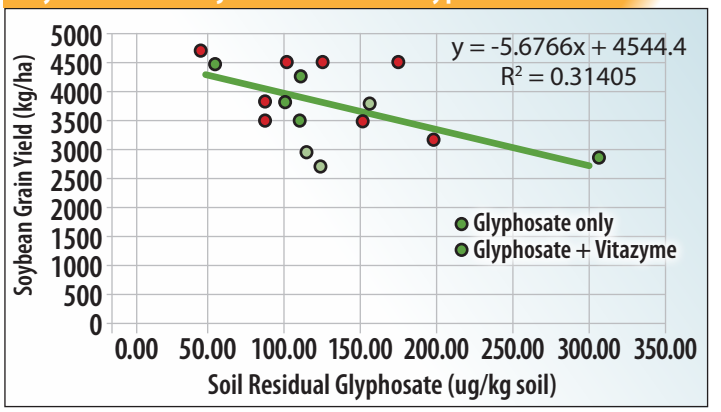
IAA-producing Bacteria





Note how indole acetic acid bacteria, which are detected in the petri dishes by the pink halos they form around the bacteria, are much more numerous in the Vitazyme treated soybean soil inoculum. The bacteria are very beneficial to plant growth.

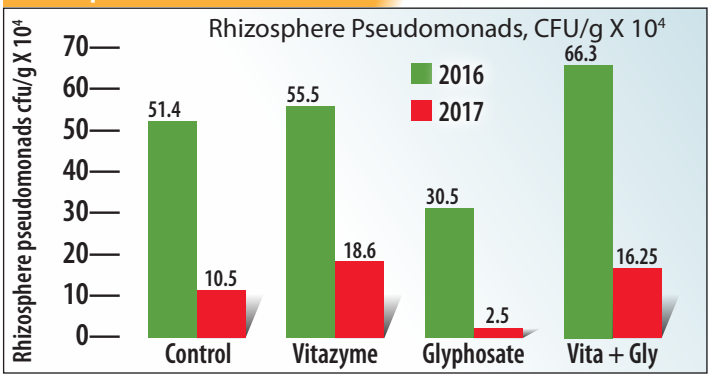
Soybean Yield Projection With Soil Glyphosate



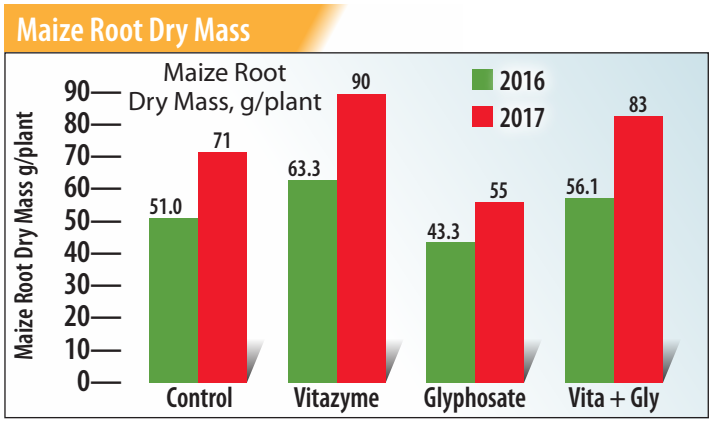
Corn Results:

Note the highly beneficial effect of Vitzyme in enhancing root growth and ear development in this University of Missouri trial..

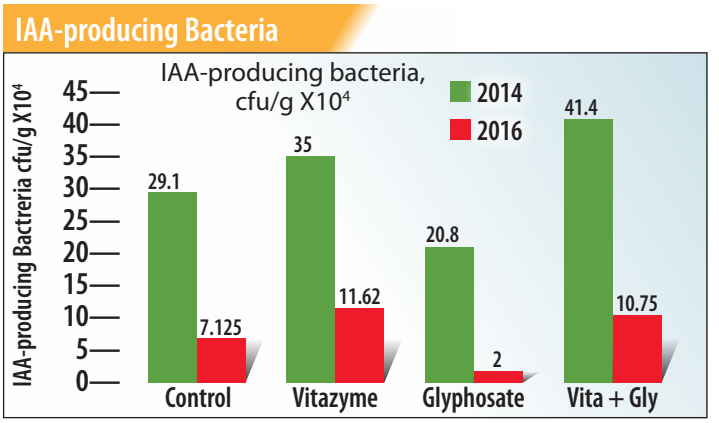
Rhizosphere Pseudomonads



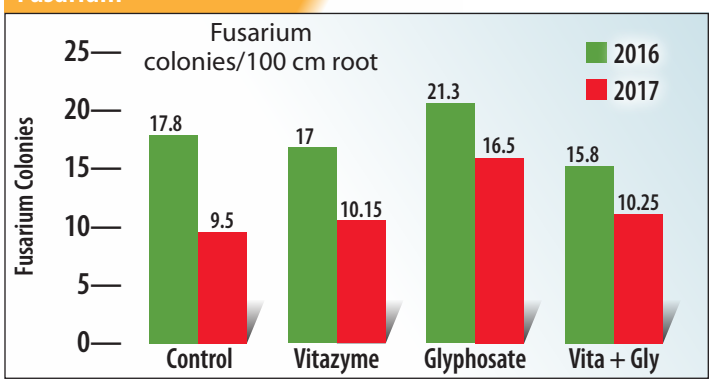
Maize Root Dry Mass



IAA-producing Bacteria

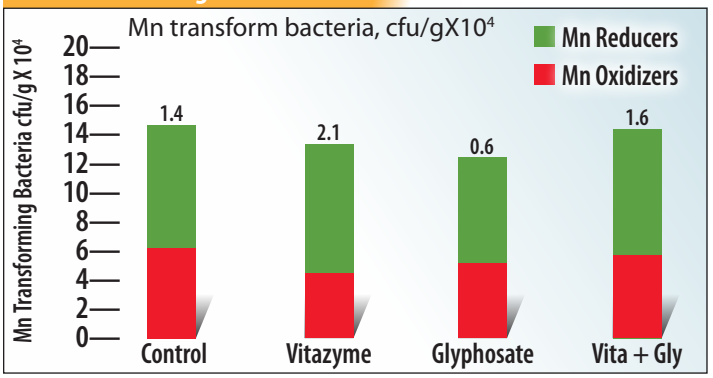


Fusarium

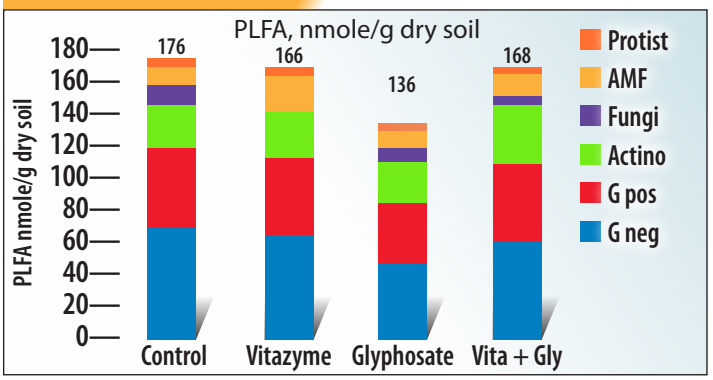


With corn rhizosphere soil samples, the prevalence of Fusarium fungi is much higher when glyphosate is applied to the leaves, but when Vitazyme is added with the glyphosate these fungi are held in check. The same occurs with soybeans.

Mn Transforming Bacteria



PLFA Nmole 2016



Overall results:

Vitazyme-improved soil health indicator and overcame glyphosate effects on maize and soybean at all sites across years:

- Root growth (dry biomass) improved while colonization by potentially pathogenic Fusarium fungi was significantly ($p<0.05$) reduced, root nodulation on soybean improved or did not decrease with glyphosate + Vitazyme.
- Rhizosphere fluorescent pseudomonads, which contribute to beneficial plant growth-promoting funtions, and IAA-producing bacteria, significantly increased in both Vitazyme-treated crops.
- Maintained high Mn reducers to Mn oxidizers ratio, notably in presence of glyphosate, suggesting adequate available Mn (reduced) for plant and microbial uptake and metabolism, and limiting unavailable, immobilized Mn (oxidized) associated with glyphosate and oxidizing bacteria
- Maintained soil microbial community composition (PLFA groups) and total microbial biomass in glyphosate treated crops at similar levels of control, non-glyphosate soils, which tended to improve mycorrhizal component
- Enhanced glucosidase activity, indicator of soil microbial function, in both control and glyphosate treatments

Glyphosate Soil Residues and Grain Yields:

- Residual glyphosate contents in soil ranged from 0 to >1000 ug/kg (ppb) of soil, which was randomly distributed among plots at field sites, regardless of glyphosate application timing
- Soybean grain yields increased 1 to 4% (data not shown)
- No relationship between yields of individual plots with soil glyphosate content was found for maize (2016)
- Apparent relationship between soybean yield in individual plots with soil glyphosate-tendency for lower yield with higher soil glyphosate; Vitazyme may offset potential yield decline due to glyphosate buildup in Mexico silt loam (6 of 8 plots)

Conclusions:

- A polyphasic microbial analysis multiple assesments of sensitive soil health indicators, previously used to evaluate GM crop effects on soil biology and ecology (Kremer & Means 2009), was successfully adapted for evaluating the biostimulant Vitazyme as a means of suppressing effects of glyphosate on root growth and rhizosphere biology in (GM) cropping systems and maintaining or improving soil health.
- Soil microbial diversity based on PLFA analyses was restored by Vitazyme in soils planted to maize and soybean treated with glyphosate; a high microbial diversity is essential to maintain a stable ecosystem and crop productivity (Grayston et al. 1998).
- Glyphosate residue buildup in soils under GM crops is a reality (Kremer 2017b) and may affect crop growth and yields in future seasons. Biostimulants such as Vitazyme might offset effects of residual glyphosate, however more evaluation under rigorous experimental conditions is required to confirm effect.
- Results from this project demonstrate that biostimulants can be a major management factor for addressing recurrent productivity problems and declining soil health associated with GM crops in current crop production systems.

References:

Bric, J.M. Bostock, R.M., Silverstone, S.E., 1991. Rapid in situ assay for indoleacetic acid production by bacteria immobilized on a nitrocellulose membrane. Applied & Environmental Microbiology 57:535-538.

Buyer, J.S., Sasser, M., 2012. High throughput phospholipid fatty acid analysis of soils. Applied Soil Ecology 61:127-130.

Eivazi, F., Tabatabai, M.A., 1988. Glucosidases and galactosidases in soils. Soil Biology & Biochemistry 20:601-606.

Gould, W.D., Hagedorn, C., Bardinelli, T.R., Zablotowicz, R.M., 1985. New selective medium for enumeration and recovery of fluorescent pseudomonads from various habitats. Applied & Environmental Microbiology 49:29-32.

Grayston, S.J., Wang, S.Q., Campell, C.D., Edwards, A.C., 1998. Selective influence of plant species on microbial diversity in the rhizosphere. Soil Biology & Biochemistry 30:369-378.

Hayat, S., Ahmad, A. (eds.), 2011. Brassinosteroids: A Class of Plant Hormone. Springer, London.

Huber, D.M., Graham, R.D., 1992. Techniques for studying nutrient-disease interactions. In Singleton, L.L. et al. (eds.), Methods for Research on Soilborne Phytopathogens, APS Press, St. Paul, MN. pp. 204-214.

Kremer, R.J., 2017a. Biotechnology impacts on soil and environmental services. In Al-Kasai, M., Lowery, B. (eds.), Soil Health and Intensification of Agroecosystems. Elsevier, New York. pp. 353-375.

Kremer, R.J., 2017b. Soil and environmental health after twenty years of intensive use of glyphosate. Advances in Plant & Agricultural Research. 6(5):000224, doi: 1015406/apar2017.0600224.

Kremer, R.J., Means, N.E., 2009. Glyphosate and glyphosate-resistant crop interactions with rhizosphere microorganisms. European Journal of Agronomy 31:153-161.

Levesque, C.A., Rahe, J.E., Eaves, D.M., 1993. Fungal colonization of glyphosate-treated seedlings using a new root-plating technique. Mycological Research 97:299-306.

Pritchett, K.A., Kennedy, A.C., Cogger, C.G., 2011. Management effects on soil quality in organic vegetable

systems in western Washington. Soil Science Society of America Journal 75:605-615.

Wagner, R., Kogan, M., Prada, A.M., 2003. Phytotoxic activity of root absorbed glyphosate in corn seedlings (Zea mays L.). Weed Biology and Management 3:228-232.

Zhou, U., Xia, X., Yu, G., et al., 2015. Brassinosteroids play a critical role in the regulation of pesticide metabolism in crop plants. Scientific Reports 5:9018, doi:10.1038/srep09018

Soybeans *A Study on Synergism with WakeUp Adjuvant*

Researcher: Jerry Carlson
Research organization: Renewable Farming LLC, Cedar Falls, Iowa
Location: Cedar Falls, Iowa
Variety: Asgrow 2431 (2.4 maturity)
Planting date: May 5, 2016
Seeding rate: 140,000 seeds/acre
Row spacing: 30 inches
Experimental design: A 153-acre soybean field of uniform soil types was split in half, with one half treated with Vitazyme and WakeUp Summer (a vegetable-based adjuvant), and the other half serving as the untreated control. The purpose of the study was to evaluate the effect of these two products, applied together on the growth and yield of soybeans, and to see if the results for 2016 would confirm results from 2015.

1 ***Control*** **2** ***Vitazyme + WakeUp Summer***

Fertilization: 2.5 tons/acre of chicken litter spread uniformly over the field in the spring of 2016
Vitazyme and WakeUp Summer application: 13 oz/acre of Vitazyme and 4 oz/acre of WakeUp Summer, mixed together, and sprayed foliar at early bloom on June 24, 2016
Weed control: Ledger on May 6; Flexstar GT+Select on June 14; excellent weed control
Growth results: After product application there were highly visible differences between the two sides of the field. **The treated side was more growthy and lush-appearing, and at senescence the plants remained greener about 7 days longer than the untreated control half of the field.** This required the combine operator to wait a week to combine the treated acres.
Harvest date: October 3, 2016 (control side) and October 10, 2016 (treated side)
Yield results: The moisture content of the soybeans for both halves of the field, though they were harvested a week apart, was 13.6%. A combine monitor on a combine with a 30-foot header recorded the yield of the entire field, as displayed on the accompanying map. Based on the yield monitor printout, the yield is calculated below:

Soybeans treated with Vitazyme produced excellent yields that were amplified by adding Wakeup to the spray solution.

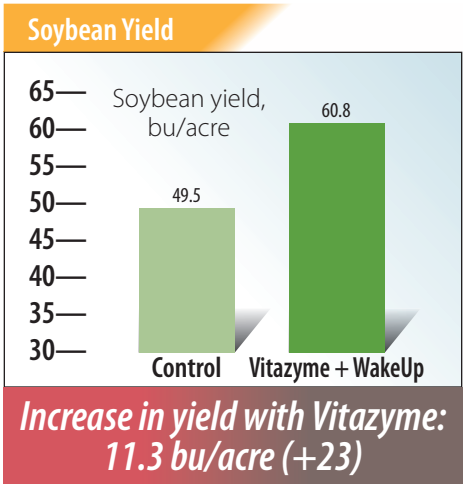
Treatment	Dark green[1]	Light green	Yellow	Orange	Purple	Red[2]
	---------- % of area in the half-field ----------					
Control	1	7	60	14	10	8
Vitazyme + WakeUp	28	32	27	6	5	2

[1]This area is termed > 70.0 bu/acre. A value of 72.0 bu/acre is estimated.
[2]This area is termed < 30.0 bu/acre. A value of 28.0 bu/acre is estimated..

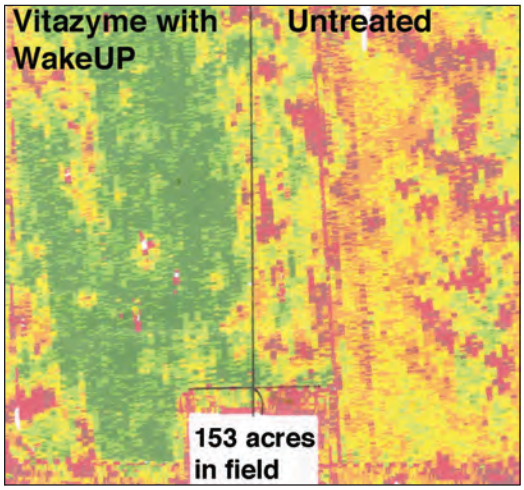
Treatment	Area	Yield[1],	Yield[1],	Yield[1],	Yield[1],	Yield[1],	Yield[1],	Total yield	Yield
		>70	60-70	50-60	40-50	30-40	<30		
	acres	---------- bushels ----------						bushels	bu/acre
Control	76.5	55.1	348.1	2,524.5	482.0	267.8	171.4	3,788.9	49.5
Vitazyme + WakeUp	76.5	1,542.2	1,591.2	1,136.0	206.6	133.9	42.8	4,652.7	60.8

[1]All yield values are calculated as follows: (area) (percent of area/100) x yield for that area. Area yields were estimated at the middle of the range, i.e. the yellow area, having 50 to 60 bu/acre, was assumed to average 55 bu/acre.

This increase in soybean yield was across all soil types. By laying a soils map on top of the yield monitor map, it appears that the same soil type yielded about 10 bu/acre more with Vitazyme + WakeUp Summer.



Conclusions: This soybean trial in a split field arrangement in east-central Iowa revealed that Vitazyme and WakeUp Summer, sprayed foliar at approximately early bloom, improved plant growth and bean yield substantially, by 11.3 bu/acre (23%) on a good crop year. The treated plants showed more aggressive growth and stayed green a week longer than did the untreated control plants. Considering the excellent synergism observed between these two products in a 2015 trial on a nearby farm, wherein Vitazyme increased soybean yield by 5.1 bu/acre and WakeUp Summer added 2.1 bu/acre to this yield, the combination of the two products is seen to be an excellent application for soybeans in eastern Iowa.



Soybean *with Vitazyme application—A Soil Microbiology Study with Roundup (Glyphosate)*

Root deveopment with Vitazyme is excellent compared to the control and the glyphosate treatments, but Vitazyme overcame the negatives of glyphosate and produced an excellent plant response when the two were combined.

Dr. Kremer displays the Vitazyme treated soybeans on the right, which have much better rooting and leaf development than the control plants on the left.

Researcher: Manjula Nathan, Ph.D., and Robert Kremer, Ph.D.
Research institution: University of Missouri Department of Plant and Soil Sciences, and the USDA-ARS, Columbia, Missouri
Location: Greenley Memorial Research Center, Novelty, Missouri
Soil type: clayey
Row spacing: 30 inches
Experimental design: A small plot soybean trial was conducted using four replications and four treatments, to evaluate the effect of Vitazyme and Roundup (glyphosate), alone and in combination, on the yield of soybean, as well as the effects of these products on the rhizosphere soil microbial populations of Fusarium and beneficial bacteria, root mass, and Rhizobium nodulation. Soil residues of glyphosate were also evaluated.

Treatment	In-furrow	Foliar, early bloom
1. Control	0	0
2. Glyphosate	0	36 oz/acre
3. Vitazyme	13/oz/acre	13 oz/acre
4. Vitazyme + Glyphosate	13/oz/acre (Vitazyme only)	13 oz/acre + 36 oz/acre

Fertilization: Nitrogen, phosphorus, and potassium were applied before planting according to soil test recommendations.
Vitazyme application: See the treatment plan.
Glyphosate application: See the treatment plan.
Weed control for the control and Vitazyme treatments: These plots were sprayed with herbicides before planting.
Growing season weather: favorable for soybean growth
Yield results:

Treatment	Yield	Yield change
	bu/acre	bu/acre
1. Control	60.0	—
2. Glyphosate	66.0	6.0 (+10%)
3. Vitazyme	62.4	2.4 (+4%)
4. Vitazyme + Glyphosate	67.0	7.0 (+12%)

Increase in soybean yield

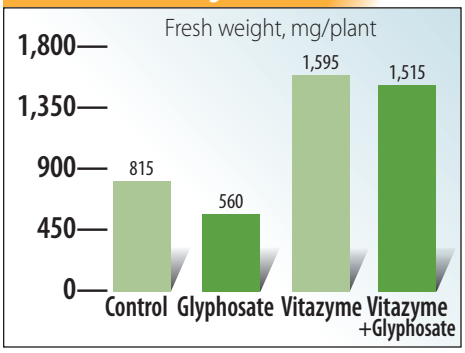
Glyphosate 10%
Vitazyme 4%
Vitazyme + Glyphosate .12%

Yield means were not significantly different, but showed responses for all treatments.

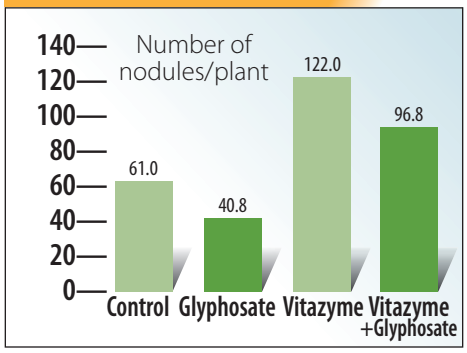
Soybean nodulation results:

Treatment	Nodule fresh weight	Weight change	Nodules/Plant	Nodule change
	mg/plant	mg/plant	nodules	nodules
1. Control	815	—	61.0	—
2. Glyphosate	560	(-) 255 (-31%)	40.8	(-) 2.02 (-33%)
3. Vitazyme	1,595	780 (+96%)	122.0	61.0 (+100%)
4. Vitazyme + Glyphosate	1.515	700 (+86%)	96.8	35.8 (+59%)

Nodule Fresh Weight



Nodule Per Plant



Changes in nodule weight

Glyphosate ..... -31%
Vitazyme .....+96%
Vitazyme+Glyphosate...+86%

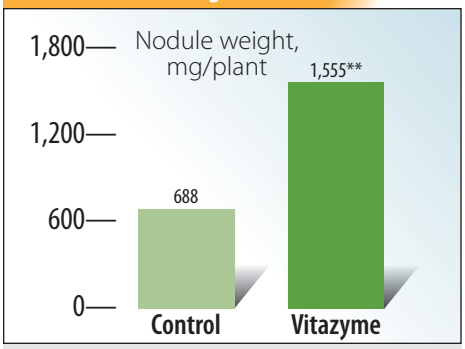
Changes in nodule number

Glyphosate ..... -33%
Vitazyme .....+100%
Vitazyme+Glyphosate...+59%

Although the fresh nodule weight and nodule number means were not significant, the differences were great, with Vitazyme giving the highest values and Vitazyme + Glyphosate being nearly as high as Vitazyme alone. This indicates a remediation affect of Vitazyme on the negative impacts of glyphosate.

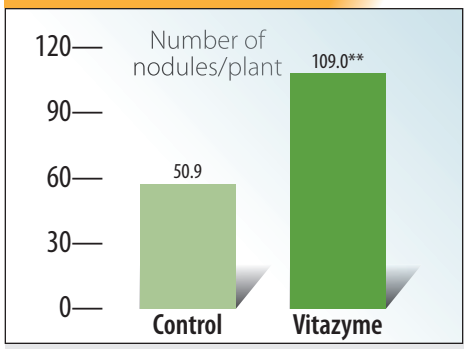
Effect fo Vitazyme on Soybean Nodulation

Nodule Fresh Weight



**Significantly greater than the control at P=0.001.

Nodule Number



**Significantly different than the control at P=0.001.

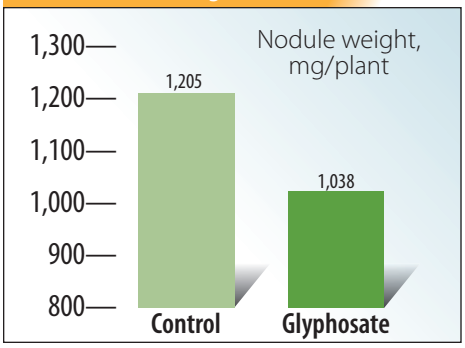
Increase with Vitazyme

Nodule fresh weight...+126%
Nodule number .....+114%

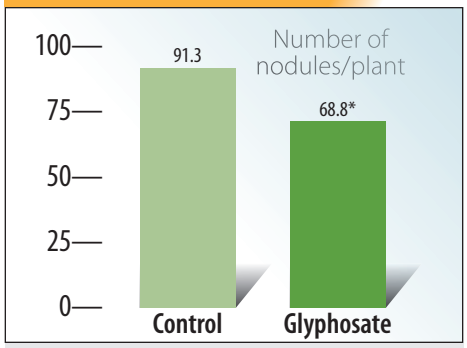
All Vitazyme treated plots were compared with all untreated plots, producing a remarkable increase in nodulation with Vitazmye.

Effect fo Glyphosate on Soybean Nodulation

Nodule Fresh Weight



Nodule Number



*Significantly less than the control at P=0.05.

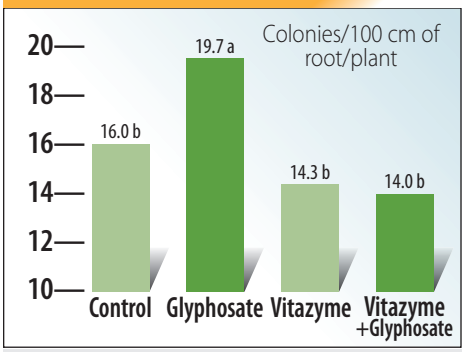
Decrease with Glyphosate

Nodule fresh weight..... -14%
Nodule number ..... -25%

All glyphosate treated plots were compared with all non-glyphosate treated plots. The data reveal that this herbicide reduces soybean nodulation, and thus nitrogen fixation.

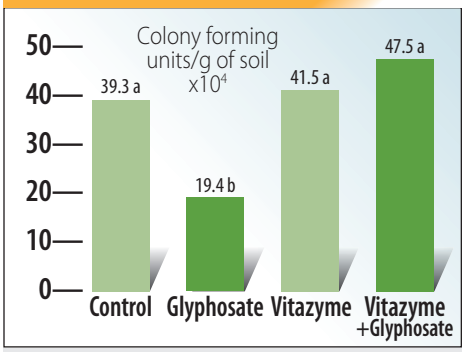
Soil microbial results:

Fusarium Root Colonization[1]



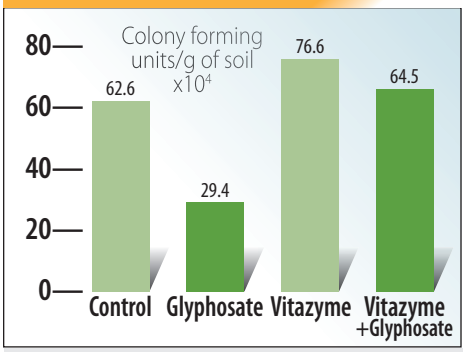
[1]Means followed by the same letter are not significantly different at P=0.05.

Rhizosphere Fluorescent Pseudomonas Colonization[1]



[1]Means followed by the same letter are not significantly different at P=0.05.

Rhizosphere IAA-Producing Bacteria Colonization[1]



[1]Means followed by the same letter are not significantly different at P=0.05.

Changes in Fusarium Colonization

Glyphosate ..... +23%
Vitazyme ..... -11%
Vitazyme + Glyphosate... -13%

Changes in Fluorescent Pseudomonas Colonization

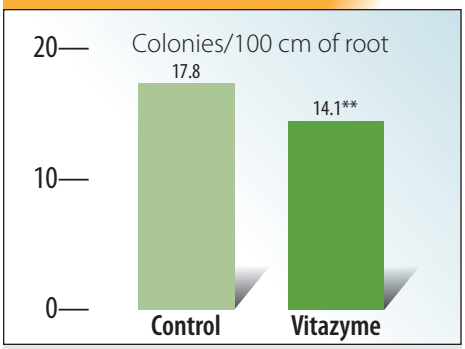
Glyphosate ..... -51%
Vitazyme ..... +6%
Vitazyme + Glyphosate... +21%

Changes in IAA-Producing Bacteria Colonization

Glyphosate ..... -53%
Vitazyme ..... +22%
Vitazyme + Glyphosate..... +3%

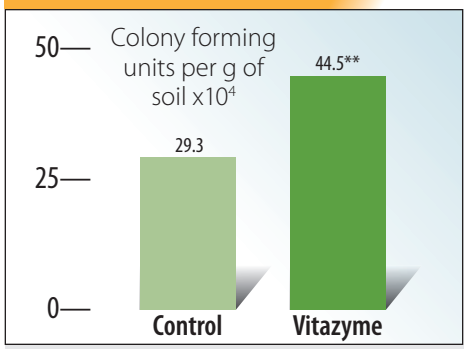
Vitazyme Effects on Fusarium and Beneficial Organism Colonization

Fusarium



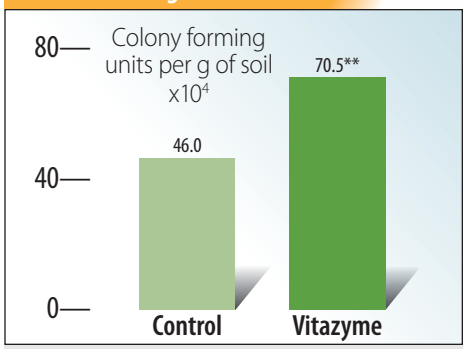
**Significantly less than the control at P=0.001.

Fluorescent Pseudomonas



**Significantly greater than the control at P=0.001.

IAA-Producing Bacteria



**Significantly greater than the control at P=0.001.

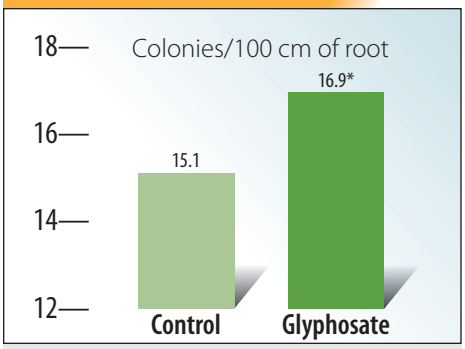
Changes with Vitazyme

Fusarium ..... -21%
Fluorescent Pseudomonas ... +52%
IAA-Producing Bacteria .... +53%

All Vitazyme treated plots were compared with all untreated plots, showing a highly significant reduction in Fusarium colonies and highly significant increases in beneficial bacteria.

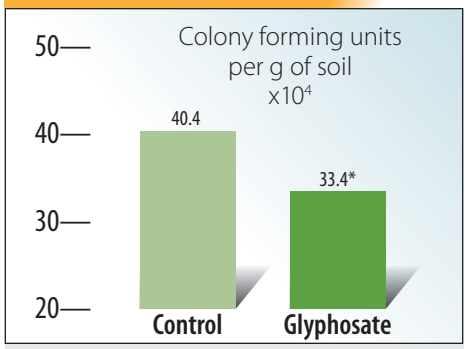
Glyphosate Effects on Fusarium and Bacterial Organism Colonization

Fusarium



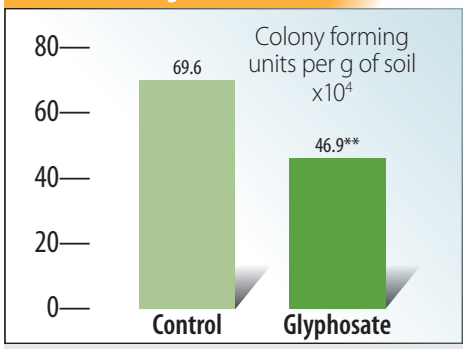
*Significantly greater than the control at P=0.061.

Fluorescent Pseudomonas



*Significantly less than the control at P=0.053.

IAA-Producing Bacteria



**Significantly less than the control at P=0.001.

Changes with Glyphosate

Fusarium ..... +12%
Fluorescent Pseudomonas .....-17%
IAA-Producing Bacteria ..... -33%

All glyphosate treated plots were compared with all non-glyphosate plots, which reveals an increase in the incidence of Fusarium colonization while beneficial bacteria are substantially reduced.

Fatty Acids, Oxidizers, Reducers, Glyphosate, and Enzyme Levels in Rhizosphere Soil

Treatment	TPLFA[1]	Mn Oxidizers[2]	Mn Reducers[3]	Red/Ox Ratio[4]	Glyphosate[5]	B-Glucosamine Activity[6]
	nm/g soil	cfu/g soil x10³	cfu/g soil x10³	cfu/g soil x10³	ug/kg soil	ug PNP/g soil/hr
1. Control	156	6.25	9.72	1.57	185	132
2. Glyphosate	87 (-44%)	7.18 (+15%)	2.63 (-73%)	0.39 (-75%)	135 (-27%)	103 (-22%)
3. Vitazyme	106 (-32%)	5.23 (-16%)	10.8 (+11%)	2.17 (+38%)	98 (-47%)	158 (+20%)
4. Vitazyme + Glyphosate	108 (-31%)	8.57 (+37%)	14.9 (+53%)	1.77 (+13%)	105 (-43%)	175 (+33%)
P>F	0.071	0.334	**0.015**	**0.027**	0.419	0.107

[1]TPLFA = total phospholipid fatty acids; [2]manganese oxidizing bacteria; [3]manganese reducing bacteria; [4]ratio of manganese reducing to oxidizing bacteria; [5]soil glyphosate levels; [6]soil level of this enzyme.

Vitazmye Effects on Fatty Acids, Oxidizers, Reducers, Glyphosate, and Enzymes

Treatment	TPLFA	Mn Oxidizers	Mn Reducers	Red/Ox Ratio	Glyphosate	B-Glucosamine Activity
	nm/g soil	cfu/g soil x10³	cfu/g soil x10³	cfu/g soil x10³	ug/kg soil	ug PNP/g soil/hr
1. Control	121	6.72	6.17	0.980	160	118
2. Vitazyme	107(-13%)	6.90 (+3%)	12.9* (+109%)	1.97**(+101%)	101(-37%)	167*(+42%)
P>F	0.432	0.878	**0.006**	**0.001**	0.118	**0.006**

*Significantly different than the control at P=0.01; **Significantly different than the control at P=0.001.

All Vitazyme treated plots were compared with untreated plots. Note the great increase in the beneficial manganese oxidizers, that convert Mn to its divalent plant available form. This gave rise to a higher Mn reduced/Mn oxidized ratio. Soil enzyme levels were also increased with Vitazyme. Soil glyphosate levels were reduced by 37% overall with Vitazyme.

Glyphosate Effects on Fatty Acids, Oxidizers, Reducers, Glyphosate, and Enzymes						
Treatment	**TPLFA**	**Mn Oxidizers**	**Mn Reducers**	**Red/Ox Ratio**	**Glyphosate**	**B-Glucosamine Activity**
	nm/g soil	cfu/g soil x10^3	cfu/g soil x10^3	cfu/g soil x10^3	ug/kg soil	ug PNP/g soil/hr
1. Control	131	5.74	10.3	1.87	141	145
2. Glyphosate	97 (-26%)	9.88 (+72%)	8.78 (-15%)	1.08**(-42%)	120 (-15%)	139 (-4%)
P>F	0.079	0.104	0.449	**0.001**	0.538	0.669

*Significantly less than the control at P=0.001..

All glyphosate treated plots were compared with non-glyphosate plots, resulting in fewer phospholipid fatty acids, more manganese oxidizers, and fewer manganese reducers, showing the nature of this herbicide to make Mn less available, as evidenced by the lower Red/Ox ration.

Conclusions: A University of Missouri replicated soybean study showed that Vitazyme, when applied with glyphosate herbicide for the foliar application, did an excellent job remediating the damage done by the herbicide to soil and root organisms. While glyphosate increased Fusarium damage (+12%), Vitazyme reduced the incidence (-21%). Conversely, beneficial soil microbes like Fluorescent Pseudomonas were increased by 52% with Vitazyme and reduced by 17% by glyphosate; IAA-producing bacteria were increased by 53% with Vitazyme and decreased by 33% with glyphosate. Combining the two products moved both pathogenic and beneficial organism levels to near the control levels. Soybean nodule fresh weight and number were also greatly enhanced by Vitazyme treatment (96 and 100%, respectively), while Vitazyme coupled with glyphosate brought nodule parameters nearly to the levels for Vitazyme; glyphosate alone greatly crippled nodulation. The highly important manganese reducing bacteria were enhanced by Vitazyme but inhibited by glyphosate; when the two were combined, the reducing bacteria increased even above the Vitazyme alone, to 53% above the control. Soil enzyme activity was also enhanced with Vitazyme—by 20% above the control—while this enhancement increased to 33% when paired with glyphosate. Glyphosate alone reduced enzyme level by 22%. The best soybean yield increase was with Vitazyme+glyphosate, a 12% (7 bu/acre) improvement about the control. These results are similar to those produced in 2014 at the University of Missouri Bradford Research Center, and show the great efficacy of Vitazyme to reduce the harmful effects of glyphosate on soybean nodulation and rhizosphere microbial populations.

Soybeans *with Vitazyme application*

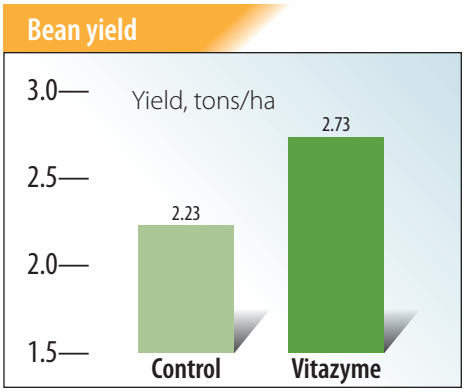
Researcher: V. V. Plotnikov
Research institution: Agro Expert International, Vinnytsya, Ukraine
Location: State Enterprise Research Farm Drabivske, Drabovo-Bariatynske Village, Drabiv District, Cherkasy Region, Ukraine
Variety: Diamond, selected seed
Planting date: April 29, 2016
Seeding rate: 750,000 seeds/ha
Previous crop: winter wheat
Soil type: Chernozem (3.9% organic matter)
Cultivation: disking to 6-8 cm, plowing to 20-22 cm, harrowing, and cultivation to 4-5 cm
Rainfall: 500-550 mm
Experimental design: A soybean field was divided into a Vitazyme treated and untreated area, with the objective of determining the effect of this product on the yield and quality of the beans.
Fertilization: at planting; 16-16-16 kg/ha of N-P_2O_5-K_2O in-row
Vitazyme application: 1.0 liter/ton on the seeds before planting, on April 24, 2016; 0.5 liter/ha on the leaves and soil at early bloom, on June 23, 2016

❶ ***Control*** ❷ ***Vitazyme***

Yield results:

Treatment	Bean yield	Yield change
	tons/ha	tons/ha
Control	2.23	—
Vitazyme	2.73	0.50 (+22%)

Increase in bean yield with Vitazyme: 22%



Income results: Vitazyme increased net profit by 184 USD/ha.
Conclusions: A soybean split-field trial in central Ukraine, on Chernozem soil, revealed that 1 liter of Vitazyme per ton of seed, coupled with a 0.5 liter/ha foliar and soil spray, increased the yield by 22%, a great response that should assure farmers of the viability of this new technology. The yield increase produced a greater net return of 184 USD/ha as well.

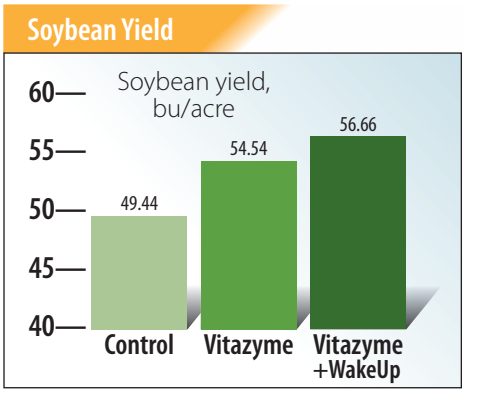
Soybeans *A Synergism Study with WakeUp*

Researcher: Jerry Carlson
Research organization: Renewable Farming LLC, Cedar Falls, Iowa
Location: Cedar Falls, Iowa
Variety: Pioneer 92M72
Planting date: May 29, 2015
Previous crop: Corn
Experimental design: A soybean field was selected to provide strips six rows wide and 350 feet long (0.121 acre), with five strips for the Vitazyme and Vitazyme + WakeUp treatments, and six strips for the untreated control. The objective of the study was to discover a possible interaction between Vitazyme and WakeUp to improve the yield response.

1 ***Control*** **2** ***Vitazyme*** **3** ***Vitazyme + WakeUp***

Fertilization: unknown
Vitazyme application: 13 oz/acre on July 8, with or without WakeUp Summer
WakeUp application: WakeUp Summer was applied along with Vitazyme at 5 oz/acre on Treatment 3 on July 8. WakeUp Summer is a surfactant made from vegetable origin that reduces water surface tension and "clear coats" leaves, cleans and softens the leaf cuticle for nutrient absorption, pulls nutrient ions into plants quicker, and reduces plant sap surface tension for more rapid movement of phloem solutes.
Weed control: Pre-emergent herbicide on May 28; Rhythm post-emergence on June 27; cultivation on July 1.
Harvest date: October 20, 2015
Growing season weather: favorable
Yield results: All plots are averaged for each treatment.

Treatment	Beans yield	Yield Change
	bu/acre	bu/acre
Control	49.44 b	--
Vitazyme	54.54 a	5.10 (+10%)
Vitazyme + WakeUp	56.66 a	7.22 (+15%)
Standard error:	1.67 (Vitazyme) 1.67 (Vitazyme + WakeUp) 1.56 (Control)	
Control vs. Vitazyme + WakeUp: P(0.10)=0.0018 Control vs. Vitazyme: P(0.10)=0.0131 Vitazyme vs. Vitazyme + WakeUp: P(0.10)=0.2421		
Statistics were performed using the Statistical Analysis System.		



Increase in bean yield

Vitazyme alone 10%
Vitazyme + WakeUp.....15%

Moisture and test weight results: Bean moisture at harvest varied from 8.55 to 8.60%, and test weight from 56.17 to 56.82 lb/bu, so were not significantly different.
Conclusions: A soybean trial in east-central Iowa, using Vitazyme and Vitazyme + WakeUp in 0.121-acre field strips, with six equal-sized control strips, revealed that Vitazyme significantly (P=0.0131) boosted bean yield (5.10 bu/acre, or 10%) over the control. WakeUp boosted yield even further, producing a synergism with Vitazyme by increasing yield another 2.12 bu/acre over Vitazyme alone for a 15% yield improvement. This increase was significant at P=0.0018. These results show that Vitazyme, applied at bloom, can significantly improve soybean yield, and WakeUp Summer applied with it can improve the yield even more. This product combination holds great promise for soybean production in Iowa.

Soybeans *A Soil Microbiology Study with Roundup (Glyphosate)*

A soybean trial at The University of Missouri Bradford Research Center proved that Vitazyme can reverse the negative effects of glyphosate on soil microbiology and root growth.

Besides improving rhizosphere microflora and reducing glyphosate residues, Vitazyme increased branching and pod formation by up to 131%.

Researcher: Manjula Nathan, Ph.D., and Robert Kremer, Ph.D.

Research institution: University of Missouri Department of Plant and Soil Science, and the U.S.D.A.-A.R.S., Columbia, Missouri

Location: Bradford Research Center, Columbia, Missouri

Variety: Asgrow 3832 (GMO)

Planting rate: 150,000 seeds/acre

Row spacing: 30 inches

Planting date: May 24, 2014

Experimental design: A replicated soybean trial was arranged with four replications and four treatments, using plots that were 4 rows (10 feet) x 200 feet. A randomized complete block design was used. Glyphosate (Roundup) was applied to two of the treatments to evaluate the effects of the product alone, as well as with Vitazyme, to note the potential of Vitazyme to remediate the toxic effects of glyphosate. These effects were measured by a number of factors including root Rhizobium Nodulation, root mass, rhizosphere microbial biomass, Fusarium root colonization, and populations of Pseudomonas and indoleacetic acid- producing bacteria in the rhizosphere. Glyphosate residues in the soil were also measured.

Treatment	Vitazyme	Glyphosate
1. Control	0	0
2 Vitazyme	x	0
3. Glyphosate	0	x
4. Vitazyme +Glyphosate	x	x

Fertilization: Nitrogen, phosphorus, and potassium were applied according to soil test recommendations. Thus, the required amount of O-46-62% N-$P_2 0_5$-$K_2 0$ was applied before planting;

Vitazyme application: (1) 13 oz/acre (1 liter/ha) applied on the seeds before planting; (2) 13 oz/acre (1 liter/ha) sprayed on the leaves and soil at early bloom, on July 18

Glyphosate application: On July 24, 36 oz/acre of Roundup herbicide was sprayed on appropriate plots. Any surviving weeds were hand pulled.

Weed control for the control and Vitazyme treatments: The entire field plot area was sprayed before planting with 1.25 pint/acre of Dual II magnum herbicide + 3 oz/acre of Fierce herbicide.

Growing season weather: favorable for soybean growth

Harvest date: October 23, 2014

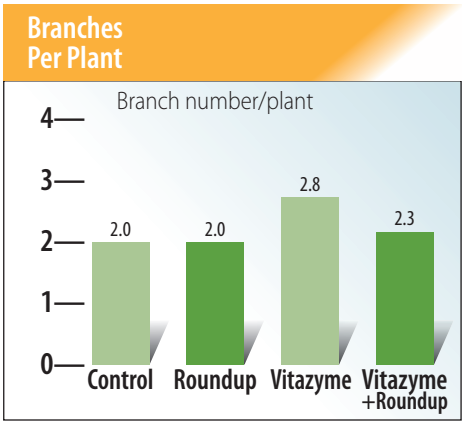
Yield results: Yield differences among the four treatments were not significant.

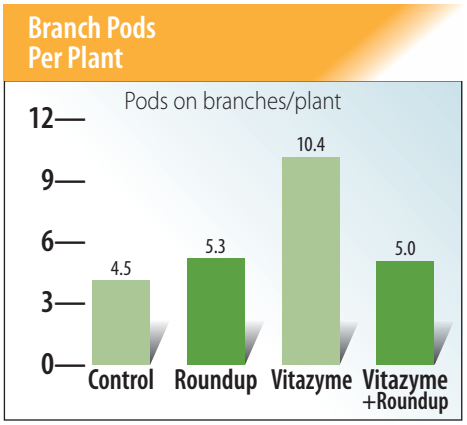
Plant characteristic results: Means followed by the same letter are not significantly different at P=0.05.

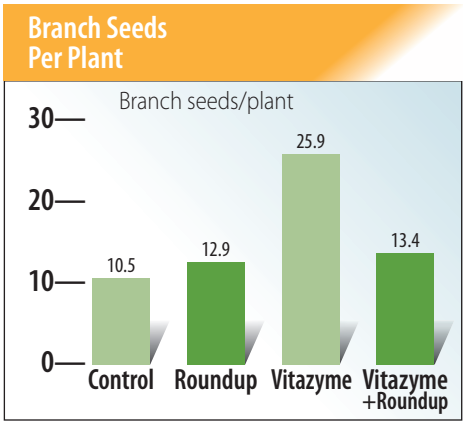
Soybeans *A Soil Microbiology Study with Roundup (Glyphosate) cont.*

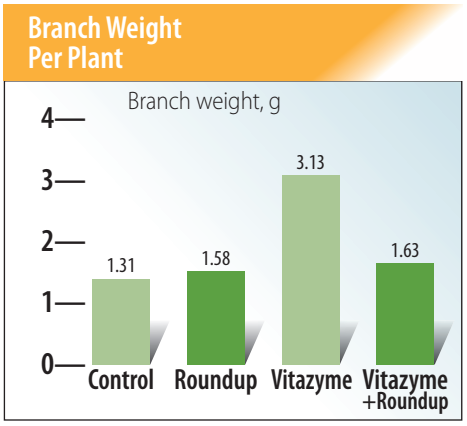
Treatment	Nodes/plant	Main stem pods/plant	Branches/ plant	Change	Branch pods/ plant	Change	Main stem seeds/plant
Control	15.3	28.0	2.0 b	--	4.5 b	--	78
Roundup	16.2	31.4	2.0 b	0	5.3 b	0.8 (+18%)	84
Vitazyme	16.0	31.3	2.8 a	0.8 (+40%)	10.4 a	5.9 (+131%)	89
Vita + Roundup	15.6	29.3	2.3 b	0.3 (+15%)	5.0 b	0.5 (+11%)	79

Treatment	Branch seeds/plant	Change	Main stem seed wt./plant	Branch wt./plant	Change	Main stem seeds/pod	Branch seeds/pod	Main stem seed wt.	Branch seed wt.
				grams	grams			grams	grams
Control	10.5 b	--	9,3	1.31 b	--	2.8	2.4	0.121	0.123
Roundup	12.9 b	2.4 (+23%)	10.3	1.58 b	0.27 (+21%)	2.6	2.4	0.123	0.117
Vitazyme	25.9 a	15.4 (+147%)	10.8	3.13 a	1.82 (+139%)	2.8	2.4	0.121	0.120
Vita + Roundup	13.4 b	2.9 (+28%)	10.4	1.63 b	0.32 (+24%)	2.7	2.4	0.131	0.132









Changes in Plant Characteristics				
	Branches/plant	Branch pods/plant	Branch seeds/plant	Branch wt./plant
Roundup only	0	+18%	+23%	+21%
Vitazyme only	+40%	+131%	+147%	+139%
Vita + Roundup	+15%	+11%	+28%	+24%

Vitazyme greatly increased soybean branching, and the number of pods and seeds on these branches. This fact is reflected in a huge increase in branch weight per plant.

Soil microbial biomass and community structure results:
All values are in nm/g of soil. Means followed by the same letter are not significantly different at P=0.05.

Soybeans *A Soil Microbiology Study with Roundup (Glyphosate) cont.*

Treatment	TPLFA[1]		TBACT[2]		GNEG[3]		GPOS[7]		Anaerobes	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	pico moles /g dry soil		cfu/g soil		cfu/g soil		cfu/g soil		cfu/g soil	
Control	199	15.6	132 a	25.5	68.8	9.6	41.4	3.63	2.33	0.32
Roundup	201	47.1	123 ab	22.0	87.1	21.5	38.3	5.65	2.15	0.40
Vitazyme	193	41.1	107 b	14.2	64.2	17.9	38.3	4.20	1.95	0.13
Vita + Roundup	243	36.9	148 a	17.3	103.0	15.9	42.4	6.50	2.35	0.48
Probability>F	0.26		0.017		0.233		0.215		0.074	

Treatment	Actinomycetes		Total fungi		AM fungi[5]		Eukaryote bacteria	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	cfu/g soil		cfu/g soil		cfu/g soil		cfu/g soil	
Control	21.1	2.17	6.03	1.60	9.18	0.71	4.33	0.98
Roundup	19.9	2.14	11.40	2.10	7.15	1.00	3.73	1.06
Vitazyme	19.4	2.62	6.90	0.96	10.10	1.09	3.80	1.34
Vita + Roundup	20.3	2.60	12.80	3.12	9.48	0.50	5.13	0.83
Probability>F	0.452		0.810		0.143		0.121	

[1]TPLFA=total phospholipid fatty acids; [2]TBACT=total bacteria; [3]GNEG=gram negative bacteria; [4]GPOS=gram positive bacteria; [5]AM fungi=arbuscular mycorrhizal fungi. Std. Dev.=Standard Deviation.

Most values among the microbial community structure were not significantly different at P=0.05.

Only total bacteria was significant, and anaerobic bacteria mean differences were almost significant.

Soil biological and glyphosate residue measurement results: Means followed by the same letter are not significantly different at P=0.05.

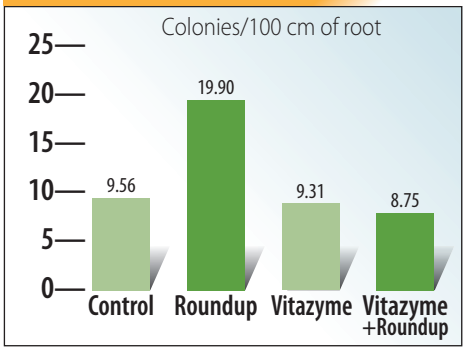
Treatment	Fusarium colonization		RFP[1]		RIPB[2]		SNFW[3]		SRDW[4]	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	colonies/100 cm root		cfu/g dry soil x 10^4		cfu/g dry soil x 10^4		g/plant		g/plant	
Control	9.56 b	0.83	36.6	15.0	25.0	5.72	6.31	2.29	13.4 b	3.34
Roundup	19.90 a	2.55	11.3	3.33	6.5	1.29	4.72	0.73	11.0 b	1.56
Vitazyme	9.31 b	0.59	43.0	9.73	21.8	10.30	6.96	0.87	13.5 b	0.78
Vita + Roundup	8.75 b	1.62	41.0	8.13	15.0	5.77	7.08	1.19	20.0 a	5.12
Probability>F	0.001		0.065		0.121		0.202		0.025	

Treatment	MNOX[5]		MNRED[6]		RORatio[7]		GRRS[8]	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	cfu/g soil		cfu/g soil				ug/g dry soil	
Control	18.4 b	5.01	13.0	3.76	0.72 a	0.13	68.0	27.1
Roundup	87.9 a	17.50	12.3	1.71	0.14 b	0.04	179.0	86.6
Vitazyme	25.3 b	9.22	21.4	6.90	0.86 a	0.05	64.7	20.3
Vita + Roundup	33.6 b	14.10	19.8	6.56	0.61 a	0.11	142.0	47.2
Probability>F	0.001		0.858		0.005		0.464	

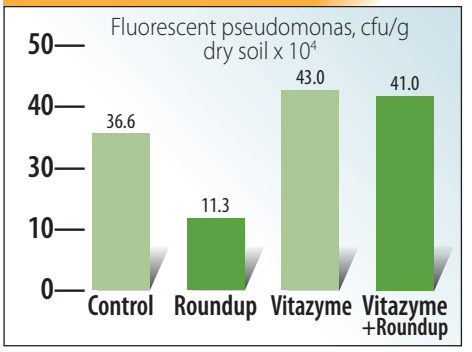
[1] RFP=rhizosphere fluorescent pseudomonas bacteria; [2] RIPB=rhizosphere IAA-producing bacteria; [3] SNFW=soybean nodule fresh weight; [4] SRDW=soybean root dry weight; [5] MNOX=manganese oxidizing bacteria; [6] MNRED=manganese reducing bacteria; [7] Mn reducing/Mn oxidizing ratio; [8] GRRS=glyphosate residue.

Soybeans *A Soil Microbiology Study with Roundup (Glyphosate) cont.*

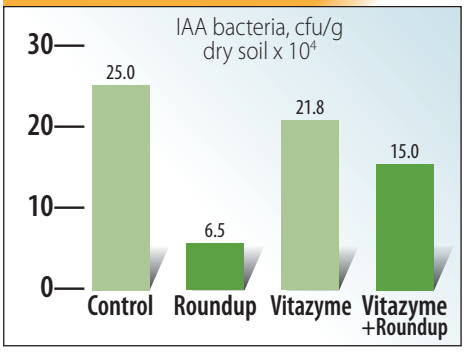
Fusariuam Colonization



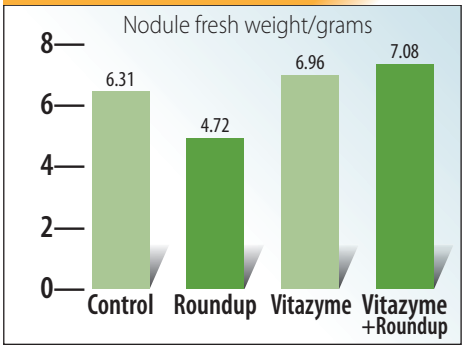
Rhizosphere Fluorescent Pseudomonas Bacteria



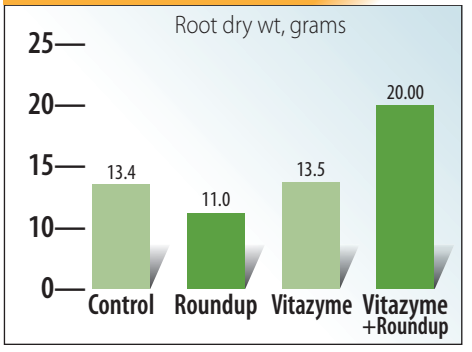
Rhizosphere Indole Acetic Acid Producing Bacteria



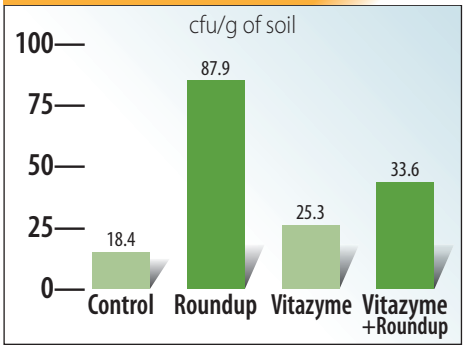
Soybean Nodule Fresh Weight



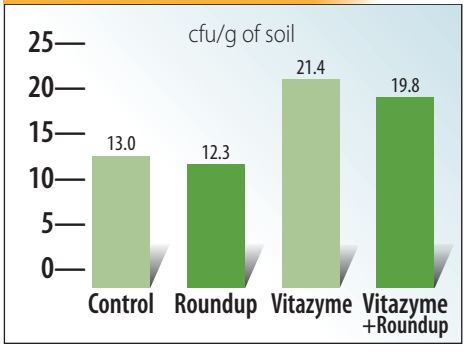
Soybean Root Dry Weight



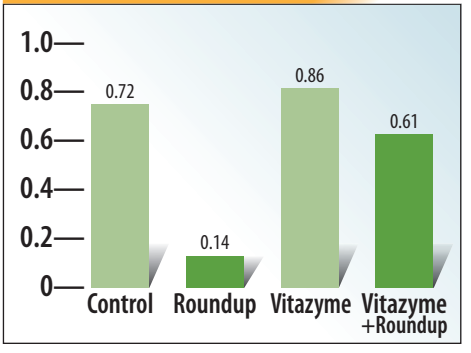
Manganese Oxidizing Bacteria



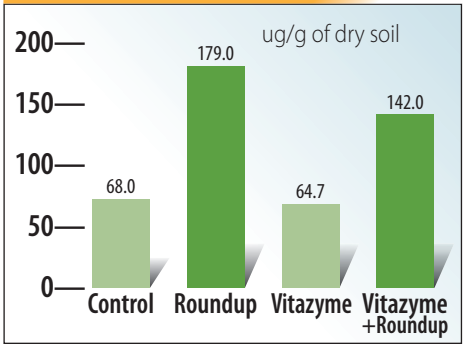
Manganese Reducing Bacteria



Manganese Reducing/ Manganese Oxidizing Ratio



Soil Glyphosate Residue



Changes in Parameters vs. the Control			
Parameter	Roundup only	Vitazyme only	Vitazyme + Roundup
Fusarium colonization	+108%	-3%	-8%
Rhizosphere Fluorescent Pseudomonas	-69%	+17%	+12%
Rhizosphere IAA-producing bacteria	-74%	-13%	-40%
Soybean nodule fresh weight	-25%	+10%	+12%
Soybean dry root weight	-18%	+1%	+49%
Manganese oxidizing bacteria	+378%	+38%	+83%
Manganese reducing bacteria	-5%	+65%	+52%
Ratio of Mn reducing/Mn oxidizing bacteria	-81%	+19%	-15%
Soil glyphosate residue	+163%	-5%	+109%

Soybeans *A Soil Microbiology Study with Roundup (Glyphosate) cont.*

Note that Vitazyme overcame the suppressive effects of Roundup on beneficial soil bacteria (Fluorescent Pseudomonas and IAA-producing bacteria), as well as the beneficial manganese (Mn) reducing bacteria, which change manganese to the soluble +2 oxidation state for plant root uptake; the Mn oxidizing bacteria make the element insoluble and unavailable for plant use. The ratios of these Mn bacteria reflect these effects. Fusarium root colonization was greatly increased with Roundup, but totally alleviated by Vitazyme with Roundup. Roundup negatively impacted root and nitrogen-fixing nodule weights, while Vitazyme increased these two parameters, alone and especially along with Roundup for root weight. Vitazyme reduced glyphosate residues in the soil by 54 percentage points compared to glyphosate alone. These results show how beneficial Vitazyme is to reduce the negative impacts of Roundup in the rhizosphere.

Discussion and conclusions: The following text is by Manjula Nathan, Ph.D.

Soybean yield was not significantly affected by Vitazyme treatment in 2014. However, there was a significant difference in the number of branches and branch pods per plant with Vitazyme treatment which resulted in more branch seeds and seed weight. Treatment with glyphosate reduced the number of branches and pods on branches in the Vitazyme treatment to that of the control. These results are interesting since Schon and Blevins (1990) in Missouri at the Bradford Research Center showed that foliar boron treatments also increased the number of soybean branches and branch pods/branch. The number of branches on soybeans will be affected by several factors including light penetration into the canopy, but also from the auxin/cytokinin balance in the plant. Unpublished field research by Reinbott and Blevins found that foliar and intravenous cytokinin application also increased branch and branch pod number on soybean. Cytokinins are produced at the plant root tips, so a large root system with more root tips could result in more soybean branching and pods per branch. In this case, Vitazyme could be stimulating root growth resulting in more branches and branch pods. However, this stimulus is lost when glyphosate is applied.

Soybean Root Growth and Nodulation

Previous studies revealed detrimental effects of glyphosate on nodulation and root development in soybean grown on Mexico silt loam (Kremer and Means, 2009), the same environment for the current study. Glyphosate alone reduced root biomass relative to no-glyphosate treatment and, interestingly, Vitazyme appeared to counteract the inhibitory effects, resulting in significantly greater root biomass, and might stimulate root growth. Similar effects were observed for nodule biomass, although the increased biomass for Vitazyme was not significant, which may be due to variability in the replicate values. Nodule biomass serves as an indicator of effective nitrogen fixation of the Bradyrhizobium-soybean symbiosis; we did not measure actual nitrogen fixation by assay such as acetylene reduction, but prior experience has shown that nodule biomass correlates positively with acetylene reduction.

Soil Residual Glyphosate

Little information is currently available on glyphosate residues in soils resulting from prior application of Roundup herbicide in row crops. This is likely due to the popular assumption that glyphosate is readily dissipated, immobilized, and degraded in the environment. Results of this study show that glyphosate is indeed remaining in soil at detectable levels (ug glyphosate/g dry soil is equivalent to ppb). We analyzed rhizosphere soil because we previously demonstrated that glyphosate is actively released by treated soybean plants through roots (Kremer et al., 2005). An interesting revelation in this study is that although glyphosate was not applied to half the plots in 2014, residual chemical was detected suggesting that glyphosate was carried over from previous applications on this field site. Furthermore, the concentrations in plots receiving 2014 application were two to three times that in plots without glyphosate. Statistical analysis did not detect significant differences among the treatments, likely due to high variability in glyphosate concentrations from plots receiving applications, ranging from 91 to >300 ug/g of soil. More intensive sampling might reduce this variability. Nevertheless, results suggest that glyphosate is released in relatively high amounts through roots during the year of application, or it may accumulate over seasons. The latter possibility can be tested in 2015 by follow-up soil analysis from the 2014 plots. Based on results of the 2014 study, Vitazyme seems to have a slight, although non-significant, effect in reducing glyphosate in the soybean rhizosphere.

Microbiological Assays

We have consistently documented considerable increases in Fusarium root colonization, and a decrease in beneficial microorganisms in glyphosate-resistant soybean and corn with use of Roundup (Kremer and Means, 2009; Means and Kremer, 2007; Zobiole et al., 2010). Although Fusarium is a ubiquitous group of soil fungi, many species are opportunistic phytopathogens and may cause economically important diseases including wilts, root rots, and sudden death syndrome in soybean under optimum environmental conditions. Thus, a high root colonization by Fusarium species indicates a high potential for disease development. The 2014 soybean study confirmed that glyphosate treatment leads to high Fusarium root colonization relative to soybean not receiving glyphosate. Vitazyme treatment significantly reduced colonization in glyphosate treated soybean, possibly through improved root growth or stimulation of other microorganisms that suppress Fusarium growth and root colonization. The increases in the beneficial rhizobacteria,

Soybeans *A Soil Microbiology Study with Roundup (Glyphosate) cont.*

fluorescent Pseudomonas spp. and indole acetic acid (IAA)-producers, confirm this interaction of Fluorescent Pseudomonas spp. represent a group of Gram-negative bacteria that produce antibiotics , plant-growth-regulation compounds, and nutrient acquisition substances that benefit plant growth and development. The IAA producing bacteria stimulate root growth and aid in plant nutrient uptake. These bacterial groups were suppressed by glyphosate in 2014, confirming previous studies. Vitazyme appeared to overcome glyphosate effects although not significant at P=0.05; however, it is of interest to follow up to determine the impact of the product on potentially remediating effects of glyphosate on the rhizosphere microbial dynamics.

Microbial Community Characterization

Characterization of soil microbial groups indicates relative functioning of biological processes mediated by various microbial components based on their proportion of the total community. We used the phospholipid fatty acid (PLFA) characterization, which provides PLFA patterns that are distinctive for major soil microbial groups (Unger et al., 2013). The total PLFA is an index of the total microbial biomass in soil. In the 2014 soybean study, no differences were detected, likely because although the community may have differed among treatments (i.e., glyphosate treatment caused increases in Fusarium but decreased rhizobacteria, thereby balancing total PLFA), the general biomass remained at similar concentrations across treatments. The greatest impact of glyphosate detected using PLFA analysis was on the bacterial community shown as reductions in total bacteria, which reflects the reductions in cultural rhizobacteria reported as Pseudomonas spp. and IAA-producing bacteria. A notable effect of Vitazyme was the significantly (P=0.05) increased PLFA marker for total bacteria in the glyphosate treated soybean, which seems to coincide with an increase (although non-significant) for the Gram-negative bacteria, which include the Pseudomonas sp. and most of the IAA-producers.

References

Kremer, R.J., Means, N.E., and Kim, S. 2005. Glyphosate affects soybean root exudation and rhizosphere microorganisms. Int. J. Environ. Anal. Chem. 85:1165-1174.

Kremer, R.J. and Means, N.E. 2009. Glyphosate and glyphosate-resistant crop interactions with soil and rhizosphere microorganisms. European J. Agron. 31:153-161.

Means, N.E. and Kremer, R.J. 2007. Influence of soil moisture on root colonization of glyphosate-treated soybean by Fusarium species. Comm. Soil Sci. Plant Anal. 38:1713-1720.

Schon, M.K. and Blevins, D.G. 1990. Foliar boron applications increase the final number of branches and pods on branches of field-grown soybeans. Plant Phys. 92:602-607.

Unger, I.M., Goyne, K.W., Kremer, R.J., and Kennedy, A.C. 2013. Microbial community diversity in agroforestry and grass vegetative filter strips. Agroforestry Syst. 87:395-402.

Zobiole, L.H., R.J. Kremer, R.S. Oliveira, and J. Constantin. 2010. Glyphosate affects microorganisms in rhizospheres of glyphosate-resistant soybeans. J. Appl. Microbiol. 110:118-127.

Soybeans *with Vitazyme application*

Researcher: Steve May and others
Research organization: The Iowa Soybean Association, Ankeny, Iowa
Location: Washington County, Iowa
Variety: Asgrow AG3334
Planting date: May 23, 2015
Row spacing: 30 inches
Seeding rate: unknown
Previous crop: corn
Soil type: Taintor silty clay loam, Mahaska silty clay loam, Kalona silty clay loam (all had 0 to 2% slope)
Experimental design: A soybean field was selected for a replicated trial using six alternating field strips, of sprayer boom width (90 feet), to determine the effect of foliar-applied Vitazyme on soybean yield.

1 ***Control*** **2** ***Vitazyme***

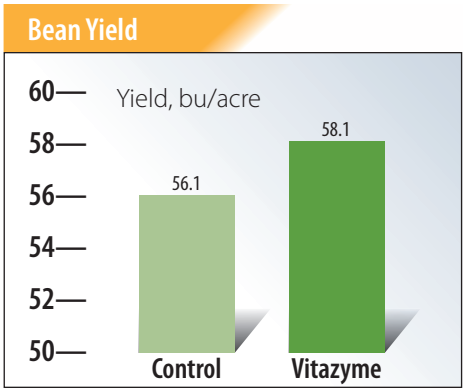
Fertilization: unknown
Vitazyme application: 13 oz/acre on the leaves and soil with glyphosate, on July 1
Harvest date: October 8, 2015
Yield results: The combine speed was 3.9 mph.

Vitazyme on the soybean leaves and soil with glyphosate(right) at an Iowa Soybean Association site show much greater leafing and branching compared to the untreated control.

Treatment	Yield[1]	Yield change
	bu/acre	bu/acre
Control	56.1 b	—
Vitazyme	58.1 a	2.0 (+4%)

[1]Means followed by different letters are significantly different at P=0.05.

Yield increase with Vitazyme: 4%



Soil type	Part of trial		Yield		Yield increase *with Vitazyme*
	Control	Vitazyme	Control	Vitazyme	
	%	%	bu/acre	bu/acre	bu/acre
Taintor silty clay loam	24.3	33.0	56.4	58.2	1.8 (+ 3%)
Mahaska silty clay loam	14.2	13.9	54.6	56.1	1.5 (+3%)
Kalona silty clay loam	6.6	8.0	60.4	63.3	2.9 (+5%)

These three soil types are closely associated with one another, and the only differences between Kalma and Taintor soils is that Kalma soil have no argillic horizon (a layer of higher clay content beneath the topsoil). Possibly the lack of this elevated subsoil clay content is related to the better response of the soybean crop to Vitazyme, such as by allowing better root penetration to the subsoil.

Conclusion: This replicated (with field strips) Iowa Soybean Association soybean trial in southeastern Iowa, using 13 oz/acre applied foliar with a herbicide, produced a significant yield increase of 2.0 bu/acre. Kalona soils, having no argillic horizon, gave the best increase (5%). This 4% improvement was highly profitable and shows the efficacy of the product for soybean growers in Iowa.

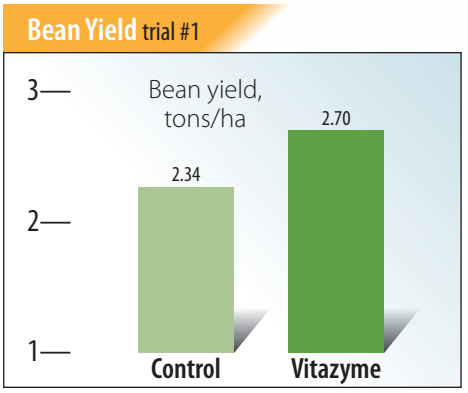
VitalEarth 2015 Crop Results

Soybeans *A Summary of Five Field Trials in Ukraine*

All trials were organized by V.V. Plotnikov, Ph.D, to determine the yield and profit-improving potential of Vitazyme. Fields were divided into Vitazyme treated and control areas.

1. Conducted by LLC "Atlantic Farms" at Myronivs'kyi District, Kyiv Region, Myronivka Farm, Ukraine, on a podzolized chernozem soil (organic matter = 2.8%).

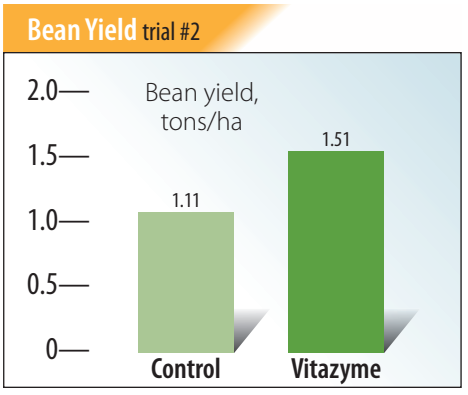
Variety: Highpro
Seeding rate: 700,000 seeds/ha
Planting date: May 2, 2015
Previous crop: winter wheat
Cultivation methods: disking to 8 cm, plowing to 22 cm, cultivation to 5 cm
Fertilization: 16 kg/ha N, 16 kg/ha P_20_5, 16 kg/ha K_20 in-furrow at planting
Vitazyme application: 1 liter/ha on the leaves and soil at the third trifoliate stage on June 1, 2015
Results: *(See bar chart to the right)*



Yield increase with Vitazyme: 0.36 tons/ha(+15%)
Profit increase with Vitazyme: 2,534 UAH/ha

2. Conducted by Private Agricultural Enterprise "Vatutina" at Vil'shans District, Kirovohrad Region, Vil'shanka Town, Ukraine, on a podzolized chernozem soil (organic matter = 3.1%).

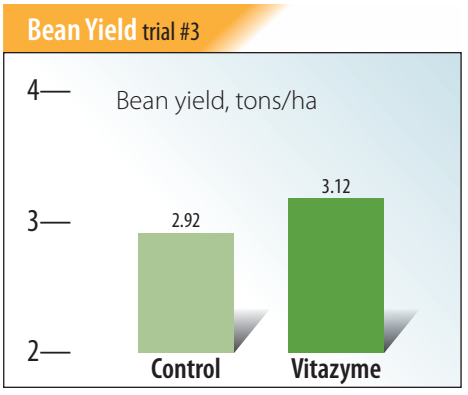
Variety: Volos
Seeding rate: 700,000 seeds/ha
Planting date: April 24, 2015
Previous crop: winter wheat
Cultivation methods: disking to 8 cm, plowing to 22 cm, cultivation to 5 cm
Fertilization: 16 kg/ha N, 16 kg/ha P_20_5, 16 kg/ha K_20 in-furrow at planting
Vitazyme application: 1 liter/ha on the leaves and soil at the third trifoliate stage on June 10, 2015
Results: *(See bar chart to the right)*



Yield increase with Vitazyme: 0.40 ton/ha(+36%)
Profit increase with Vitazyme: 2,870 UAH/ha

3. Conducted by Agricultural LLC "Skif" at Kotelevs 'kyi District, Poltava Region, Bil'sk Village, Ukraine, on a chernozem soil (organic matter = 3.2%).

Variety: Medison
Seeding rate: 700,000 seeds/ha
Planting date: April 30, 2015
Previous crop: corn
Cultivation methods: disking to 8 cm, plowing to 22 cm, cultivation to 5 cm
Fertilization: 35 kg/ha N, pre-plant incorporated; 16 kg/ha N, 16 kg/ha P_20_5, 16 kg/ha K_20 in-furrow at planting
Vitazyme application: 1 liter/ha sprayed on the leaves and soil at the fifth trifoliate, on June 23
Results: *(See bar chart to the right)*

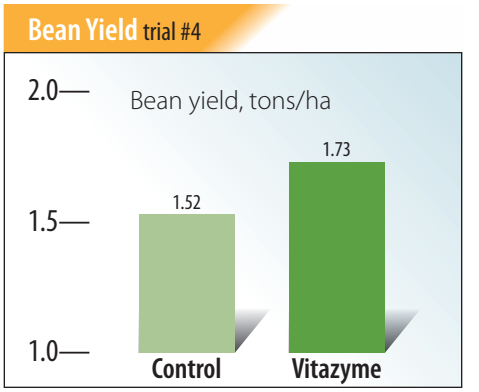


Yield increase with Vitazyme: 0.20 ton/ha(+7%)
Profit increase with Vitazyme: 1,190 UAH/ha

Soybean *A Summary of Five Field Trials in Ukraine cont.*

4. Conducted by Farming Enterprise "Korol" at Pervomayskyi District, Mykolayiv Region, Kamyanyi Mist Village, Ukraine, on podzolized chernozem soil (organic matter = 3.0%).

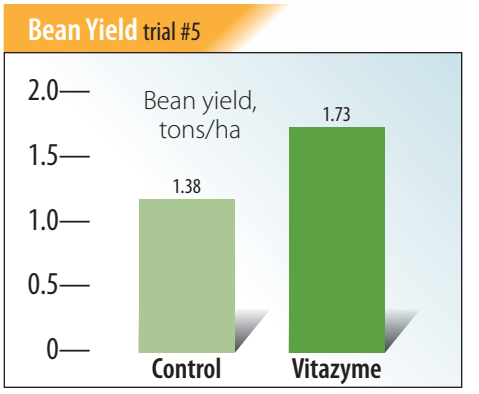
Variety: Don'ka
Seeding rate: 700,000 seeds/ha
Planting date: April 24, 2015
Previous crop: winter wheat
Cultivation methods: disking to 8 cm, plowing to 24 cm, cultivation to 5 cm
Fertilization: 35 kg/ha N, pre-plant incorporated; 15 kg/ha N, 15 kg/ha $P_2 0_5$, 15 kg/ha $K_2 0$ in-furrow at planting
Vitazyme application: 1 liter/ha on the seeds, four days before planting, on April 20, 2015
Results: *(See bar chart to the right)*



Yield increase with Vitazyme: 0.21 ton/ha(+14%)
Profit increase with Vitazyme: 1,694 UAH/ha

5. Conducted by Farming Enterprise "Yuzko-Agro", at Kivertsivs'Kyi District, Volyn' Region, Zviriv Village, Ukraine, on podzolized chernozem soil (organic matter = 1.8%).

Variety: Cheremosh
Seeding rate: 750,000 seeds/ha
Planting date: April 29, 2015
Previous crop: winter wheat
Cultivation methods: disking to 8 cm, plowing to 24 cm, cultivation to 5 cm
Fertilization: 35 kg/ha N, pre-plant incorporated; 16 kg/ha N, 16 kg/ha $P_2 0_5$, 16 kg/ha $K_2 0$ in-furrow at planting
Vitazyme application: 1 liter/ha on the seeds, eight days before planting, on April 21, and (2) 0.6 liter/ha on the leaves and soil at the third trifoliate stage on June 5, 2015
Results: *(See bar chart to the right)*



Yield increase with Vitazyme: 0.35 ton/ha(+25%)
Profit increase with Vitazyme: 2,572 UAH/ha

Summary of the Five Ukraine Soybean Trials

All five field trials in this Ukrainian Vitazyme study gave good to excellent responses to a seed treatment, a foliar spray, or a combined seed and foliar application. The average yield increase was 19.4%. Profit improvements also were sizable, averaging 2,172 UAH/ha. This program is an excellent choice for soybean growers in Ukraine.

Location	Yield increase	Profit increase
	%	UAH/ha
Central Ukraine (500-550 mm ppt.)		
"Atlantic Farms" — Myronivka	15	2,534
"Vatutina" — Vil'shanka	36	2,870
"Skif" — Bil'sk	7	1,190
Southern Ukraine (300-350 mm ppt.)		
"Korol" — Kamyanyi Mist	14	1,694
Western Ukraine (650-700 mm ppt.)		
"Yuzko-Agro" — Zviriv	25	2,572
Mean	19.4	2,172

Soybeans *A Synergism Study with Seaweed*

Bert Schou at ACRES Research explains plot treatments at the facility near Cedar Falls, Iowa.

Researcher: Bertel Schou, Ph.D.
Research organization: ACRES Research, Cedar Falls, Iowa
Location: Cedar Falls, Iowa
Variety: NuTech 7240
Seeding rate: 53 lb/acre
Planting depth: 1.5 inches
Row width: 30 inches
Soil type: Floyd loam (pH=6.3, organic matter=4.4%, cation exchange capacity=13.3 meg/100g, fertility level=excellent, drainage=excellent)
Planting date: May 7, 2015
Experimental design: A small-plot soybean trial, using a randomized complete block design and four replicates, was laid out in plots that were 15 (six rows) x 30 feet, with the objective of determining the effectiveness of Vitazyme and seaweed to influence bean yield, alone and together.

1 ***Control*** **2** ***Vitazyme***
3 ***Seaweed*** **4** ***Vitazyme + Seaweed***

Fertilization: All plots received a fall (2014) broadcast application of 18-16-60 lb/acre of N-$P_2 0_5$-$K_2 0$.

Vitazyme applied twice to the soybeans in this trial greatly increased top and root growth and branching, giving a 7% yield increase

Soybeans *A Synergism Study with Seaweed cont.*

Vitazyme application: For Treatments 2 and 4, (2) 13 oz/acre in-furrow at planting on May 7: (2) 13 oz/acre on the leaves and soil at R1 on June 27.

Seaweed application: For Treatments 3 and 4, (1) 2 qts./acre in-furrow at planting on May 7; (2) 2 qts./acre on the leaves and soil at R1 on July 2. The seaweed was from Ocean Organics based in Waldoboro, Maine, and Ann Arbor, Michigan.

Growing season weather: Excellent, with rainfall evenly distributed throughout the spring and summer, and average temperatures were good for growth. Rainfall: April=2.97 in.; May=5.62 in.; June=5.40 in.; July=4.65 in.; August=7.50 in.; September=3.33 in. Temperature (daily average maximum): April=66; May=70; June=80; July=85; August=79; September=8.

Harvest date: September 25, 2015

Bean moisture results: Bean moisture varied from 11.86 to 12.17%, and differences among treatments were not significant.

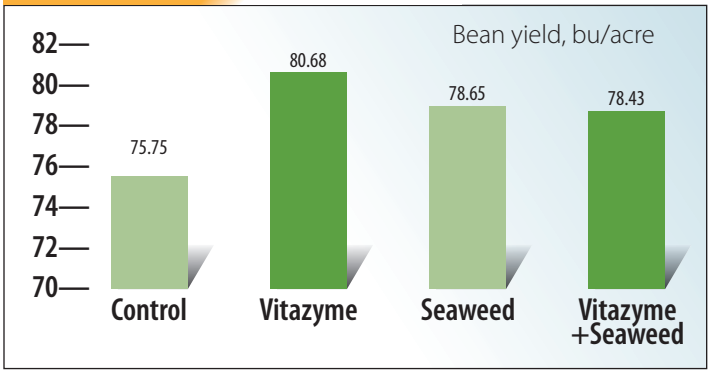
Yield results: The beans were harvested using a Massey-Ferguson plot combine, with an electronic scale and moisture meter.

Treatment	Bean yield[1]	Yield change
	bu/acre	bu/acre
1. Control	75.75 b	—
2 Vitazyme	80.68 a	4.93 (+7%)
3. Seaweed	78.65 ab	2.90 (+4%)
4. Vita + Seaweed	78.43 ab	2.68 (+4%)
LSD (P=0.05)	3.99	
CV	3.66	
Replicate probability	0.9545	
Treatment probability	0.8906	

[1] Means followed by the same letter are not significantly different at P=0.05 according to the Student-Newman-Keuls Test.

Conclusions: This small-plot soybean trial in east central Iowa revealed that soybean yield was significantly improved (at P=0.05) by 4.93 bu/acre (+7%) with Vitazyme only—in-furrow and foliar at R1—during an especially favorable cropping year. Seaweed, applied in-furrow and foliar at R1 at 2 quarts/acre each time, increased the yield by 2.90 bu/acre (+4%), but the increase was not significantly greater than the control. Neither was the combined Vitazyme and Seaweed treatment, which increased bean yield by 2.68 bu/acre (4%). This combined treatment received foliar treatments of Vitazyme and seaweed at different times, separated by 5 days to minimize possible negative interactions that appeared during a 2014 Vitazyme-seaweed study by ACRES Research. However, the separated foliar applications did not remove the lack of positive interaction for the two products. Both Vitazyme and seaweed are highly effective agents for improving soybean yields in Iowa when applied at planting, and as a foliar at early bloom.

Bean Yield



Increase in Bean Yield

Vitazyme alone 7%
Seaweed alone 4%
Vitazyme + Seaweed 4%

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2014 Crop Results

Vitazyme on Soybeans

University of Missouri - Bradford Research Center

Researcher: Majula Nathan, Ph.D. Columbia, Missouri

Location: University of Missouri Bradford Research Center,

Variety: Pioneer 94MO1 *Population*: 180,000 seeds/acre

Row spacing: 30 inches *Planting date*: June 12, 2013

Experimental design: A replicated soybean study (four replications) was set up using a randomized complete block design, with plots four rows wide and 400 feet long (0.09183 acre per plot.) Two Vitazyme applications were made — at planting on the seeds and at bloom — to determine the effect of the product on soybean leaf tissue analysis, bean yield, and growth and seed parameters.

1. Control **2. Vitazyme on the seeds and leaves**

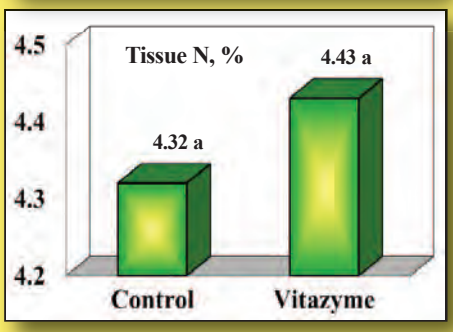
Fertilization: according to soil test recommendations using 0-46-62 lb/acre N-P_2O_5-K_2O before planting

Vitazyme application: (1) 13 oz/acre equivalent on the seeds, mixed thoroughly, just before planting; (2) 13 oz/acre on the leaves and soil at full bloom (R-2) on July 17.

Weather during the 2013 growing season: A wet spring delayed planting, and a drought in August and early September caused some abortion of pods.

Tissue nutrient levels: The youngest, most fully expanded leaves were collected at R-5, on September 6, from 24 plants of each plot for nutrient analysis. These samples were analyzed for N, P, K, Ca, and Mg at the University of Missouri.

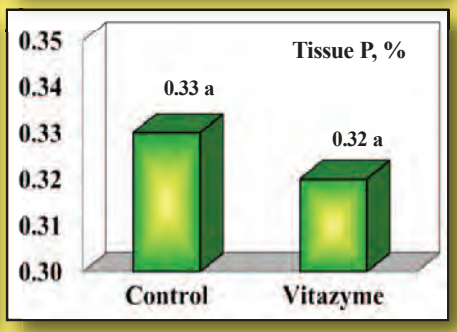
Soybean Tissue Nitrogen



P > F = 0.364

Increase in N with Vitazyme: 3%

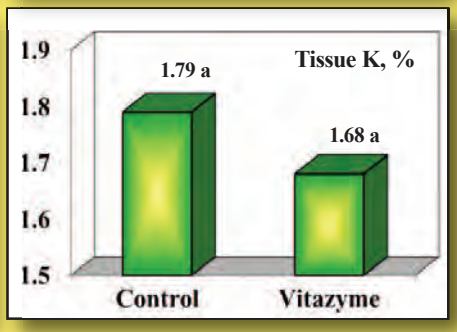
Soybean Tissue Phosphorus



P > F = 0.567

Decrease in P with Vitazyme: 3%

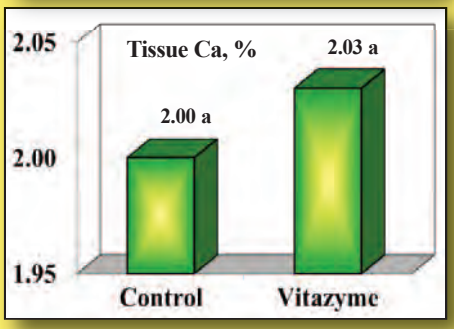
Soybean Tissue Potassium



P > F = 0.306

Decrease in K with Vitazyme: 6%

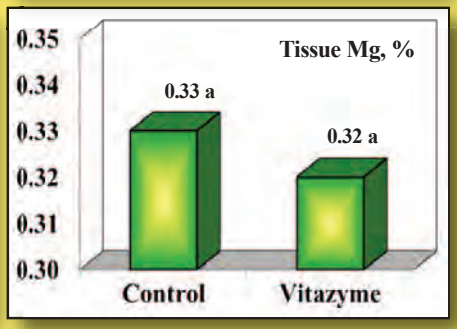
Soybean Tissue Calcium



P > F = 0.845

Increase in Ca with Vitazyme: 2%

Soybean Tissue Magnesium



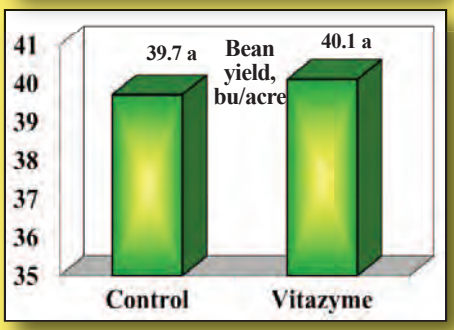
P > F = 0.556

Decrease in Mg with Vitazyme: 3%

There was very little change in tissue elemental levels with Vitazyme application compared with the control treatment.

Growth and yield parameter results: Before harvest, various plant and seed parameters were measured.

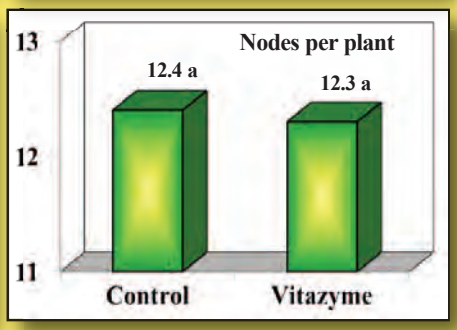
Soybean yield



P > F = 0.840

Increase with Vitazyme: 1%

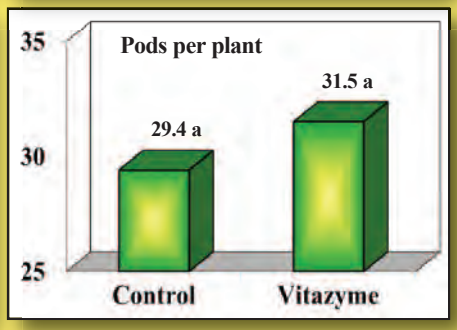
Nodes Per Plant



P > F = 0.806

Decrease with Vitazyme: -1%

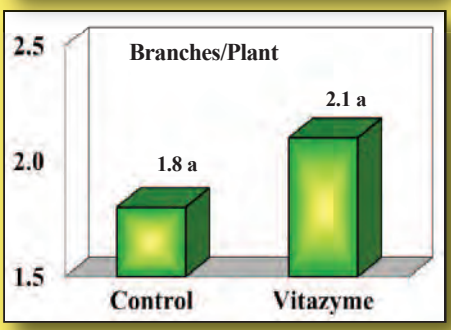
Main Stem Pods Per Plant



P > F = 0.179

Increase with Vitazyme: 7%

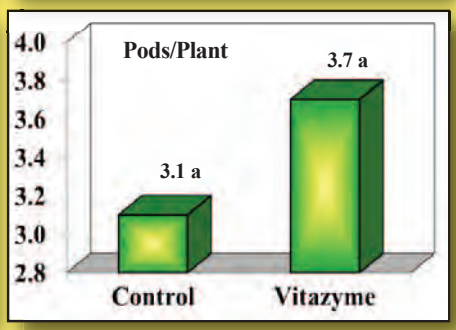
Branches Per Plant



P > F = 0.396

Increase with Vitazyme: 17%

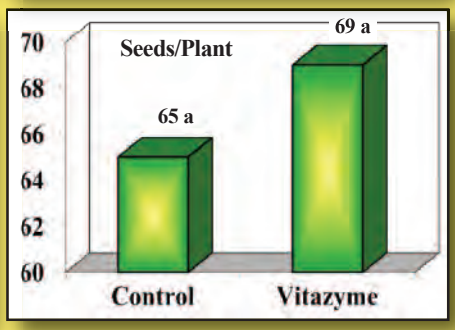
Branch Pods Per Plant



P > F = 0.433

Increase with Vitazyme: 19%

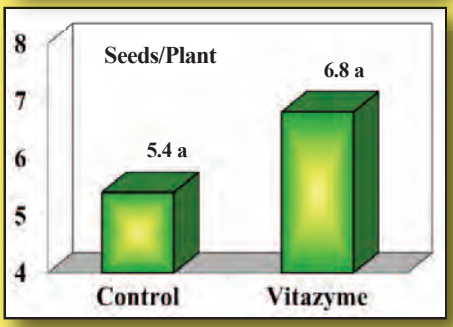
Main Stem Seeds Per Plant



P > F = 0.350

Increase with Vitazyme: 6%

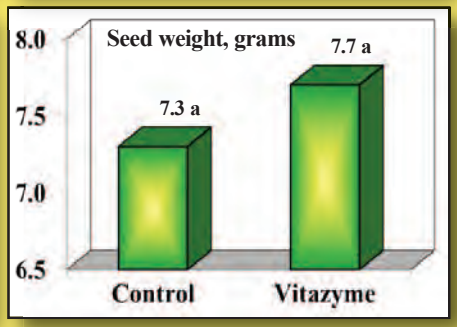
Branch Seeds Per Plant



P > F = 0.387

Increase with Vitazyme: 26%

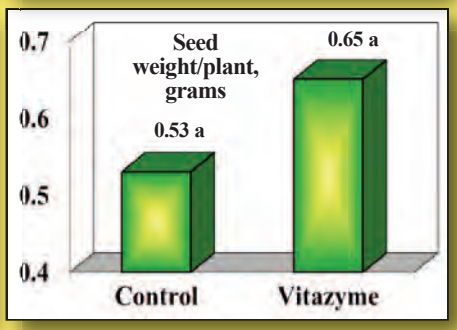
Main Stem Seed Weight Per Plant



P > F = 0.603

Increase with Vitazyme: 5%

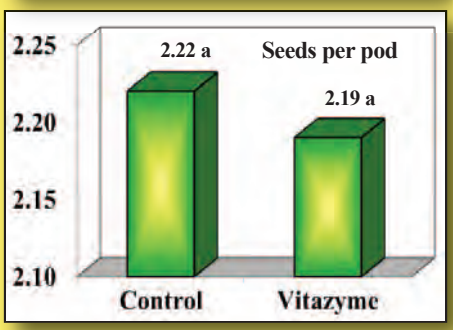
Branch Seed Weight Per Plant



P > F = 0.351

Increase with Vitazyme: 23%

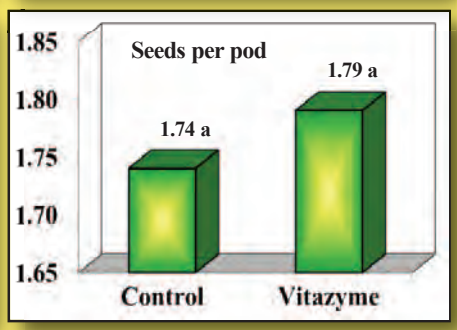
Main Stem Seeds Per Pod



P > F = 0.755

Decrease with Vitazyme: (-) 1%

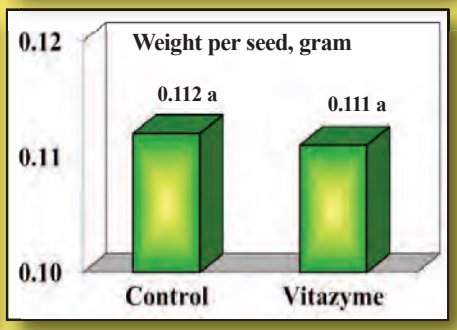
Branch Seeds Per Pod



P > F = 0.679

Increase with Vitazyme: 3%

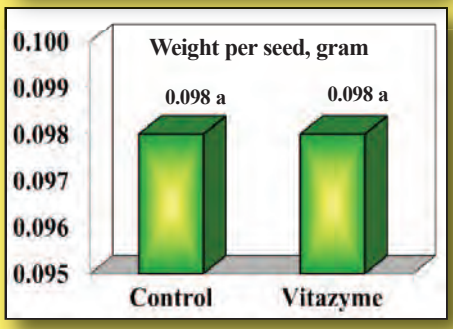
Main Stem Weight Per Seed



P > F = 0.830

Decrease with Vitazyme: 1%

Branch Weight Per Seed



P > F = 0.994

Soybean yield was increased only 1% by Vitazyme, although most plants characteristics were improved substantially, in particular pod number, branches, and seed weight per plant. However, pod abortion during the summer drought caused a loss of yield potential by season's end.

Crude protein and oil results: The crude protein and oil content of the beans were determined at the University of Missouri, and showed little difference between the two treatments, Vitazyme being only slightly higher for both.

Treatment	Crude protein, %	Oil, %
Control	23.7	37.4
Vitazyme	23.9	37.5

Conclusions: A replicated soybean trial at the University of Missouri in 2013 proved that Vitazyme can substantially improve plant and seed characteristics. In this study, however, a summer drought caused many pods to abort so that the potential yield increase was reduced to only 1%. Tissue element levels were changed little, and bean oil and protein levels were only slightly elevated by Vitazyme. Plant and seed characteristics were affected as follows.

Change with Vitazyme

Nodes per plant ..... -1%	Main stem seed weight ..... +5%
Main stem pods per plant .... +7%	Branch seed weight per plant ... +23%
Branches per plant ..... +17%	Main stem seeds per plant ..... -1%
Branch pods per plant ..... +19%	Branch seeds per plant ..... +3%
Main stem seeds per plant ... +6%	Main stem weight per seed ..... +1%
Branch seeds per plant ..... +26%	Branch weight per seed 0%

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2014 Crop Results

Vitazyme on Soybeans

Agricultural Custom Research and Education Services (ACRES)

Researcher: Bertel Schou, Ph.D.
Research organization: Agricultural Research and Educational Services
Location: Cedar Falls, Iowa
Variety: NuTech 7240 (Roundup Ready)
Planting rate: 53 lb/acre
Planting date: May 19, 2014
Planting depth: 1.5 inches
Soil type: Aredale loam (36% sand, 42% salt, 22% clay, 4.6% organic matter, pH = 6.2, cation exchange capacity = 17.6 meq/100 g)
Soil test results: (Perry Agricultural Laboratory, Bowling Green, Missouri): total exchange capacity = 25.00, pH = 5.8, organic matter = 3.2%, nitrogen = 82 lb/acre, sulfur (as sulfate) = 30 lb/acre, phosphorus = 117 lb/acre, calcium (Ca) = 5,793 lb/acre, magnesium (Mg) = 805 lb/acre, potassium (K) = 232 lb/acre, sodium (Na) = 75 lb/acre, boron (B) = 2.36 lb/acre, iron (Fe) = 686.6 lb/acre, manganese (Mn) = 109.6 lb/acre, copper (Cu) = 3.0 lb/acre, zinc (Zn) = 11.6 lb/acre; base saturations: Ca = 57.9, Mg = 13.4, K = 1.2, Na = 0.9, other bases = 5.8, H = 21.0.
Row width: 30 inches
Planting conditions: good
Tillage: conventional
Previous crop: corn
Experimental design: A randomized complete block design of a small plot study was used to evaluate the effect of Vitazyme and seaweed, alone and together, on the yield of soybeans. The treatments were replicated four times, and plants were four rows wide x 30 feet long (0.00689 acre/plot).

Treatment	In-furrow at planting	Foliar
1. Control	0	0
2. Vitazyme	13 oz/acre	13 oz/acre
3. Seaweed	2 quarts/acre	2 quarts/acre
4. Vitazyme + Seaweed	13 oz/acre + 2 quarts/acre	13 oz/acre + 2 quarts/acre

Fertilization: according to soil test
Vitazyme application: (1) 13 oz/acre in-furrow at planting (May 19, 2014) using 38 ml/gallon at 10 gallons/acre; (2) 13 oz/acre on the leaves and soil at V6-R1 (July 2, 2014), using 26 ml/gallon at 10 gallons/acre
Seaweed application: obtained from Ocean Organics; (1) 2 quarts/acre in-furrow at planting (May 19, 2014) using 189 ml/gallon at 10 gallons/acre; (2) 2 quarts/acre on the leaves and soil at V6-R1 (July 2, 2014) using 126 ml/gallon at 15 gallons/acre
Weather for 2014: Growing conditions for the trial were very good with below-normal temperatures and adequate precipitation, except for a few days in June and August that received irrigation water.

Harvest date: October 6, 2014

Bean moisture results:

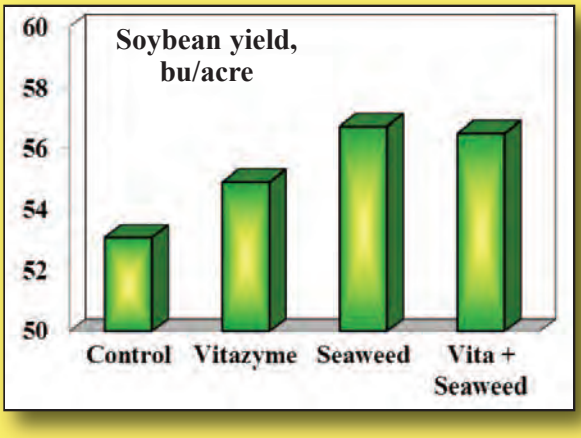
Treatment	Bean moisture	Moisture change
	%	%
1. Control	13.45	—
2. Vitazyme	13.47	(+) 0.02
3. Seaweed	13.44	(-) 0.01
4. Vitazyme + Seaweed	13.44	(-) 0.01

The moisture content of the beans was nearly identical for all four treatments.

Bean yield results:

Treatment	Bean yield[1]	Yield change
	bu/acre	bu/acre
1. Control	53.08 b	—
2. Vitazyme	59.90 a	6.82 (+13%)
3. Seaweed	56.73 ab	3.65 (+7%)
4. Vitazyme + Seaweed	56.50 ab	3.42 (+6%)
LSD (P = 0.05)	3.04	
CV	3.36%	
Treatment F	8.627	
Treatment probability	0.005	

[1]Means followed by the same letter are not significantly different at P = 0.05, according to the Student-Newman-Keuls Test.



Increase in soybean yield with Vitazyme: 13%

Vitazyme significantly increased the soybean yield at P = 0.005, a great increase above the control, and greater than the seaweed by 6%. The combined products showed no synergism in this study.

Conclusions: A replicated soybean study in east-central Iowa revealed that two applications of Vitazyme significantly increased the soybean yield above the control (+13%). Seaweed at two applications increased bean yield by 7%, which was statistically equal to the Vitazyme treatment as well as to the control. The two products combined did not reveal a synergine, though possibly a synergine could be realized if the two were applied seperately, perhaps a week apart as revealed on studies on grapes.

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2013 Crop Results

Vitazyme on Soybeans

Researcher: Tim Heikens
Farmer: Tim Heikens
Location: Lake Park, Iowa
Variety: Asgrow
Planting date: June 12, 2013
Row spacing: 7.5 inches
Plant population: 145,000 seeds/acre
Previous crop: corn
Tillage: soybeans planted directly into standing corn stalks
Soil type: Okoboji

Experimental design: A 30-acre uniform soybean field was treated with Vitazyme, except for a 90-foot strip that served as a control. The purpose of the study was to evaluate the effect of this product on the yield of soybeans.

1. Control **2. Vitazyme**

Fertilization: 100 lb/acre of 0-0-60% N-P_2O_5-K_2O the fall of 2012

Vitazyme application: 20 oz/acre (1.5 liters/ha) sprayed on the leaves and soil at flowering, the first part of July

Weed control: Roundup (glyphosate) herbicide

Aphid control: insecticide

Growing season weather: wet spring, dry summer and fall

Harvest date: October 8, 2013

Yield results: A weigh wagon was used to weigh samples from the two treatments.

Treatment	Yield	Yield change
	bu/acre	bu/acre
Control	52.8	—
Vitazyme	54.5	1.7 (+3.2%)

Moisture content was about the same for both treatments at harvest (11.9 to 12.1%), and test weight was a bit higher for the control treatment.

Increase in bean yield with Vitazyme: 3.2%

Conclusions: A soybean study in northwestern Iowa in 2013 revealed that Vitazyme improved the yield by 3.2%. A higher increase would likely have been achieved if an early, at-planting treatment had been made, in addition to the 20 oz/acre spray made at bloom.

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2013 Crop Results

Vitazyme on Soybeans

Researcher: unknown *Farmer*: Dam Van Huan *Location*: Dakrong, Cu Jut, Dak Nong, Viet Nam
Variety: DT 26 *Planting date*: April 28, 2013
Experimental design: A soybean field was divided into a Vitazyme treated area and an untreated control area, to determine the effect of this product on plant growth parameters and bean yield.

1. Control **2. Vitazyme**

Fertilization: unknown
Vitazyme application: 1 liter/ha at 2, 4, and 6 weeks after planting
Plant growth results: Both treatments germinated on May 5, 2013, 7 days after planting, and had more than 98% germination.

Plant Height at 70 Days

Increase in plant height with Vitazyme: 8%

Plant height was somewhat greater with Vitazyme at 70 days after planting.

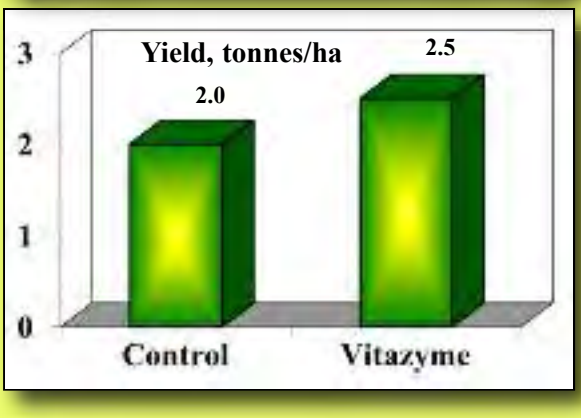
Yield results: The crop was harvested July 29, 2013. There were 32 plants/m^2 for both treatments.

Treatment	Pods/Plant	Unfilled pods/Plant	Pods with ...			Weight of 1,000 seeds
			1 seed	2 seeds	3 seeds	
	number	number	number	number	number	grams
Control	24	6	5	10	3.2	191
Vitazyme	30	4	3	20	3.7	195

Change With Vitazyme	
Pods/Plant	+25%
Untilled Pods/Plant	-50%
Pods With 1 Seed	-67%
Pods With 2 Seeds	+100%
Pods With 3 Seeds	+16%
Weight of 1,000 Seeds	+2%

.
Only the unfilled and 1 seed/pod parameters were not increased with Vitazyme application, the pod number, 2-seeded pods, 3-seeded pods, and weight of 1,000 seeds all improved with the product.

Bean Yield



Increase in yield with Vitazyme: 25%

A sizable increase of 25% in yield was realized from the program.

Income results: Extra cost for Vitazyme: 1,500,000 VND/ha
Increase in income for Vitazyme: 6,000,000 VND/ha
Return On Investment: 4:1

Conclusions: A soybean trial in Viet Nam, using three foliar applications of the product, produced a sizable 25% yield increase as a result of larger plants having 25% more pods, fewer unfilled pods, twice as many 2-bean pods, and 16% more 3-bean pods than the control. The seeds were 2% heavier as well. This yield increase produced 6,000,000 VND/ha more income, and a 4:1 Return On Investment, showing the great efficacy of Vitazyme for soybean production in Viet Nam.

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2013 Crop Results

Vitazyme on Soybeans

Researcher: Linden Heikens and Leonard Jensen *Farmer*: Leonard Jansen
Location: Lake Park, Iowa *Variety*: Golden Harvest S20-Y2 (Roundup Ready)
Row spacing: 15 inches *Seeding rate*: 150,000/acre *Previous crop*: corn
Planting date: May 15, 2013
Tillage: stalks chopped in the fall of 2012, and ripped; field cultivated before planting
Experimental design: A 100-acre, uniform soybean field was treated with Vitazyme except for an 80-foot strip to serve as a control. The objective of the study was to evaluate the effect of this product on soybean yield.

1. Control **2. Vitazyme**

Fertilization: 18-46-60 lb/acre of N-P_2O_5-K_2O, plus 9 lb/acre of S and 1 lb/acre of Zn
Vitazyme application: 13 oz/acre sprayed foliar on July 1, at early flowering
Weed control: Sonic herbicide at 3 oz/acre on May 16 (preemergence), and Roundup (glyphosate) at 1 quart/acre with Vitazyme on July 1; Roundup (glyphosate) again at 1 quart/acre on July 22
Weather for 2013: a wet spring, followed by a dry summer and fall
Harvest date: October 10, 2013
Yield results: A harvest sample was taken for the control strip and the Vitazyme treated areas and weighed in a weigh wagon.

Treatment	Yield	Yield change	Bean moisture	Moisture change
	bu/acre	bu/acre	%	%
Control	57.61	—	10.8	—
Vitazyme	59.62	2.01 (+3.5%)	10.2	-0.6

Increase in soybean yield with Vitazyme: 3.5%

Decrease in bean moisture with Vitazyme: 0.6 percentage point

Conclusions: This northwestern Iowa soybean study revealed that Vitazyme, applied once with a Roundup application at early bloom, increased the bean yield by 3.5%, while reducing bean moisture at harvest by 0.6 percentage point. A Vitazyme application at planting would very likely have substantially improved this yield increase.

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2013 Crop Results

Vitazyme on Soybeans

Researcher: V.V. Plotnikov *Research organization*: Scientific, Innovation, and Technology Center of the Institute of Forages and Agriculture of Podillya NAAS *Location*: National Academy of Agricultural Sciences, Ukraine *Variety*: Khutorianochka *Soil type*: ash gray soil (humus = 2.2%, hydrolyzed-N = 8.4 mg/100 g of soil, P = 15.8 mg/100 kg of soil, exchangeable K = 12.4 mg/100 g of soil, pH = 5.5) *Previous crop*: soybeans *Planting date*: May 2, 2013
Soil preparation: disking, plowing, harrowing *Seeding rate*: 800,000 seeds/ha
Experimental design: A small plot soybean study was conducted, with four replications, to determine the effect of Vitazyme on bean yield, profitability, quality, and plant characteristics. One treatment was on soils treated with Vitazyme in 2012 to evaluate the carryover effect.

Treatment	2012 treatment	Seed treatment	Third trifoliate	Branching
		liter/tonne	liter/ha	liter/ha
1. Control	0	0	0	
2. Vitazyme carryover	X	0	0	0
3. Vitazyme twice	0	1	1	0
4. Vitazyme three times	0	1	0.5	0.5

Fertilization: All phosphorus and potassium fertilizers were applied the fall of 2012.
Vitazyme application: See the table above. The seed treatment was applied May 2, at planting time, the third trifoliate soil and foliar spray on June 11, and the branching soil and foliar spray on June 18.
Yield results:

Increase in soybean yield

Carryover effect 8%
Vitazyme twice 20%
Vitazyme three times 22%

There was a small carryover effect from Vitazyme applied in 2012, and a sizable yield increase (20 to 22%) for both two and three Vitazyme applications.

Income results:

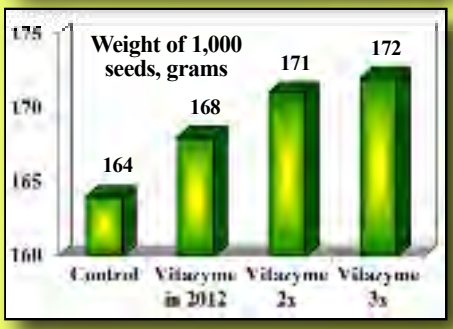
Increase in net income with Vitazyme

Carryover effect ..... 840 UAH/ha
Vitazyme twice ..... 1,850 UAH/ha
Vitazyme three times .... 2,050 UAH/ha

Two or three Vitazyme applications boosted the net income significantly over the control treatment. The carry-over was substantial, giving 840 UAH/ha more income.

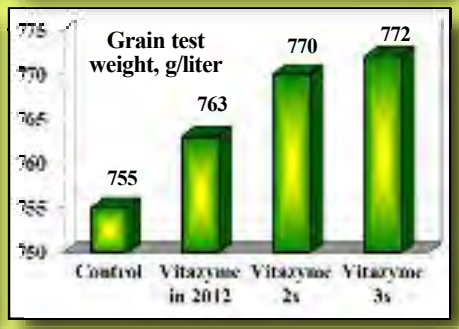
Grain quality results:

1,000 Seed Weight



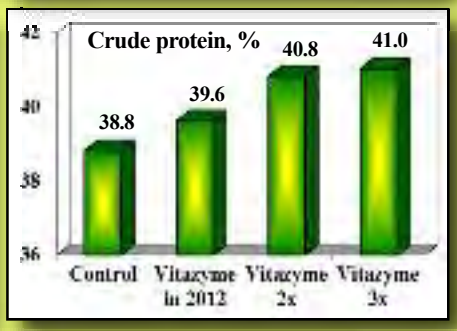
Increase in 1,000 seed weight with Vitazyme: 2 to 5%

Grain Density



Increase in grain density with Vitazyme: 1 to 2%

Crude Protein

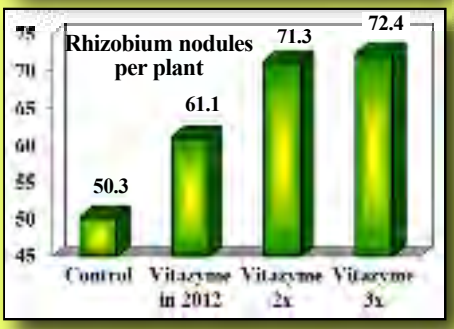


Increase in grain crude protein with Vitazyme: 0.8 to 1.2%-points

All three grain quality parameters were slightly improved with all three Vitazyme regimes, in particular protein, which increased by up to 1.2%-points.

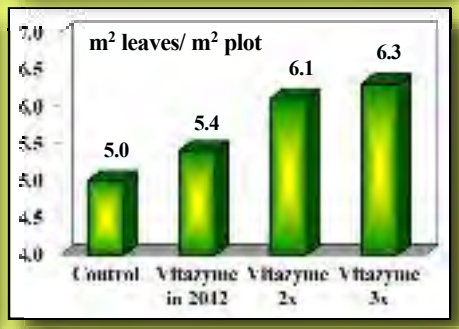
Plant characteristic results:

Rhizobium Nodules



Increase in nodules per plant with Vitazyme: 21 to 44%

Leaf Area



Increase in leaf area with Vitazyme: 8 to 26%

Both nodule number and leaf area of the plants increased with the number of Vitazyme applications. Three applications improved nodule number by an amazing 44%, and leaf area by 126%, but the two-application treatment was nearly as effective.

Conclusions: The researchers concluded,

1. Soybean plants with either one or two foliar treatments (1 L/ha, and 1 L/ha + 0.5 L/ha) of Vitazyme, on top of a 1 L/tonne seed treatment, provided a yield increase of 0.52-0.57 tonne/ha, or 20-22%, and a profit of 1,850-2,050 UAH/ha.

2. The impact of Vitazyme applied in 2012 on soybean yield provided a yield increase of 0.21 tonne/ha (8%), and a profit of 840 UAH/ha.

3. Vitazyme application provided soybean seed quality improvement; the weight of 1,000 seeds increased by 4-8 grams, grain density by 8-17 grams/L, and crude protein by 0.8-2.2%.

4. Vitazyme application on seeds and plants, and carryover effects from 2012, provided an increase of nitrogen-fixing nodules of 9.7-18.6 nodules, and an increase of soybean leaf area of 0.4-1.3 m^2 per one square meter of the plot (m^2/m^2).

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2013 Crop Results

Vitazyme and Fish on Soybeans

Researcher: Bertel Schou, Ph.D. *Research organization*: ACRES (Agricultural Research and Educational Services), Cedar Falls, Iowa
Location: Cedar Falls, Iowa *BBCH scale*: BSOY
Variety: NuTech 7240 (Roundup Ready) *Planting depth*: 1.5 inches *Row spacing*: 30 inches
Planting rate: 53 lb/acre *Planting date*: June 1, 2013 *Slope of plot*: 2%
Tillage: conventional (field cultivating and harrowing) *Previous crop*: corn
Soil type: Maxfield silty clay loam
Soil test values: pH = 6.3, organic matter = 4.7%, cation exchange capacity = 36.5 meq/100 g, N = 97 lb/acre, SO_4-S = 31 lb/acre, P_2O_5 = 278 lb/acre, Ca = 10,225 lb/acre, Mg = 1,129 lb/acre, K_2O = 250 lb/acre, Na = 99 lb/acre, B = 1.7 lb/acre, Fe = 232.2 lb/acre, Mn = 95.4 lb/acre, Cu = 2.2 lb/acre. Zn = 18.0 lb/acre; percent base saturations: Ca = 70.0%, Mg = 12.9%, K = 0.9%, Na = 0.6%, other bases = 5.1%, H = 10.5%.
Experimental design: A soybean area having plots that were 30 x 10 feet, with six replications, in a randomized complete block configuration, was set up to evaluate the effect of Vitazyme and fish, alone and together, on the yield and growth of soybeans.

Treatment	At planting	At V6R1	At R4
1. Control	0	0	0
2. Vitazyme	13 oz/acre	13 oz/acre	0
3. Fish	2 gal/acre	2 gal/acre	2 gal/acre
4. Vitazyme + Fish	13 oz + 2 gal (Trt. 2 + 3)	13 oz + 2 gal (Trt. 2 + 3)	2 gal/acre (Fish only)

Fertilization: In the fall of 2012, 100 lb/acre of 18-46-0 (% N-P_2O_5-K_2O) and 100 lb/acre of 0-0-60.
Vitazyme application: At planting, for Treatments 2 and 4, 13 oz/acre (1 liter/ha) in-row in a 10 gallon solution; at V6R1 (Treatments 2 and 4), 13 oz/acre (1 liter/ha) sprayed on July 19 at 15 gallons/acre.
Fish application: At planting, for treatments 3 and 4, 2 gallons/acre in-row; at V6R1, 2 gallons/acre on the leaves on July 19; at R4, 2 gallons/acre on the leaves on August 22.
Weed control: herbicides, including glyphosate
Harvest date: October 2, 2013

Yield results:

Treatment	Yield[1]	Yield change
	bu/acre	bu/acre
1. Control	57.85 a	—
2. Vitazyme	58.98 a	1.13 (+2.0%)
3. Fish	60.53 a	2.68 (+4.6%)
4. Vitazyme + Fish	60.03 a	2.18 (+3.8%)
LSD (P = 0.05)	3.72	
Standard deviation	3.03	
CV	5.1%	
Replicate F	4.992	
Treatment F	0.451	

[1] Means followed by the same letter are not significantly different at P = 0.05 according to the Student-Newman-Kuels Test.

None of the treatments yielded significantly more than the control at P = 0.05. Increases varied from 2.0% for Vitazyme to 4.6% for the fish; the products together gave a 3.8% yield increase.

Bean moisture results: There were no significant differences in soybean moisture, which ranged from 12.49 to 12.64%.

Conclusions: This Iowa soybean study, using Vitazyme and fish alone and in combination, revealed that yields were improved but not significantly. These increases were from 2.0 to 4.6%, and there appeared to be no synergism between the two products, even though testimonials from growers indicate that Vitazyme and fish products work exceptionally well in combination.

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2012 Crop Results

Vitazyme on Soybeans

Researcher: Linden Heikens
Location: Lake Park, Iowa
Variety: Pioneer 91Y92
Planting date: May 26, 2012
Soil type: silty clay loam
Planting rate: 166,000 seeds/acre
Planting depth: 1.75 inches
Row spacing: 30 inches

Experimental design: A soybean field was divided into Vitazyme treated and control areas, to determine the effects of Vitazyme on the yield from one application.

1. Control **2. Vitazyme**

Fertilization: 100 lb/acre of 0-0-60% N-P_2O_5-K_2O, and 100 lb/acre 18-46-0, applied in April of 2012

Vitazyme application: 13 oz/acre at early bloom (June 28, 2012), along with herbicide

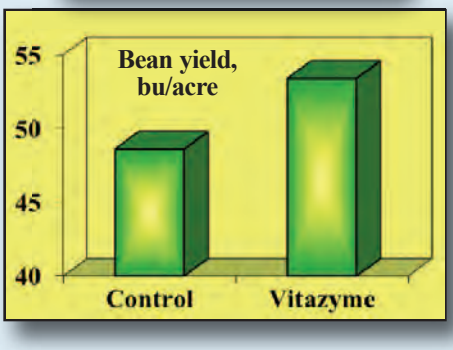
Herbicide application: pre-emergence (May 17, 2012), 2 lb/acre Encompass /AC and 32 oz/acre Roundup (glyphosate); early bloom (June 28, 2012), 0.3 oz/acre Cadet, 5 oz/acre Select, and 36 oz/acre Roundup along with Vitazyme

Harvest date: September 22, 2012

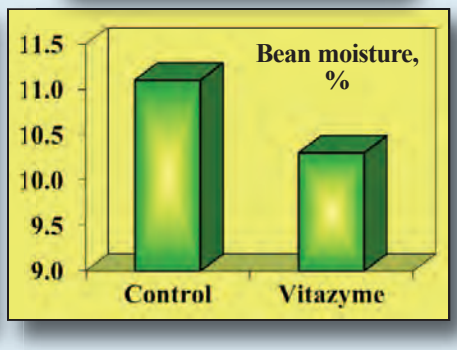
Yield results: A John Deere 9670 combine with a 630F platform and a weigh wagon were utilized.

Treatment	Area	Total yield	Area yield	Yield change	Bean moisture	Moisture change
	acres	lb	bu/acre	bu/acre	%	%
Control	1.61	4,699	48.6	—	11.1	—
Vitazyme	1.61	5,161	53.4	4.8 (+10%)	10.3	-0.8

Bean Yield



Bean Moisture



Increase in bean yield with Vitazyme: 10%

Decrease in bean moisture with Vitazyme: -0.8 %-point

Conclusions: This soybean field trial in northwestern Iowa, using a single foliar Vitazyme application at early bloom, provided a 10% yield increase along with 0.8% less bean moisture at harvest. An income increase of about $67.20/acre — using a price of $14.00/bu — was realized, making the return on product invested about 15:1. Not only was the yield improved, but the beans were drier at harvest, indicating maturity was reached sooner with Vitazyme. Had a treatment been made at planting, the yield increase would likely have been greater. These results prove the great efficacy of this program for soybeans in Iowa.

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2012 Crop Results

Vitazyme on Soybeans

Free Amino Acid Levels -- University of Missouri

Researcher: Manjula Nathan, Ph. D. *Location*: University of Missouri, Columbia, Missouri
Variety: unknown *Planting date*: June 6, 2011 *Row spacing*: 15 inches
Seeding rate: 180,000 seeds/acre *Soil type*: unknown
Experimental design: A soybean area with plots of 15 feet by 200 feet (0.0689 acre), with four replications, was set up to compare Vitazyme treatment with an untreated control, and determine differences in yield, growth characteristics, and tissue levels of free amino acids. This report discusses the effect of Vitazyme on free amino acid levels, which are correlated with plant pathogen activity.

1. Control **2. Vitazyme**

Fertilization: none
Vitazyme application: The seeds were treated with 100% Vitazyme before planting to achieve a 13 oz/acre rate on 180,000 seeds; the untreated seeds received water only. A second Vitazyme application of 13 oz/acre was applied to the leaves and soil on July 13 (R1 stage).
Hail damage event: On July 3 a powerful hailstorm, dropping golf ball sized hailstones, severely damaged the beans, leaving only one trifoliate intact. The soybean plants quickly recovered and produced a reasonable crop.
Free amino acid analysis: Soybean leaves were harvested on July 28 (R3 stage) and August 18 (R5 stage), by collecting 24 of the youngest fully expanded trifoliates from each plot. These samples were washed and frozen for later analyses at a University of Missouri laboratory. The results of the second analysis (August 18 collection) are shown on the next page, except for those amino acids that were not present. The results of the first analysis (July 28 collection) did not show much difference between the two treatments, so are not shown.

Amino acid*	Control	Vitazyme	Change
	µg/100 mg	µg/100 mg	µg/100 mg
Aspartic acid	20.86	12.25	-8.61
Threonine	22.25	18.02	-4.23
Serine	19.58	15.55	-4.03
Asparagine	17.78	16.98	-0.80
Glutamic acid	7.01	3.91	-3.10
Glutamine	6.12	6.07	-0.05
Proline	24.11	15.23	-8.88
Glycine	8.52	5.88	-2.64
Alanine	32.67	22.78	-9.89
Citrulline	2.14	2.35	+0.21
α-amino-n-butyric acid	2.59	2.05	-0.54
Valine	26.92	21.45	-5.47
Methionine	5.33	1.69	-3.64
Cystine	14.57	15.53	+0.96
Isoleucine	19.39	20.27	+0.88
Leucine	35.21	26.50	-8.71
Tyrosine	11.88	9.81	-2.07
Phenylalanine	25.99	17.86	-8.13
∂-amino butyric acid	52.45	47.24	-5.21
Homocystine	0.83	2.52	+1.69
Tryptophan	6.69	7.75	+1.06
Ornithene	18.73	26.67	+7.94
Lysine	26.55	19.73	-6.82
Histidine	4.51	4.20	-0.31
Arginine	24.87	17.17	-7.70
Totals	437.55	359.46	-78.09 (-18%)

In all but a few cases, Vitazyme lowered the amino acid level in the soybean plant tissue, with an overall 18% reduction in total free amino acids. This great reduction very likely would inhibit the proliferation of pathogenic bacteria, fungi, nematodes, and other organisms that would prey on the plant, reducing their number and activity, and the loss of production due to their presence.

Conclusions: In this University of Missouri study on the effect of Vitazyme on soybean yield, growth parameters, and free amino acids levels, the free amino acids were shown to be significantly reduced by two Vitazyme applications, one at planting (on the seeds) and one at the R1 stage. The reduction was 18%, meaning the plant pathogens (bacteria, fungi, nematodes, viruses, and some insects) would be inhibited from damaging the plants. Vitazyme enhances metabolic cycles in plants, thus speeding the incorporation of free amino acids into proteins (proteosynthesis) and reducing their buildup in plant tissues.

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2012 Crop Results

Vitazyme on Soybeans

Yield and Plant Characteristics - University of Missouri

Researcher: Manjula Nathan, Ph. D., and Timothy Reinbott, research station supervisor
Location: University of Missouri Division of Plant Sciences, Columbia, Missouri, research farm
Variety: unknown *Planting date*: June 6, 2011 *Row spacing*: 15 inches
Planting rate: 180,000 seeds/acre
Experimental design: An experimental area was established with soybeans in plots that were 15 feet wide by 200 feet long (0.0689 acre), with four replications. The objective of the trial was to determine the effect of Vitazyme on bean yield and growth characteristics, and also to evaluate the effects of the product on free amino acid levels; this evaluation is discussed in a separate report.

1. Control **2. Vitazyme**

Fertilization: none
Vitazyme application: The seeds were treated with 100% Vitazyme before planting to achieve a 13 oz/acre rate on 180,000 seeds; the untreated seeds received water only. A second Vitazyme application of 13 oz/acre was applied to the leaves and soil on July 13 (R1 stage).
Hail damage event: On July 3 a powerful hailstorm, dropping golf ball sized hailstones, severely damaged the beans, leaving only one trifoliate intact. The soybean plants quickly recovered, however, and produced a reasonable crop.
Plant analysis results: Twenty-four of the youngest fully expanded trifoliate leaves from each plot were harvested on July 28 (R3) and August 18 (R5) for analysis at the University of Missouri Soil and Crop Testing Laboratory. The July 28 data is not shown here because of lack of uniformity of the data. Below is the data for the August 18 sample. d.m. = dry matter.

Treatment	Nitrogen	N change	Phosphorus	P change	Potassium	K change	Crude protein	Protein change
	% d.m.	% d.m.	% d.m.	% d.m.	% d.m.	% d.m.	%	%
Control	3.40	—	0.26	—	1.35	—	21.3	—
Vitazyme	3.50	0.10 (+3%)	0.29	0.03 (+12%)	1.42	0.07 (+5%)	21.6	0.3 (+1.4%)

Increase in leaf tissue levels with Vitazyme:

Nitrogen 3%
Phosphorus 12%
Potassium 5%
Crude Protein 1.4% (0.3%-point)

All leaf nutrient parameters and crude protein, especially leaf phosphorus, were increased with Vitazyme.

Bean analysis results: Soybean samples ar harvest were analyzed for elements, protein, and oil at the University of Missouri Soil and Plant Testing Laboratory, with the following results.

Treatment	N	P	K	Ca	Mg	Zn	Fe	Mn	Cu	B	Mo	S	N:S
	%	%	%	%	%	ppm	ppm	ppm	ppm	ppm	ppm	%	
Control	5.32	0.55	1.66	0.35	0.27	35.6	59.8	26.4	10.5	39.2	1.6	0.18	29.5
Vitazyme	5.16	0.53	1.65	0.35	0.27	36.2	53.5	26.3	10.3	39.5	1.5	0.19	27.5

The elements varied little between the two treatments.

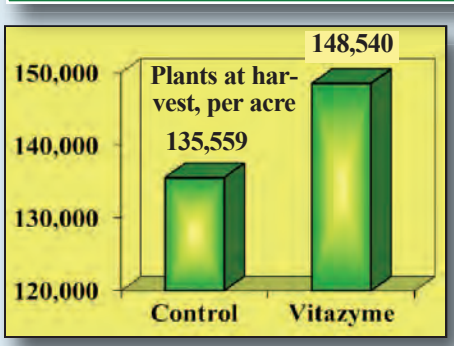
Treatment	Crude protein	Oil
	%	%
Control	33.5	19.5
Vitazyme	32.1	19.6

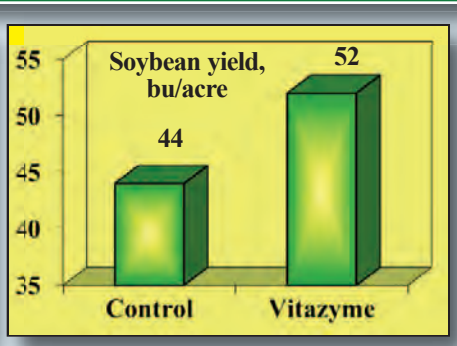
While crude protein dropped with Vitazyme, the oil content rose slightly, but neither change was great.

Yield and stand results:

Treatment	Stand count	Stand change	Bean yield[1]	Yield change
	plants/acre	plants/acre	bu/acre	bu/acre
Control	135.559	—	44 b	—
Vitazyme	148,540	12,981 (+10%)	52 a	8 (+18%)

[1]Letters a snd b are significantly different at P = 0.10.



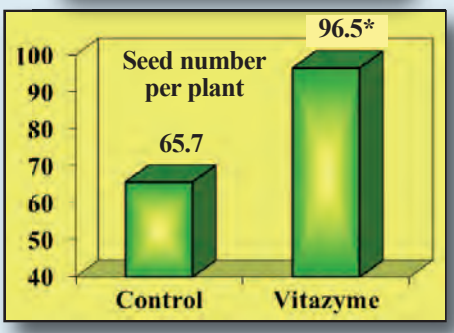


Increase in final stand with Vitazyme: 10%

Increase in yield with Vitazyme: 18%

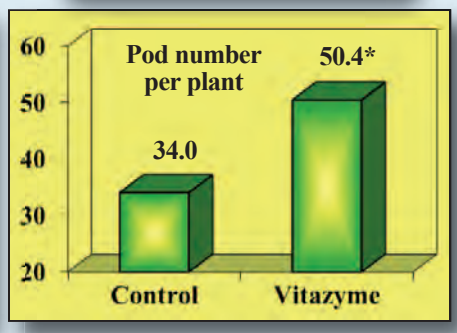
Vitazyme enhanced both the population and yield of the soybeans, even with a severe hailstorm in July.

Seeds Per Plant



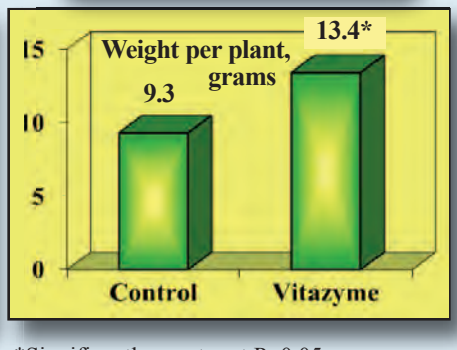
*Significantly greater at P=0.05.

Pods Per Plant



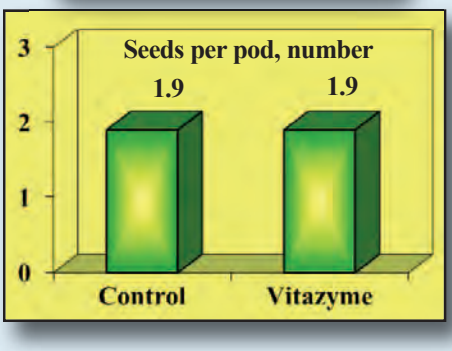
*Significantly greater at P=0.05.

Weight Per Plant

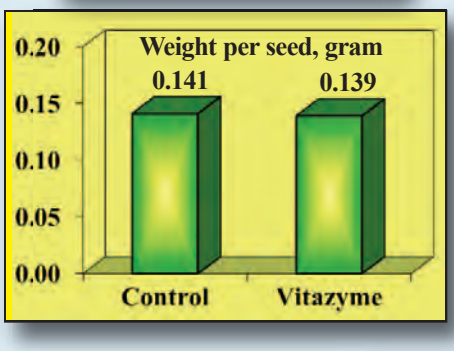


*Significantly greater at P=0.05.

Seeds Per Pod



Weight Per Seed



Vitazyme produced more vigorous plants having more pods, seeds, and plant weight. However, the seeds per pod and weight per seed were the same for both treatments.

Increase with Vitazyme

Seeds per plant 47%
Pods per plant 48%
Weight per plant 44%

Conclusions: A replicated plot study on soybeans at the University of Missouri -- Columbia revealed that Vitazyme increased leaf nutrients during growth, especially for phosphorus (by 12%), and leaf crude protein as well. There was little effect in grain nutrient, protein, and oil levels. Growth parameters and yield were greatly enhanced: seeds per plant by 47%, pods per plant by 48%, and weight per plant by 44%; seeds per pod and seed weight were not affected. The final stand was improved by 10%, perhaps due to enhanced recovery after a severe hailstorm in early July, and yield was increased by 8 bu/acre, or 18%. These results show the great utility of using Vitazyme to improve soybean growth and yield in Missouri. Data on free amino acids in tissues are discussed in a separate report.

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2012 Crop Results

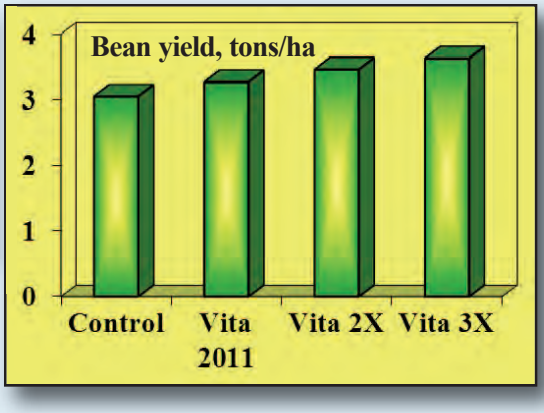
Vitazyme on Soybeans

Researcher: V. Plotnikov *Research organization*: National Academy of Agricultural Sciences
Location: Vinnytsia, Ukraine *Variety*: Hutoryanochka *Tillage*: conventional (disking, plowing, harrowing, and cultivation) *Soil type*: gray podzolic (2.2% organic matter, 8.4 mg/100 g of soil hydrolyzed N, 15.8 mg/100 g of soil P, 12.4 mg/100 g of soil exchangeable K, pH = 5.5)
Planting date: May 12, 2012 *Previous crop*: soybeans *Planting rate*: 750,000 seeds/ha
Experimental design: A small plot soybean trial, using 0.1 ha plots and four replications, was established to evaluate the effects of Vitazyme, applied two or three times, on soybean yield, income, nodulation, and quality. Some plots were placed on soils treated the previous year with Vitazyme to evaluate any carryover effects.

1. Control **2. Vitazyme carryover** **3. Vitazyme twice** **4. Vitazyme three times**

Fertilization: none
Vitazyme application: For Treatment 2, applications were made in 2011 on soybeans that had been treated twice. For Treatment 3, 1 liter/ton of seeds was applied before planting (May 12), and 0.5 liter/ha was sprayed on the leaves and soil at the second trifoliate (June 12). For Treatment 4, the same applications were made as for Treatment 3, plus an additional 0.5 liter/ha at branching (June 22).
Yield results:

Treatment	Bean yield	Yield change	Income increase
	tons/ha	tons/ha	hrn/ha
1. Control	3.05	—	—
2. Vitazyme in 2011	3.27	0.22 (+7%)	924
3. Vitazyme 2X	3.46	0.41 (+13%)	1,602
4. Vitazyme 3X	3.63	0.58 (+19%)	2,221



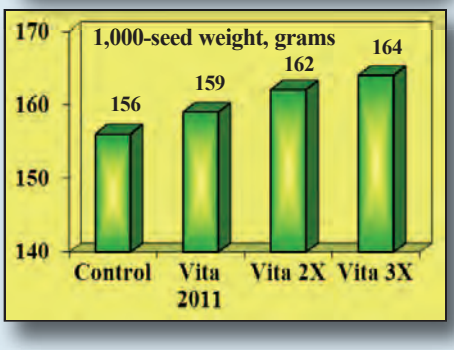
Yields of soybeans responded very well to Vitazyme application, with a carryover effect of 7%, and two applications giving a 13% increase. Three applications provided an excellent 19% yield improvement, granting 2,221 hrn more income per hectare.

Increase in soybean yield with Vitazyme

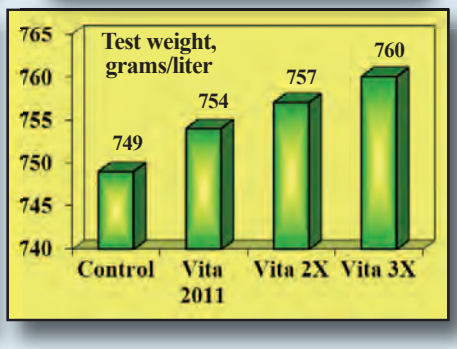
Carryover effect 7%
Vitazyme two times 13%
Vitazyme three times 19%

Bean quality results:

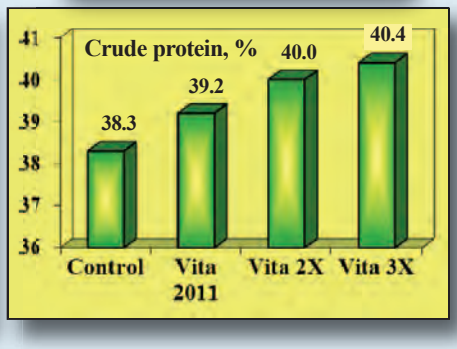
Weight of 1,000 Seeds



Bean Test Weight



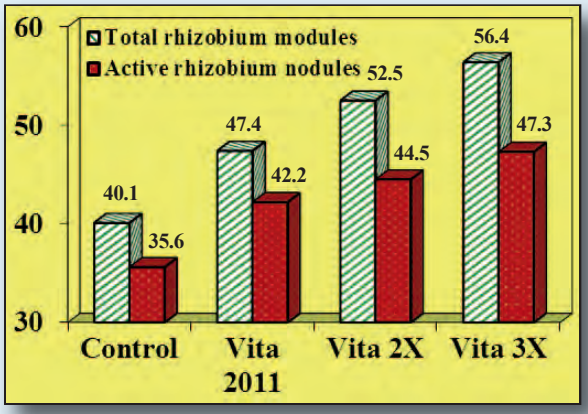
Crude Protein



Increase in bean quality with Vitazyme			
	1,000 seeds, grams	Test weight, grams/liter	Protein, %
Vitazyme carryover	3	5	0.9
Vitazyme twice	6	8	1.7
Vitazyme three times	8	11	2.1

All bean quality parameters were enhanced with Vitazyme, three applications doing better than two. There was good evidence of a carryover effect from 2011 as well.

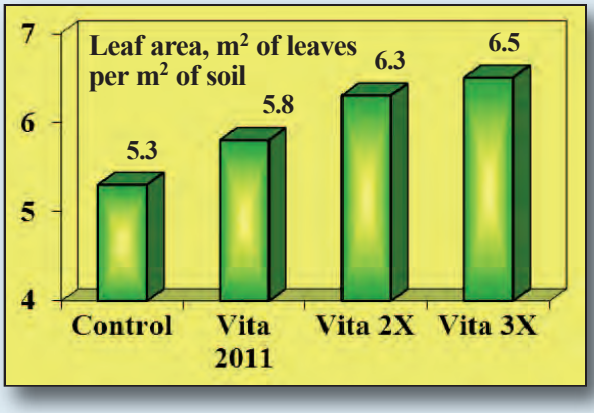
Rhizobium nodulation results: Counts were made of the nodules in the late flowering stage.



Increase in Rhizobium nodules with Vitazyme		
	Total	Active
Vitazyme carryover	+18%	+19%
Vitazyme twice	+31%	+25%
Vitazyme three times	+41%	+33%

Vitazyme n all cases caused great increases in *Rhizobium* nodulation of both total and active types. Three applications produced the greatest increases (33% more active nodules).

Leaf area results: At the late flowering stage, leaf area determinations were made.



Increase in leaf area with Vitazyme
Vitazyme in 2011 ..... +9%
Vitazyme twice ..... +19%
Vitazyme three times ..... + 23%

Leaf area increased up to 23% as more Vitazyme was applied. There was a noticeable carryover effect of 9% from a 2011 application.

Conclusions: A soybean trial in Ukraine compared Vitazyme with an untreated control. Vitazyme was applied the year before and in 2012 on the seeds before planting at 1 liter/ton of seed, and either once or twice more during growth at 0.5 liter/ha. Yields responded consistently to all applications, increasing by 7% for the 2011 carryover effect, and 13 to 19% for the two and three application treatments, respectively. Bean quality also was positively influenced by Vitazyme, the 1,000-seed weight, test weight, and crude protein all responding to the applications in stairstep fashion. The 2011 treatment gave the smallest response in bean quality. Three Vitazyme applications produced 8 more grams per 1,000 seeds, 11 more grams per liter for test weight, and 2.1% more protein than the untreated control. Root nodulation was greatly enhanced by Vitazyme, increasing by up to 33% with three treatments, but by 19% with a 2011 application. Leaf area increases were from 9 to 23%. The *Rhizobium* nodulation and leaf area increases both point towards greater nitrogen and carbon fixation to stimulate growth that produced the yield and quality results noted in this study. Vitazyme is shown to be a very viable soybean amendment for Ukraine.

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2012 Crop Results

Vitazyme on Soybeans

Researcher: Bert Schou, Ph.D.
Research organization: Agricultural Custom Research and Education Services (ACRES)
Location: Cedar Falls, Iowa *Variety*: Pioneer 92M72 (non-GMO) *Previous crop*: corn
Soil type: Kenyon Loam (39% sand, 40% silt, 21% clay), 4.7% organic matter, pH = 5.9, C.E.C. = 16.8 meq/100g, fertility level = excellent, soil drainage = excellent *Planting depth*: 1.5 inches
Row spacing: 30 inches *Planting rate*: unknown *Seedbed at planting*: fine
Planting date: May 18, 2012 *Plot size*: 15 x 40 feet (600 ft.^{2}) *Tillage*: conventional
Irrigation: 3 inches total in late July and early August
Experimental design: A small plot, replicated trial, with four replicates, was set up to evaluate the ability of two Vitazyme variations, plus an amino acid formulation, alone and in combination, to affect soybean yield and quality.

Treatment	Vitazyme 1*	Vitazyme 2*	Amino acids*
1	0	0	0
2	13 oz/acre (2x)	0	0
3	0	13 oz/acre (2x)	0
4	0	0	2 oz/acre (2x)
5	13 oz/acre (2x)	0	2 oz/acre (2x)

*All applications were on the seeds at planting, and on the leaves and soil later.

Fertilization: none
Vitazyme application: For Treatments 2, 3, and 5, 13 oz/acre on the seeds at planting (May 18), and again at 13 oz/acre on the leaves and soil at V8R1 (early bloom; July 4), were applied. Treatments 2 and 5 received Vitazyme 1, and Treatment 3 received a slight modification called Vitazyme 2.
Amino acid application: A proprietary amino acid blend was applied to Treatments 4 and 5, to the seeds at 2 oz/acre on May 18, and to the leaves and soil at the V8R1 stage at 2 oz/acre on July 4. For Treatment 5, the amino acids were mixed with the Vitazyme.
Sprayer settings: seed treatment, 10 gallons/acre of 115 ml of Vitazyme in 3 gallons of water, or 18 ml of amino acids in 3 gallons of water; foliar and soil treatment, 15 gallons/acre of 77 ml of Vitazyme in 3 gallons of water, or 12 ml of amino acids in 3 gallons of water
Weed control: Stellar herbicide at 4 oz/acre, Basagran at 1 pint/acre, Select Max at 8 oz/acre, and the surfactant Class Act 17% at 1 pint/acre, applied June 20
Weather during the growing season: The season was hot and dry, with the July average high temperature being 92.3^o F, and the August high being 85.5^o F. Rainfall for April through October 12 was 12 inches, whereas the normal is 26 inches.
Harvest date: September 25, 2012. A Massey-Ferguson 9 plot combine harvested the middle two rows of

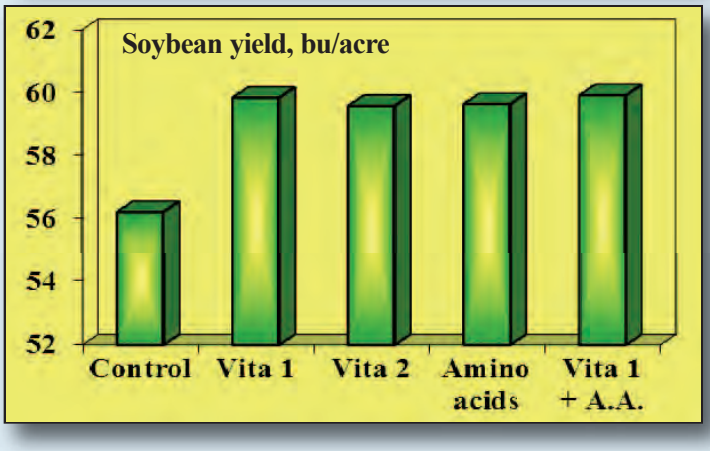
each plot, and the soybeans were weighed on an electronic scale.
Plant population results: no significant differences
Test weight results: no significant differences
Soybean protein results: Composite bean samples from the four replicates of each treatment were sent to Midwest Laboratories, Inc., Omaha, Nebraska, to evaluate protein levels. All five treatments varied within a narrow range, of 38.7 to 40.2%, the control being 39.4%.
Yield results: The two inner rows of each plot were harvested.

Treatment	Yield[1]	Yield change
	bu/acre	bu/acre
1. Control	56.22 b	—
2. Vitazyme 1	59.84 a	3.62 (+6%)
3. Vitazyme 2	59.58 ab	3.36 (+6%)
4. Amino acids	59.64 a	3.42 (+6%)
5. Vita 1 + A.A.	59.92 a	3.70 (+7%)
$LSD_{0.05}$	3.39 bu/acre	
Standard deviation	2.53 bu/acre	
Replicate F	16.910	
Treatment F	1.960	
C.V.	6.09%	

[1]Means followed by the same letter are not significantly different at P = 0.05, according to the Student-Newman-Keuls Test.

Yield increase with Vitazyme and amino acids

Vitazyme 1 ..... 6%
Vitazyme 2 ..... 6%
Amino acids 6%
Vitazyme + Amino acids 7%



All four treatments increased soybean yield to about the same level: 6 to 7%. All displayed significant increases over the control, except Vitazyme 2, which was nearly significant.

Conclusions: A soybean replicated trial in east-central Iowa, during a hot and dry season, revealed that two varients of Vitazyme and an amino acid formulation, alone or together, all raised bean yield by 6 to 7%; all increases were significant, except for the Vitazyme 2 treatment, which was nearly so. Test weight and protein were not influenced significantly by the treatments. These results show the great efficacy of utilizing these materials for Corn Belt soybean production, since at $16.00/bu (the fall 2012 soybean price) a 3.62 bu/acre increase for Vitazyme 1 equals $57.92/acre greater income.

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2012 Crop Results

Vitazyme on Soybeans

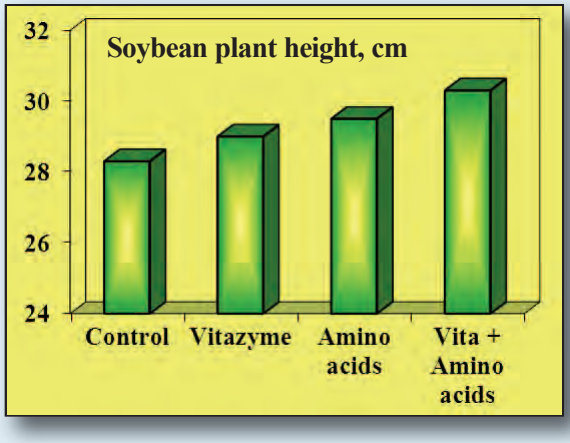
A Greenhouse Trial - Synergism with Amino Acids

Researcher: Paul W. Syltie, Ph.D.
Location: Vital Earth Resources Research Greenhouse, Gladewater, Texas
Variety: "Common" *Planting date*: January 19, 2012 *Pot size*: 1 gallon
Soil type: silt loam *Planting rate*: 12 seeds/pot, thinned to two plants per pot
Experimental design: A greenhouse pot trial, using four replicates, was arranged to determine the effect of Vitazyme and amino acids, alone and in combination, on plant height and dry weight accumulation.

1. Control **2. Vitazyme** **3. Amino acids** **4. Vitazyme + amino acids**

Fertilization: none
Vitazyme application: Pots of Treatments 2 and 4 received 100 ml/pot of a 0.1% Vitazyme solution just after seeding.
Amino acid application: A special liquid proprietary amino acid blend was applied at 100 ml/pot of a 0.04% solution to Treatments 3 and 4. For Treatment 4, the product was mixed with Vitazyme in 100 ml of water.
Harvest date: March 1, 2012, 41 days after planting
Height results: The two plants from each pot were measured to the nearest cm, and averaged. A statistical analysis was performed on these averages.

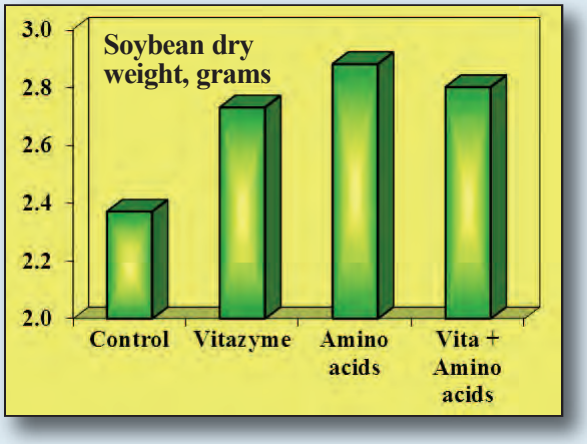
Treatment	Plant height	Height change
	cm	cm
1. Control	28.3 b	—
2. Vitazyme	29.0 ab	0.7 (+2%)
3. Amino acids	29.5 ab	1.2 (+4%)
4. Vita + A.A.	30.3 a	2.0 (+7%)
Block F	0.1105	
Main effects F	0.1338	
Model F	0.1006	
$CV_{0.10}$	3.83%	
$LSD_{0.10}$	1.5 cm	



Increase in plant height with Vitazyme + amino acids: 7%

All treatments increased the height of the soybean plants, the combined products doing this significantly (+7%).

Dry weight results: The plants from each pot were dried in a drying oven at 125° F for 24 hours, and weighed to the nearest 0.01 gram.



Treatment	Plant dry weight	Weight change
	grams	grams
1. Control	2.37 b	—
2. Vitazyme	2.73 a	0.36 (+15%)
3. Amino acids	2.88 a	0.51 (+22%)
4. Vita + A.A.	2.80 a	0.43 (+18%)
Block F	0.679	
Main effects F	0.0053**	
Model F	0.0216*	
$CV_{0.10}$	5.69%	
$LSD_{0.10}$	0.20 gram	

All of the treatments significantly improved soybean dry weight (P = 0.10) above the control, and were not significantly different from one another.

Increase in dry weight

Vitazyme 15%
Amino acids 22%
Vitazyme + Amino acids 18%

Conclusions: This greenhouse trial with soybeans revealed that both Vitazyme and amino acids improved the dry weight of the crop significantly, and the plant height as well for the combined products. No synergism of the products was detected in this trial, except for an indication of it in plant height response.

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2011 Crop Results

Vitazyme on Soybeans

Researcher: Unknown
Research coordinator: I.V. Braginets
Research organization: Alfa-Agro, Ukraine
Variety: unknown
Experimental design: A field was divided into a Vitazyme treated and an untreated portion to evaluate the effect of this product on crop yield.

1. Control **2. Vitazyme**

Fertilization: farm practice
Vitazyme application: 1 liter/ha sprayed on the leaves and soil at flower initiation
Yield results: No yield results are available, but the increase in yield is given.

Increase in soybean yield with Vitazyme:
0.53 tons/ha (7.9 bu/acre)

Conclusion: This yield increase was an excellent result of Vitazyme application in this Ukraine study.

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2011 Crop Results

Vitazyme on Soybeans

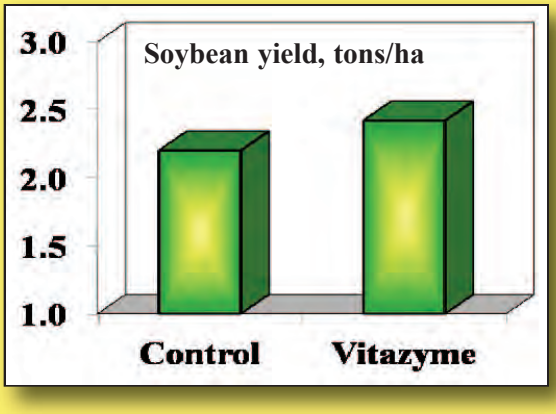
Farmer: unknown *Location*: Chau Thanh District, Dong Thap Province, Mekong Delta, Viet Nam
Variety: unknown *Soil type*: alluvial *Planting date*: February through May 2011
Experimental design: A soybean test involving 118 farmers on a total of 70 ha was initiated the spring of 2011 to evaluate the effects of Vitazyme on soybean yield and profitability.

1. Control **2. Vitazyme**

Fertilization: unknown
Vitazyme application: (1) 1 liter/ha on the leaves and soil 15 days after seeding; (2) 1 liter/ha on the leaves and soil 55 days after seeding
Yield results:

Treatment	Soybean yield	Yield change
	tons/ha	tons/ha
Control	2.20	—
Vitazyme	2.42	0.22 (+10%)

Increase in yield with Vitazyme: 10%



Growth results: Soybeans treated with Vitazyme showed **fewer insect and disease infestations** than the untreated beans.
Income results:

Parameter	Control	Vitazyme
	------ Vietnamese dollars/ha[2] ------	
Total income	33,000,000	36,420,000
Total expenditures[1]	15,297,000	14,920,000
Net income	17,703,000	21,500,000
Extra profit with Vitazyme	---	3,797,000

[1]Costs for the control soybeans were 6,953 VND/kg of crop; for Vitazyme soybeans, the costs were 6,156 VND/kg of crop.
[2]1 USD = 20,000 VND.

Increase in profit with Vitazyme: 3,797,000 VND/ha ($189.85)

Plant protection chemicals	Applications of sprays for plant protection	
	Control	Vitazyme
Pesticides	5	4.4
Anti-disease products	2	1.6
Herbicides	1	1

The improved net income with Vitazyme was due to ...
(1) increased yield
(2) reduced cost for plant protection

Conclusion: A soybean study in the Mekong Delta of Viet Nam, involving 118 farmers and 70 ha of land, compared two Vitazyme applications to none, and revealed that the yield with this product was increased by 10%. Besides, the number of pesticides and anti-disease products applied with Vitazyme treatments was reduced, further reducing costs. The total returns from Vitazyme application were $189.85/ha (3,797,000 VND/ha) greater than for the control areas.

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Average Values for 2009 to 2011 in Ukraine

Vitazyme on Soybeans

Researcher: V.V. Plotnikov *Location*: National Academy of Agrarian Sciences, Vinnytsia State Agricultural Research Station, Vinnytsia, Ukraine (Central Forest and Steppe Region)

Demonstration plot values averaged over three years, 2009 to 2011:

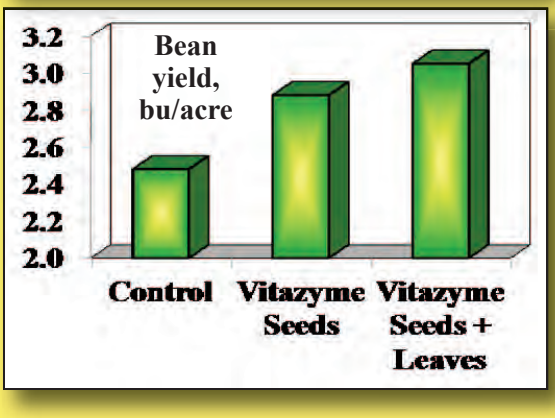
Treatment	Yield	Yield change
	tons/ha	tons/ha
1. Control	2.48	—
2. Vitazyme on seeds[1]	2.88	0.40 (+16%)
3. Vitazyme on seeds + leaves[2]	3.05	0.57 (+23%)

[1]1 liter/ton of seeds; [2]1 liter/ha at branching.

Three-Year Average Increases With Vitazyme

1 liter/ton of seed ..... +16%
1 liter/ton of seed + 1 liter/ha ... +23%

Three-Year Average



Conclusion: Over three years of demonstrations, Vitazyme is shown to be an excellent adjunct to soybean production in Ukraine, especially the seed plus foliar applications.

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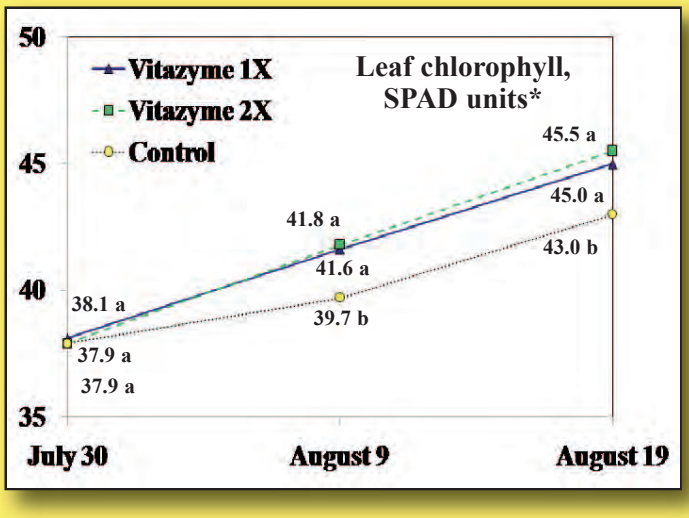
2011 Crop Results

Vitazyme on Soybeans

Researcher: Michael Rethwisch, S.J. Boggs, T. Peterson, and B. Whitson.
Research organization: University of Nebraska-Lincoln Extension, David City, Nebraska
Location: Waverly, Nebraska *Variety*: Pioneer 93M11 *Planting date*: May 28, 2010
Previous crop: corn *Tillage*: disking once before planting
Soil type: Kennebec silt loam (pH=5.6-7.3, low salinity, high water availability, excellent permeability)
Seeding rate: 133,000 seeds/acre *Row spacing*: 30 inches
Experimental design: A soybean field in eastern Nebraska was divided into plots that were 12 rows wide x 1,100 feet long. Four replications were utilized. Upon those were superimposed several seed and foliar treatment products applied at low rates to enhance crop growth. The responses to these products were evaluated, including leaf chlorophyll, nodes, height, pods, pod distribution on the nodes, yield, moisture of the beans at harvest, and certain other parameters. Some of the products were fungicides. Only the results with Vitazyme will be reported here.

1. Control **2. Vitazyme on seeds** **3. Vitazyme on seeds + leaves**

Fertilization: none
Vitazyme application: 13 oz/acre (1 liter/ha) directly over the seed at planting on May 28 for Treatments 2 and 3; 13 oz/acre (1 liter/ha) on the leaves and soil on July 20
Chlorophyll results: Chlorophyll readings were taken on July 30, August 9, and August 19 using an SPAD 502 meter on 30 leaflets per plot, using leaves from the top node having fully expanded leaves



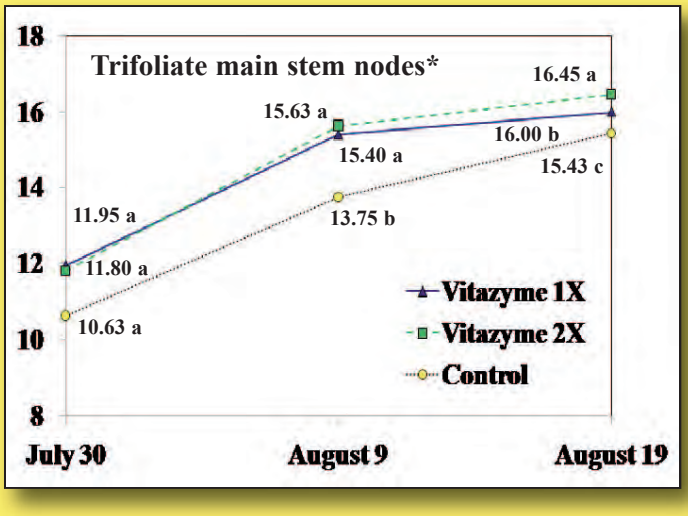
*Means followed by the same letter are not significantly different at P-0.05 according to the Tukey-Kramer HSD Test.

Increase in SPAD units with Vitazyme on August 19

Vitazyme once ..... 2.0 units
Vitazyme twice ..... 2.5 units

During the latter part of the growing season Vitazyme significantly increased leaf chlorophyll for both one and two applications.

Trifoliate main stem nodes results: On July 30, August 9, and August 19 the number of nodes on the main stem was counted for each plot, using ten randomly selected plants.



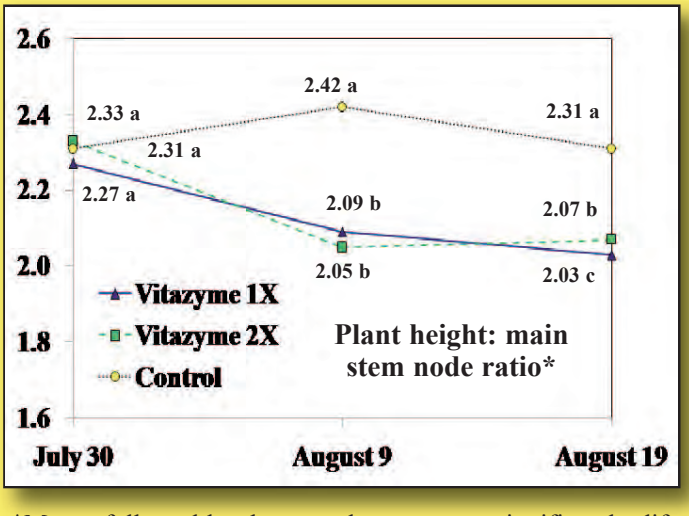
*Means followed by the same letter are not significantly different at P-0.05 according to the Tukey-Kramer HSD Test.

Increase in main stem nodes with Vitazyme

Vitazyme once ..... 4 to 12%
Vitazyme twice ..... 7 to 14%

In every case, both Vitazyme treatments significantly increased the number of nodes on the main stems, especially the two applications treatment.

Plant height:main stem node ratio results: The ration of plant height to the number of nodes on the stem was determined for July 30, August 9, and August 19 on ten randomly selected plants from each plot.



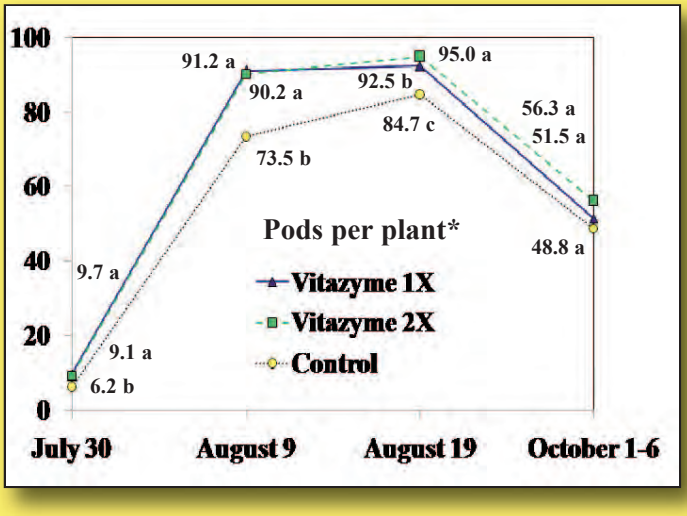
*Means followed by the same letter are not significantly different at P-0.05 according to the Tukey-Kramer HSD Test.

Change in plant height:main stem ratio with Vitazyme

Vitazyme once ... -0.28 to 0.33
Vitazyme twice ... -0.24 to 0.37

A low ratio of plant height to node number is desirable because a lower number means more nodes per unit height of stem. Both Vitazyme treatments significantly reduced the ratio.

Pods per plant results: The total pods per plant were counted on ten randomly selected plants for each plot on several dates.



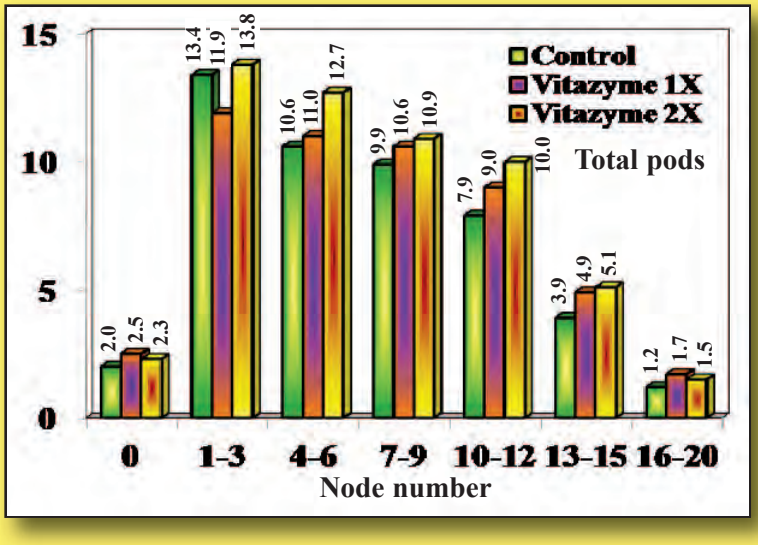
*Means followed by the same letter are not significantly different at P-0.05 according to the Tukey-Kramer HSD Test.

Increase in pods per plant with Vitazyme

Vitazyme once ..... 6 to 56%
Vitazyme twice ..... 15 to 47%

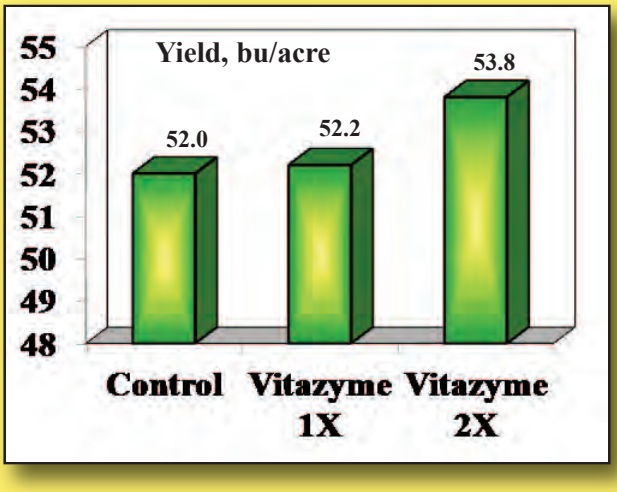
Vitazyme treatments increased pods per plant significant;y for the first three dates, but not for the last date. Many pods were aborted before harvest, giving a reduction for the October count.

Pod distribution results: At harvest, 15 consecutive plants from one of the middle four rows in each plot were collected, and the number of pods was counted for each main stem node.



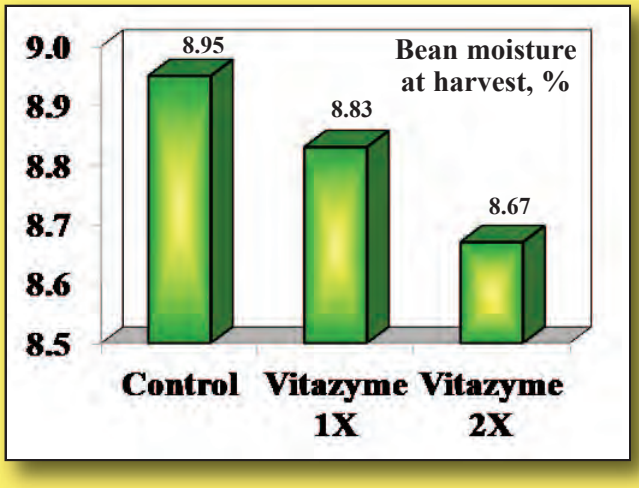
At most nodes, both Vitazyme treatments – especially the two application treatment – increased pods per node. None of the values were significantly different than the untreated control.

Yield results:



Vitazyme treatments increased yield slightly, especially for the two applications, but these increases were not significant at P=0.05.

Moisture at harvest results:



Although the differences in bean moisture at harvest were not significant, both Vitazyme treatments – especially the two application treatment – dried down faster at harvest than did the control.

Conclusions: A replicated soybean study in eastern Nebraska revealed that Vitazyme, as either a seed or a seed plus foliar treatment, significantly improved leaf chlorophyll (2.o to 2.5 SPAD units), main stem nodes (4 to 14%), plant height;main stem node ratios (-0.24 to -0.37), and pods per plant (6 to 56%). Both treatments – especially the seed plus foliar treatment – increased the pods distributed along the stem, and slightly increased yield and reduced moisture at harvest. The lack of a significant yield response is likely due to a lack of adequate soil fertility to fill the pods that were available to fill as the season progressed. These results show the utility of Vitazyme as a powerful tool for soybean producers in the Corn Belt of the United States.

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2011 Crop Results

Vitazyme on Soybeans

Effects on Oil Content

Researcher: Michael Rethwisch
David City, Nebraska
Research organization: University of Nebraska — Lincoln Extension,
Location: Clay Center, Cortland, Bancroft, and Elba, Nebraska
Variety: Pioneer 93M11

Experimental design: Four soybean field locations in Nebraska were selected to place replicated trials using several products. These products included inoculants, humates, fertilizers, and non-microbial biostimulants, of which Vitazyme was one. Evaluations were made of yield, protein, and oil to determine effects of these products on economically important parameters.

Product applications: All products were applied according to the manufacturers' recommendation, with Vitazyme applied at 13 oz/acre (1 liter/ha) at planting using a "splitter" (products were placed beside the seeds). An untreated control was included at all four sites.

Yield results: For all four sites, yield did not vary significantly, ranging from 64.3 to 71.9 bu/acre at Clay Center, from 66.5 to 70.1 bu/acre at Cortland, from 59.9 to 62.2 bu/acre at Bancroft, and from 68.1 to 71.7 bu/acre at Elba.

Protein results: The protein content of the soybeans showed no significant difference amongst all treatments at all four locations, ranging from 34.07 to 34.53% at Clay Center, from 35.19 to 35.53% at Cortland, from 32.83 to 33.35% at Bancroft, and from 34.03 to 34.28% at Elba.

Oil results: At all four sites the Vitazyme treated soybeans produced the highest oil content, although none of the differences among treatments were significant at P=0.05. Because of this consistency of response, the data are presented here.

Clay Center

Treatment	Oil content, %
Vitazyme	19.35
CALFA	19.34
Carbon Boost-S	19.33
CMPX	19.31
GreenSol 48	19.31
BioGerminator 11-0-1	19.30
BioGerminator 3-0-1	19.27
Control	19.24
GS-48	19.12
CXMPX	19.11

Cortland

Treatment	Oil content, %
Vitazyme	19.36
GS-48	19.24
CMPX	19.23
Carbon Boost-S	19.21
Control	19.18
CALFA	19.18
GreenSol 48	19.11
CXMPX	19.11
BioGerminator 3-0-1	19.08
BioGerminator 11-0-1	19.01

Bancroft

Treatment	Oil content, %
Vitazyme	19.71
GreenSol 48	19.70
CXMPX	19.69
BioGerminator 11-0-1	19.63
CMPX	19.61
CALFA	19.60
Bio Germinator 3-0-1	19.60
Carbon Boost-S	19.59
Control	19.58
GS-48	19.46

Elba

Treatment	Oil content, %
Vitazyme	20.03
GreenSol 48	19.99
Control	19.98
CMPX	19.97
CXMPX	19.94
Carbon Boost-S	19.93
BioGerminator 11-0-1	19.91
GS-48	19.90
BioGerminator 3-0-1	19.90
CALFA	19.87

Average for All Locations

Treatment	Oil content, %
Vitazyme	19.62
CMPX	19.53
GreenSol 48	19.53
Carbon Boost-S	19.52
CALFA	19.50
Control	19.50
Bio Germinator 11-0-1	19.46
Bio Germinator 3-0-1	19.46
CXMPX	19.46
GS-48	19.43

Conclusions: It is clear from the total averages from all four locations that Vitazyme had a real effect on soybean oil content. The product boosted oil content by 0.09 percentage point above the next closest oil value, while the other nine treatments varied within a range of only 0.10 percentage point. This product elicited a small but consistent boost in bean oil content in this four-location Nebraska soybean study.

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2011 Crop Results

Vitazyme on Soybeans

An Evaluation of Two Formulations

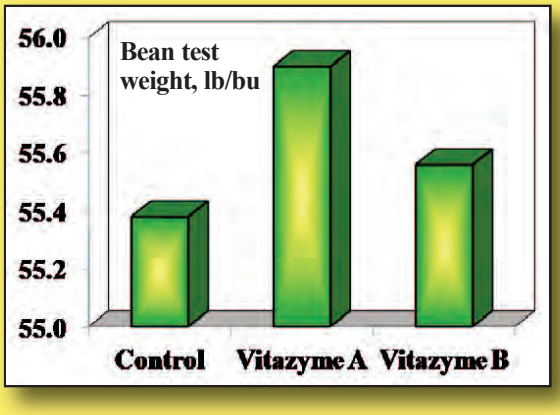
Researcher: Bert Schou, Ph.D. *Research organization*: Agricultural Custom Research and Education Services (ACRES) *Location*: Cedar Falls, Iowa *Variety*: NuTech 7249 (GMO)
Soil type: Floyd loam (42% sand, 39% silt, 19% clay, 4.4% organic matter, pH = 6.4, C.E.C. = 13.3 meq/100 g, fertility level = excellent, drainage = excellent) *Planting depth*: 2 inches
Row spacing: 30 inches *Planting rate*: 150,000 seeds/acre *Seedbed at planting*: fine
Planting date: May 19, 2011 *Tillage*: conventional *Plot size*: 15 x 40 feet (600 ft.^{2})
Experimental design: A small plot study, having six replicates, involved two Vitazyme formulations in a randomized complete block design. The purpose of the study was to evaluate the effectiveness of the two Vitazyme formulations on crop yield and quality.

1. Control **2. Vitazyme A** **3. Vitazyme B**

Fertilization: none
Weed control: herbicides
Vitazyme application: (1) 13 oz/acre (1 liter/ha) in the seed row at planting on May 19, 2011; (2) 13 oz/acre (1 liter/ha) on the leaves and soil at R1 (14 inches height) on July 7, 2011
Weather during the growing season: The season was favorable for soybean growth in terms of temperature and rainfall, despite a dry early July.
Harvest date: October 8, 2011. A Massey Ferguson 8 plot combine harvested the middle two rows of plots, and the beans were weighed using an electronic scale.
Test weight results: There were some differences in test weight for the treatments.

Treatment	Test weight[1]	Test weight change
	lb/bu	lb/bu
1. Control	55.38 b	—
2. Vitazyme A	55.90 a	0.52 (+1%)
3. Vitazyme B	55.56 ab	0.18 (0%)
$LSD_{0.05}$	0.50 lb/bu	
Standard deviation	0.39 lb/bu	
Replicate F	1.54	
Treatment F	2.71	
CV	2.77	

[1]Means followed by the same letter are not significantly different at P=0.05 according to the Student-Newman-Keuls-Test.



Vitazyme A significantly increased bean test weight above the control, while Vitazyme B gave a nonsignificant test weight increase.

Yield results:

Treatment	Yield[1]	Yield change
	bu/acre	bu/acre
1. Control	63.9 a	—
2. Vitazyme A	63.4 a	(-) 0.5 (0%)
3. Vitazyme B	65.2 a	1.3 (+2%)
$LSD_{0.05}$	2.3 bu/acre	
Standard deviation	1.8 bu/acre	
Replicate F	3.64	
Treatment F	1.68	
CV	2.77%	

[1]Means followed by the same letter are not significantly different at P=0.05 according to the Student-Newman-Keuls-Test.

Neither of the products significantly increased yield, although Vitazyme B gave a 1.4 bu/acre yield increase.

Conclusion: A replicated soybean study in east-central Iowa revealed that two Vitazyme formulations improved bean test weight, the Vitazyme A formulation significantly, above the control. Yield increases were not significant, though Vitazyme B improved yield by 1.3 bu/acre over the control. Very high yields during this favorable cropping year may indicate reduced crop stress, thus limiting the crop's response as yields approached the maximum.

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2011 Crop Results

Vitazyme on Soybeans

A Long-Term Crop and Soil Study: Year 4

Researcher: Bert Schou, Ph.D. *Research Organization*: Agricultural Custom Research and Education Services (ACRES)
Location: Cedar Falls, Iowa
Variety: Nu Tech 7244 *Soil type*: Kenyon loam (34% sand, 46% silt, 20% clay, 4.5% organic matter, pH = 7.3, C.E.C = 17.8 meq/100 g, fertility level = excellent, drainage = excellent)
Planting depth: 2 inches *Row spacing*: 30 inches *Planting rate*: 150,000 seeds/acre
Seedbed at planting: fine *Planting date*: May 19, 2011 *Tillage*: conventional
Previous crop: corn (with glyphosate) *Plot size*: 15 x 50 feet (600 ft^2)
Experimental design: The fourth year of research on the long-term effects of Vitazyme on crop yield and quality, and on soil conditions, was conducted on the same plots as the previous three years. Two treatments were utilized, as during previous years, and with five replicates.

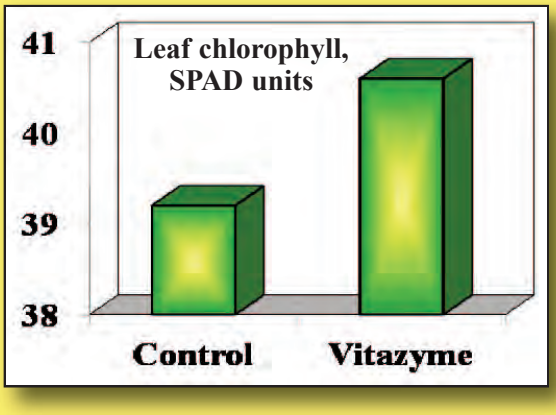
1. Control **2. Vitazyme**

Fertilization: none
Weed control: glyphosate
Vitazyme application: (1) 13 oz/acre (1 liter/ha) on the seeds in-furrow at planting (May 19); (2) 13 oz/acre (1 liter/ha) on the leaves and soil at R1 (July 7)
Weather during the growing season: The season was favorable to soybean growth in terms of temperature and rainfall, except for a dry early July.
Harvest date: October 8, 2011. A Massey-Ferguson 8 plot combine was used to harvest the three center rows of each plot; the beans were weighed electronically, and grain moisture was also measured at this time.
Leaf chlorophyll: On July 26, 2011, 25 random leaves of the first mature trifoliated were measured, and averaged for each plot using a Minolta SPAD meter.

Treatment	Leaf chlorophyll[1]	Chlorophyll change
	SPAD units	SPAD units
1. Control	39.2 b	—
2. Vitazyme	40.6 a	+1.4

[1]Means followed by the same letter are not significantly different at P=0.05 according to the Student-Newman-Kuels Test. $LSD_{0.05}$=0.7 SPAD unit.

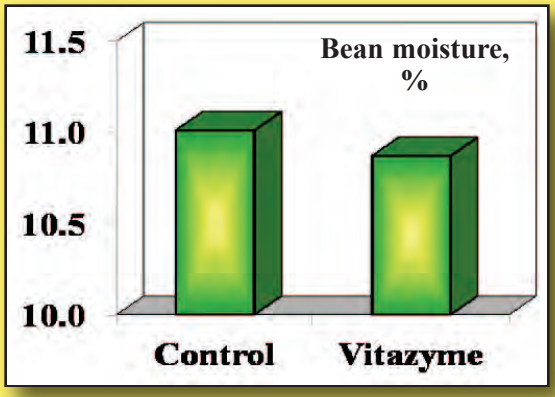
Increase in leaf chlorophyll with Vitazyme: 1.4 SPAD units



Bean moisture: There was a nonsignificant lower moisture content of the Vitazyme treated soybeans compared to those that were untreated.

Treatment	Bean moisture[1]	Change
	%	%
1. Control	11.01 a	—
2. Vitazyme	10.87 a	(-) 0.14
LSD (P=0.05)	0.81%	
Standard deviation	0.46%	
CV	4.22%	
Replicate F	0.845	
Treatment F	0.224	

[1]Means followed by the same letter are not significantly different according to the Student-Newman-Kuels Test (P=0.05).



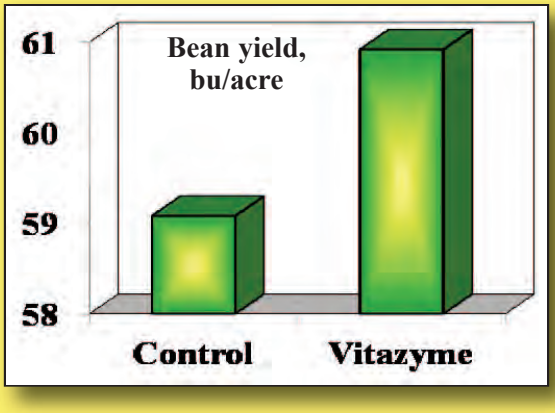
Reduction in bean moisture with Vitazyme: 0.14 percentage point

Bean test weight: There was a nonsignificant increase in test weight with Vitazyme versus the control, of 0.14 lb/bu (55.43 lb/bu for Vitazyme, versus 55.29 lb/bu for the control).

Yield results:

Treatment	Bean yield[1]	Yield change
	bu/acre	bu/acre
1. Control	59.08 a	—
2. Vitazyme	60.92 a	1.84 (+2%)
LSD (P=0.05)	3.75 bu/acre	
Standard deviation	2.13 bu/acre	
CV	3.56%	
Replicate F	10.388	
Treatment F	1.860	

[1]Means followed by the same letter are not significantly different according to the Student-Newman-Kuels Test (P=0.05).



Increase in yield with Vitazyme: 2%

The yield increase with Vitazyme was not significant at P=0.05, but was highly profitable, At $12.00/bu, this 1.85 bu/acre increase was worth $22.08/acre

Grain quality results: Samples of soybeans from each plot was sent to Midwest Laboratories, Omaha, Nebraska, for analyses of protein and minerals. Statistical analyses were conducted on these data.

Treatment	Crude protein	Sulfur	Phosphorus	Potassium	Magnesium	Calcium	Iron	Manganese
	%	%	%	%	%	%	ppm	ppm
1. Control	42.08	0.30	0.602	1.96	0.266	0.332	85.6	34.4 b
2. Vitazyme	42.34	0.31	0.602	2.01	0.268	0.338	92.2	36.6 a
Treatment F		0.374			0.374		0.135	0.011*
$LSD_{0.1}$		0.01			0.004		7.5	1.0

*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Kuels Test.

Treatment	Copper	Zinc
	ppm	ppm
1. Control	11.6	33.8 b
2. Vitazyme	12.6	35.0 a
Treatment F		0.109*
$LSD_{0.1}$		1.2

*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Kuels Test.

Nutrient increases with Vitazyme

- **Crude protein 0.26%-pt**
- **Sulfur 0.01%-pt**
- **Potassium 0.05%-pt**
- **Magnesium 0.002%-pt**
- **Calcium 0.006%-pt**
- **Iron ..... 6.6 ppm**
- **Manganese ..... 2.2 ppm**
- **Copper ..... 1.0 ppm**
- **Zinc ..... 1.2 ppm**

All parameters, except phosphorus and protein, increased in the beans from Vitazyme application. Increases were not always large or significant, but they were positive.

Soil microorganism results: A composite soil sample from each rep of both treatments was collected and sent to the Soil Food Web laboratory in Corvalis, Oregon, for microorganism analyses.

Treatment	Active Bacteria	Total Bacteria	Active Fungi	Total Fungi	Amoebic Protozoa	Nematodes	Nitrogen Release	Actinomycetes
	µg/gram	µg/gram	µg/gram	µg/gram	µg/gram	number/gram	lb/acre	µg/gram
1. Control	8.31	1,762	11.2	304	7,376	7.23	88	2.94
2. Vitazyme	11.90	3,166	14.5	372	34,657	18.30	125	4.30

Improvements in microbial populations with Vitazyme

- **Active bacteria ..... +43%**
- **Total bacteria ..... +80%**
- **Active fungi ..... +29%**
- **Total fungi ..... +22%**
- **Amoebic protozoa..... +370%**
- **Nematodes..... +153%**
- **Nitrogen release..... +37 lb/acre**
- **Actinomyceyes..... +46%**

[1]Most of these nematodes are beneficial types.

Vitazyme increased the number of fungi, bacteria, actinomycetes, and protozoa in the soil versus the untreated control. The ratio of total fungi to total bacteria was 0.17 for the control, and 0.12 for the Vitazyme treatment, showing a preference to soil fungi with Vitazyme, a beneficial trait. Available nitrogen production by soil microorganisms was increased by 42% by Vitazyme treatment as well.

Soil results: Soil samples from each plot of both treatments were sent to Perry Agricultural Laboratory in Bowling Green, Missouri, for a broad analysis of minerals and other parameters. Statistical analyses were conducted on these data.

Treatment	Cation Exchange Capacity	pH	Organic Matter	Nitrogen	Sulfur	Phosphorus	Calcium	Magnesium
	meq/100 grams		%	lb/acre	ppm	lb/acre	lb	lb/acre
1. Control	27.34	5.64 b	2.68	73.6	7.8	128.4	5,398	1,077 b
2. Vitazyme	26.27	5.78 a	2.68	73.6	6.4	147.4	5,447	1,138 a
Treatment F	0.1215	0.0046**	1.000	1.000	0.431	0.452	0.575	0.015*
$LSD_{0.1}$	1.16	0.05	0.26	5.2	3.4	48.7	172.6	172.6

*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Kuels Test.

Treatment	Potassium	Sodium	Boron	Iron	Manganese	Copper	Zinc
	lb/acre	lb/acre	ppm	ppm	ppm	ppm	ppm
1. Control	272	80	0.65	241.2	57.4	0.94	4.60
2. Vitazyme	312	62	0.67	222.8	58.0	0.94	4.54
Treatment F	0.215	0.228	0.918	0.103	0.816	1.000	0.529
$LSD_{0.1}$	58	27	0.23	18.6	5.2	0.15	0.19

Changes in soil parameters with Vitazyme

pH ..... +0.14*
Organic matter ..... no change
Nitrogen ..... no change
Sulfur ..... -1.4 ppm
Phosphorus ..... +19.0 lb/acre
Calcium ..... +49 lb/acre
Magnesium ..... +61 lb/acre
Cation exchange capacity .... -1.07 meq/100g
Potassium ..... +40 lb/acre
Sodium ..... -18 lb/acre
Boron ..... +0.02 ppm
Iron ..... -18.4 ppm
Manganese ..... +0.6 ppm
Copper ..... no change
Zinc ..... -0.06 ppm

Note that most soil parameters were improved with Vitazyme, and significantly for pH and magnesium. Even sodium, which is undesirable at higher levels, was reduced in this study while calcium, magnesium, and potassium were increased.

Balance of Soil Cations

Vitazyme had a remarkable effect on the percentages of base saturation for all of the measured cations, moving the composition of the soil colloid towards a more favorable balance.

Treatment	Calcium Saturation	Magnesium Saturation	Potassium Saturation	Sodium Saturation	Hydrogen Saturation
	% B.S.	% B.S.	% B.S.	% B.S.	% B.S.
1. Control	49.64 b	16.51 b	1.29 b	0.64	25.8 a
2. Vitazyme	52.25 a	18.22 a	1.57 a	0.52	21.6 b
Treatment F	0.013*	0.002**	0.090*	0.294	0.005**
$LSD_{0.1}$	1.31	0.51	0.27	0.21	1.57

B.S. = base saturation
*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Kuels Test.

Control base saturations	Vitazyme base saturations
Ca 49.6	Ca 52.3
Mg 16.5	Mg 18.2
K 1.3	K 1.6
Na 0.6	Na 0.5
H 25.8	H 21.6

All of the elements moved in favorable directions with Vitazyme compared to the control, after four years of treatment. Calcium, magnesium, and potassium increased, while sodium and hydrogen decreased, thus providing better nutrient availability to plants, as mediated by the added microbial stimulation of Vitazyme's active agents. This microbe evidence is available for this year and previous years as well.

Conclusion: The fourth year of a long-term study into the effects of Vitazyme on crop yield (corn-soybean rotation), crop quality, and soil characteristics has shown that this product continues to favorably affect the yields and quality of the crop, and also improves soil parameters. Soybeans were grown in 2011, following corn in 2010, and the following results were obtained.

Leaf chlorophyll. Vitazyme significantly improved leaf chlorophyll in a midsummer evaluation, by 1.4 SPAD units.

Bean moisture at harvest. The treated soybeans were slightly dryer at harvest then were the untreated beans.

Bean yield. Vitazyme increased the yield above the control by 1.84 bu/acre (2%), which was not significant but was highly profitable.

Bean composition. Nearly all minerals and protein were increased in the beans with Vitazyme treatment – especially manganese and zinc, which responded significantly at P=0.10 – and only phosphorus did not respond at all.

Soil microorganisms. Both active and total bacteria and fungi increased above the control with Vitazyme (22 to 80%), but especially the fungi, leading to a lower fungi;bacteria ratio, a favorable result. Protozoa, beneficial nematodes, and actinomycetes also increased with Vitazyme, and projected nitrogen release rose by 37 lb/acre.

Soil parameters. After four years of treatment, the Vitazyme treated soils showed consistent improvements in availability of most elements – except sulfur, iron, copper, and zinc, and sodium, which declined – although soil organic matter and available nitrogen showed no change from the control; magnesium increased significantly at P=0.01. Soil pH increased significantly to 5.78 with Vitazyme. Of special interest is the fact that the cations all significantly moved towards a more favorable balance in terms percent base saturation, sodium declining at the same time.

These results show the considerable benefit of Vitazyme for soybeans and for soil characteristics over a long-term use program on highly fertile Iowa soils.

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2011 Crop Results

Vitazyme on Soybeans

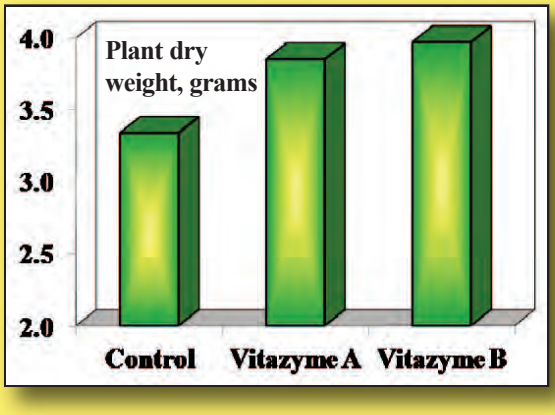
Researcher: Paul W. Syltie, Ph.D *Location*: Vital Earth Resources Research Greenhouse, Gladewater, Texas
Variety: Common *Pot size*: 1 gallon *Soil type*: silt loam
Planting rate: 12 seeds/pot, thinned to 3 plants/pot *Planting date*: November 12, 2010
Experimental design: A replicated greenhouse pot study was conducted to evaluate the effect of two Vitazyme formulations to increase plant growth. Seven replicates were used.

1. Control **2. Vitazyme A** **3. Vitazyme B**

Fertilization: none
Vitazyme application: Vitazyme A: 100 ml/pot at planting of a 0.1% solution, for regular product; Vitazyme B: 100 ml/pot at planting of a 0.1% solution, diluted directly from concentrate
Dry weight results: The plant roots were washed clean of soil on December 15, and weighed to the nearest 0.01 gram.

Treatment	Dry Weight*	Weight change
	grams	grams
Control	3.34 b	—
Vitazyme A	3.85 a	0.51 (+15%)
Vitazyme B	3.97 a	0.63 (+19%)
Treatment P	0.0133*	
Model P	0.0133*	
CV	10.05%	
$LSD_{0.05}$	0.42 gram	

[1]Means followed by the same letter are not significantly different at P=0.05 according to the Student-Newman-Keuls-Test.



Increase in dry weight with Vitazyme A: 15%

Increase in dry weight with Vitazyme B: 19%

Conclusion: A replicated greenhouse soybean study, using two Vitazyme formulations, revealed that both significantly increased dry weight accumulation over the control treatments, by 15% for Vitazyme A and by 19% for Vitazyme B. The results reveal the excellent effectiveness of both products to improve soybean growth, especially the B formulation that is made directly from concentrate.

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2011 Crop Results

Vitazyme on Soybeans

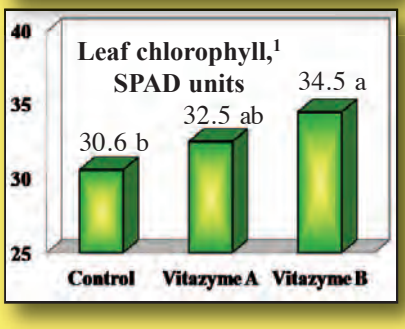
A Greenhouse Study

Researcher: Paul W. Syltie, Ph.D. *Location*: Vital Earth Resources Research Greenhouse, Gladewater, Texas
Variety: common *Pot size*: 1 gallon *Soil type*: silt loam
Planting rate: 12 seeds/pot, thinned to 3 plants/pot *Planting date*: February 14, 2011
Experimental design: A replicated greenhouse pot study was established to evaluate the effects of two Vitazyme formulations on the growth of soybeans. Seven replications were utilized.

1. Control **2. Vitazyme A** **3. Vitazyme B**

Fertilization: none
Vitazyme application: Vitazyme A: 100 ml/pot at planting of a 0.1% solution, from regular product; Vitazyme B: 100 ml/pot at planting of a 0.1% solution, diluted directly from concentrate
Chlorophyll results: At harvest on March 22, chlorophyll determinations were made on the first fully expanded trifoliate, as well as on the second trifoliate; the values for the same pot were averaged. A Minolta SPAD meter was used.

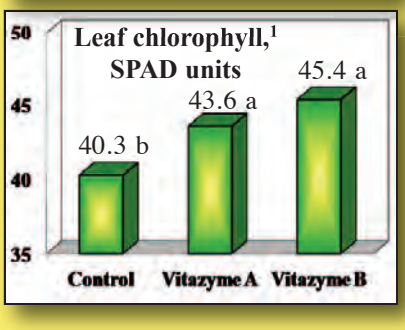
First Trifoliate



Block P - 0.399
Treatment P - 0.039*
Model P - 0.148
$CV_{0.10}$ - 7.86%
$LSD_{0.10}$ - 2.4 units

[1]Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls-Test.

Second Trifoliate



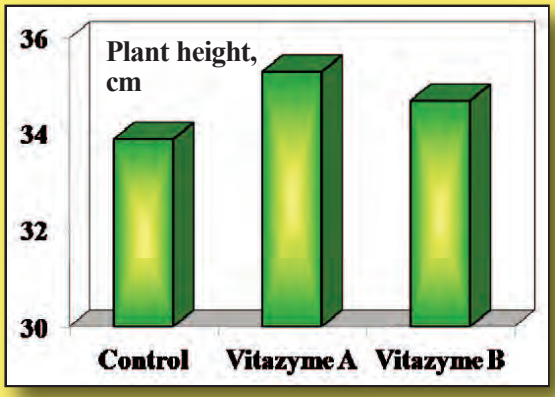
Block P - 0.679
Treatment P - 0.026*
Model P -0.182
$CV_{0.10}$ - 7.09%
$LSD_{0.10}$ - 2.9 units

[1]Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls-Test.

Plant height results: At harvest on March 22, the heights of the three plants for each pot were measured and averaged.

Treatment	Plant height[1]	Height change
	cm	cm
Control	33.9 a	—
Vitazyme A	35.3 a	1.4 (+4%)
Vitazyme B	34.7 a	0.8 (+2%)
Block P	0.288	
Treatment P	0.422	
Model P	0.334	
CV	5.70%	
$LSD_{0.10}$	1.9 cm	

[1]Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls-Test.

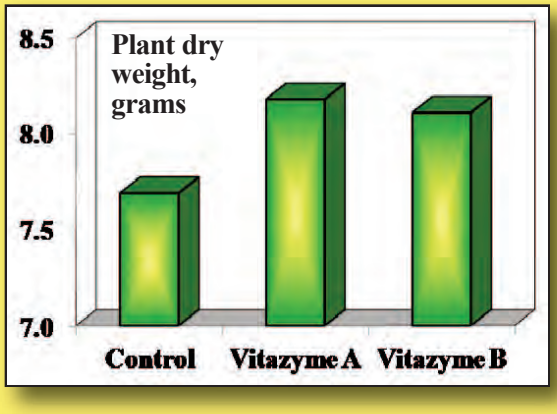


No significant differences were detected on plant height for the three treatments.

Dry weight results: On March 22, the soil was washed from the roots of all plants, and they were placed in a drying oven for 24 hours at 120º F. Weights were made to the nearest 0.01 gram.

Treatment	Dry weight[1]	Weight change
	grams	grams
Control	7.69 a	—
Vitazyme A	8.18 a	0.49 (+6%)
Vitazyme B	8.11 a	0.42 (+5%)
Block P	0.714	
Treatment P	0.335	
Model P	0.641	
$CV_{0.10}$	8.11%	
$LSD_{0.10}$	0.62 gram	

[1]Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls-Test.



Increase in dry weight with Vitazyme

Vitazyme A 6%
Vitazyme B 5%

Although the soybean dry weights were not significantly different, both Vitazyme types increased the weight.

Conclusion: A replicated greenhouse trial with regular Vitazyme, as well as Vitazyme diluted directly from concentrate, revealed significant improvements in leaf chlorophyll for both the first and second mature trifoliates, up to 5.1 SPAD units for Vitazyme B. Both Vitazyme A and Vitazyme B increased plant height (2 to 4%) and dry weight (5 to 6%), but not significantly. These results reveal a tendency of both products to increase crop yield by elevating the rate of photosynthesis and nutrient uptake.

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2011 Crop Results

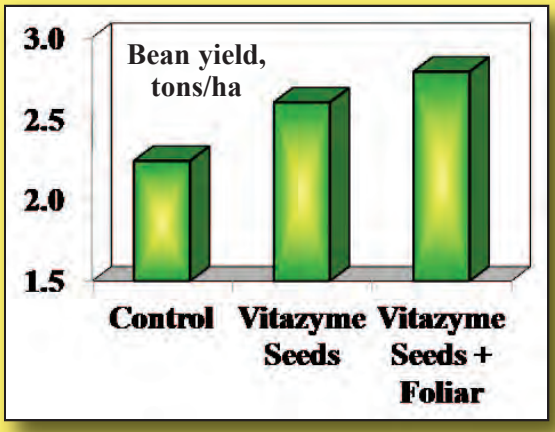
Vitazyme on Soybeans

Researcher: Unknown *Research organization*: National Academy of Agrarian Sciences, Vinnytsia State Agricultural Research Station *Location*: Vinnytsia, Ukraine (Central Forest and Steppe Region)
Variety: Kyivska 98 *Planting date*: unknown
Soil type: gray podzolic (organic matter = 2.2%, hydrolyzed N = 8.4 mg/100 g soil, P = 15.8 mg/100g soil, exchangeable K = 12.4 mg/100 g soil, pH = 5.5)
Experimental design: Soybean plots were prepared and treated with two Vitazyme treatments, to evaluate the effect of the product on bean yield and profitability.

1. Control **2. Vitazyme on seeds** **3. Vitazyme on seeds and soil**

Vitazyme applications: Treatments 2 and 3, 1 liter of Vitazyme per ton of seed on May 8, 2011; Treatment 3, 1 liter/ha on the leaves and soil at branching on June 21, 2011
Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
Control	2.24	—
Vitazyme, seeds	2.60	0.36 (+16%)
Vitazyme, seeds + foliar	2.79	0.55 (+25%)



Yield increase with a Vitazyme seed treatment: 16%
Yield increase with a Vitazyme seed + foliar treatment: 25%

Income results:

- Income increase with a Vitazyme seed treatment: +992 hrn/ha
- Income increase with a Vitazyme seed + foliar treatment: +1,364 hrn/ha

Conclusion: This Ukrainian soybean study parallels other studies performed in Vinnytsia during previous years, showing that Vitazyme dramatically improved crop yield (16 to 25%), and increased income by from 992 to 1,364 hrn/ha, using a seed treatment, or a seed and a later foliar treatment. This program is proven to be consistent in its effects to aid in soybean productivity and profitability in Ukraine.

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2009 Crop Results

Vitazyme on Soybeans

A Long-Term Study: Year 2

Researcher: Bertel Schou, Ph.D. *Research organization*: ACRES (Agricultural Custom Research and Environmental Services), Cedar Falls, Iowa
Variety: Pioneer 92M40 (BBCH: BSOY) *Planting rate*: 62 lb/acre
Planting depth: 2 inches *Planting date*: May 21, 2009
Tillage: conventional (field cultivated and harrowed) *Row width*: 30 inches
Previous crop: corn

Experimental design: The same plots from the first year of this long-term study were preserved for the second year. These plots were arranged in a randomized complete block design, with five replicates and two treatments. The study is designed to assess the long-term effects of Vitazyme on the yield and growth of corn and soybeans in rotation, and especially the effects on the physical, chemical, and microbial properties of the soil.

1. Control **2. Vitazyme**

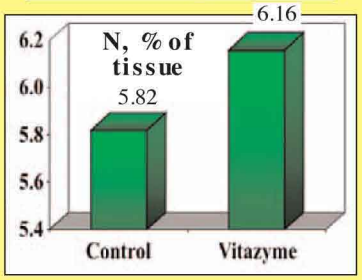
Fertilization: none

Vitazyme application: 13 oz/acre (1 liter/ha) in the seed furrow at planting (May 21, 2009), and 13 oz/acre (1 liter/ha) sprayed on the leaves and soil on June 23, 2009, at the V3 stage

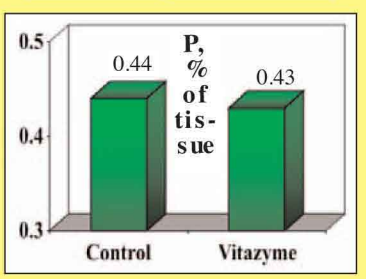
Weed control: glyphosate

Plant analyses: One sampling of leaves from the two treatments was made and sent to Midwest Laboratories, Omaha, Nebraska. Leaves were received on June 24, 2009, as a composite of the five replicates for each treatment.

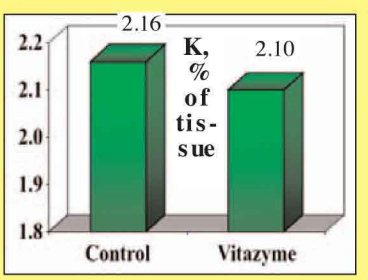
Nitrogen



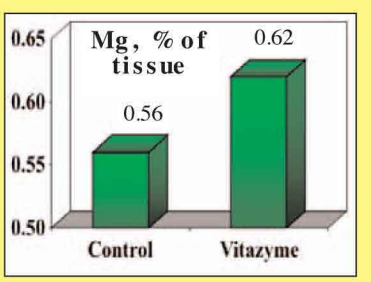
Phosphorus



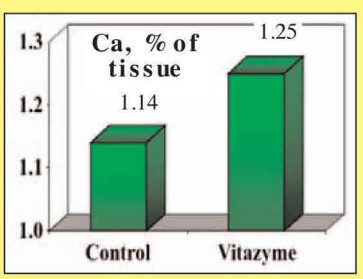
Potassium



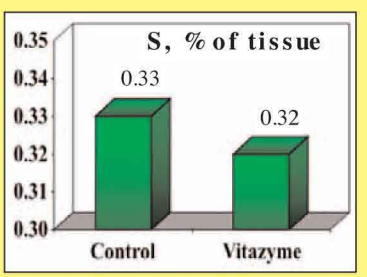
Magnesium



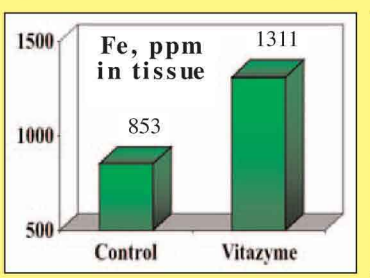
Calcium



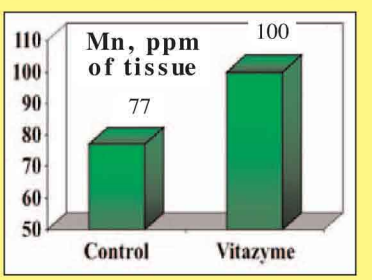
Sulfur



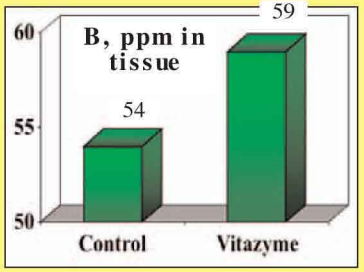
Iron



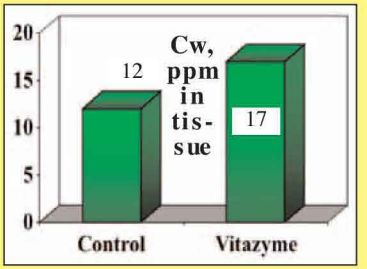
Manganese



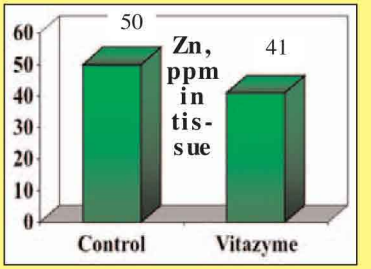
Boron



Copper



Zinc



Harvest date: The crop was harvested on September 29, 2009, with a Massey Ferguson 8 plot combine. Two rows 40 feet long were harvested from each plot.

Grain moisture: There was no major difference in the moisture content of the two treatments.

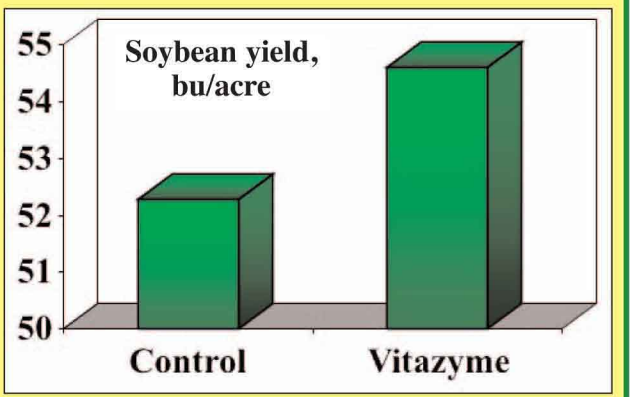
Control moisture: 14.10 Vitazyme moisture: 14.07

Yield results: All soybean yields were adjusted to 13.0% moisture.

Treatment	Bean yield*	Yield increase
	bu/acre	bu/acre
Control	52.28 a	—
Vitazyme	54.60 b	2.32 (+4%)
LSD (0.10)	2.13	
Standard deviation	1.58	
Coeff. of variation	2.96	
Replicate F	5.98	
Replicate probability	0.056	
Treatment F	5.38	
Treatment probability	0.081	

Change in soybean tissue elements with Vitazyme

N ..... +6%	Fe ..... +54%
P ..... -2%	Mn .... +30%
K ..... -3%	B ..... +8%
Mg .... +11%	Cu ..... +42%
Ca .... +10%	Zn ..... -18%
S ..... -3%	



Yield increase with Vitazyme: 4%

Conclusions: This long-term soil and crop study in Iowa, with soybeans grown the second year, revealed that the yield was significantly improved by 2.32 bu/acre (4%) with Vitazyme. Soil and plant analyses results showed improvements in tissue contents of N, Mg, Ca, Fe, Mn, B, and, Cu. These values will be monitored each year as the study progresses, as will other physical, chemical, and microbiological parameters.

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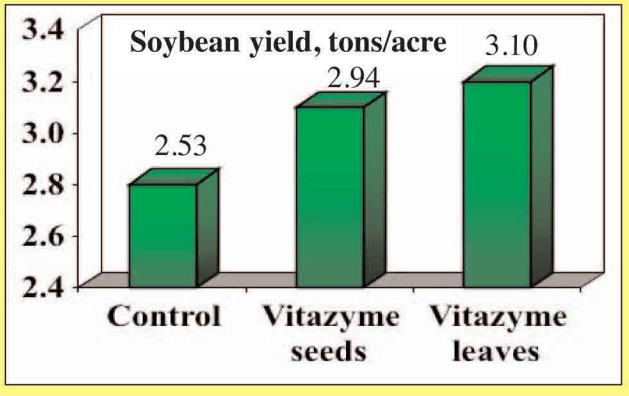
2009 Crop Results

Vitazyme on Soybeans

Researcher: O.V. Kornijchuk, V.V. Plotnikov, and agronomic scientists
Organization: Vinnytsia State Agricultural Experiment Station, Ukraine Academy of Agrarian Sciences, Vinnytsia, Ukraine
Location: Ukraine central forest-steppe area near Vinnytsia
Planting date: May 2, 2009
Seeding rate: 800,000 seeds/ha
Variety: Podil'ska 416, super elite
Tillage: plowing, harrowing, and cultivation
Previous crop: winter wheat
Soil type: gray forest steppe soil; in the 0-30 cm layer, 2.2% organic matter, 8.4 mg/100 g of soil "hydrolyzed nitrogen", 15.8 mg/100g of soil phosphorous, 12.4 mg/100 g of soil exchangeable potassium, and pH=5.5.
Experimental design: A uniform field was divided into plots of 1.0 ha each with three treatments and four replications . The objective of the study was to evaluate the effect of Vitazyme as either a seed application, or a seed plus foliar application, on the yield of soybeans.

1. Control **2. Vitazyme on seeds** **3. Vitazyme on seeds + leaves**

Fertilization: 30 kg/ha N, 30 kg/ha P_2O_5, and 60 kg/ha K_2O
Vitazyme application: Treatment 2 received 1.0 liter of Vitazyme per ton of seed on May 1, 2009, and Treatment 3 received this treatment plus a foliar treatment of 1.0/liter/ha on June 20, 2009, at branching.
Yield results:



Increase in soybean yield with Vitazyme once: 16%

Increase in soybean yield with Vitazyme twice: 23%

Income results:

- **Income increase with Vitazyme on seeds: 1.104 hrn**
- **Income increase with Vitazyme twice: 1,343 hrn**

Conclusions: In Ukraine in 2009, this Vitazyme study with soybeans using either a seed treatment alone, or a seed treatment plus a foliar treatment, proved that this product increased yield by 16% (seed treatment) or 23% (seed and foliar treatment); income was also substantially increased in both cases. These excellent improvements show the great utility of this product in soybean culture in Ukraine.

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2009 Crop Results

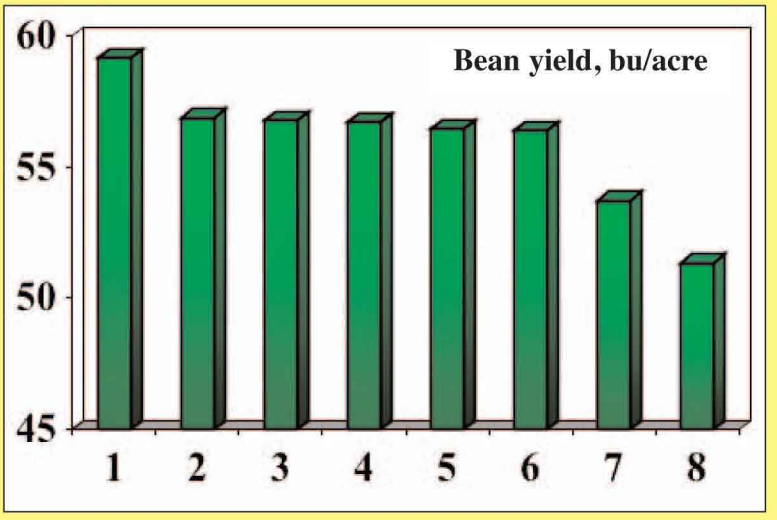
Vitazyme on Soybeans

Farmer: David Herbst *Location*: Herbst/Tierney Farms, Chaffee, Missouri, in cooperation with the University of Missouri Extension Service, Cape Girardeau and Jackson, Missouri
Variety: Nashville (Merschman) *Irrigation*: furrow, on a leveled field *Soil type*: silt loam
Previous crop: wheat, harvested before soybeans were planted (double-cropped)
Population: 140,000 seeds/acre *Planting date*: June 7, 2008 *Row spacing*: 30 inch
Experimental design: A soybean field was divided into plots that were 24 rows wide, and replicated two times, with a check (untreated) plot between each treatment. The purpose of the trial was to evaluate the relative effects of several biostimulants and foliar fertilizers.

1. Vitazyme
2. Foliar Blend
3. Impact
4. Foliar Blend + GroMax
5. GroMax
6. GroMax Plus
7. Headline (fungicide)
8. Control (no treatment)

Fertilization: none
Product applications: 13 oz/acre at R4 to R5
Yield results: The data below are from the higher yielding of the two plots from each treatment.

Treatment	Yield	Yield change
	bu/acre	bu/acre
1. Vitazyme	59.15	7.81 (+15%)
2. Foliar Blend	56.88	5.54 (+11%)
3. Impact	56.79	5.45 (+11%)
4. Foliar Blend + GroMax	56.70	5.36 (10%)
5. GroMax	56.45	5.11 (+10%)
6. GroMax Plus	56.40	5.06 (+10%)
7. Headline	53.72	2.38 (+5%)
8. Control	51.34	—



Soybean yield increase with Vitazyme: 15%

Conclusions: This soybean crop in a wheat-soybean double cropping situation revealed that, of all products used, Vitazyme performed the best, increasing the yield by 15% (7.81 bu/acre) above the control. This increase was 2.27 bu/acre above the next highest yield increase (Foliar Blend). Vitazyme was shown in this trial to be a highly effective soybean yield booster.

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2009 Crop Results

Vitazyme on Soybeans, Organic

Researcher: Dennis Demel
Location: Ogallala, Nebraska
Variety: Blue River 29A7C
Soil type: Cuma sandy loam
Plant population: unknown
Watering: center pivot
Tillage: conventional
Planting date: unknown

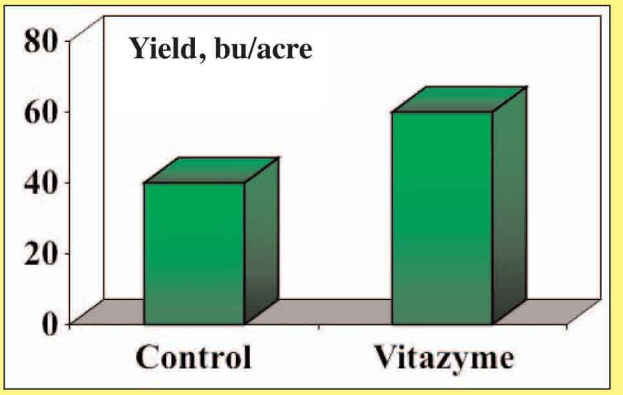
Experimental design: A soybean field was divided into a Vitazyme treated area (treated seeds only), and an untreated control area, with the objective to evaluate the effect of this product on the yield of soybeans grown under organic, irrigated conditions.

1. Control **2. Vitazyme**

Fertility treatments: In the fall of 2008 the field was subsoiled, and through drop tubes on the subsoiler were injected 0.5 gal/acre liquid humate, 1 gal/acre nitrogen (Summit), 0.5 gal/acre molasses, and 0.25 gal/acre fish. Also applied over all areas in the fall through the center pivot were 3 gal/acre nitrogen (Summit) with molasses and fish. In the spring, manganese, molasses, 1.4 gal/acre compost extract, and 1 oz/acre SP1 (Agri-Energy) were applied through the center pivot to all areas. At planting, 0.75 gal Dram 1 fish and Chilean nitrate, with Vitazyme, were applied in-furrow.
Rhizobium application: liquid, on the seeds at planting
Mycorrhizae application: 4 oz/acre in the seed box
Vitazyme application: 13 oz/acre in the furrow at planting
Test weight results: Both treatments produced soybeans weighing 57 lb/bushel.
Yield results: At harvest, eight rows were harvested from each side of the treatment boundary, with a 16-row separation between the strips that were 20 x 2,640 ft (1.212 acre). A weigh wagon was used to measure the yield.

Treatment	Yield	Yield change
	bu/acre	bu/acre
Control	48	—
Vitazyme	60	12 (+25%)

Increase in yield with Vitazyme: 25%



Conclusions: This organic soybean study in western Nebraska, under irrigation, revealed that Vitazyme increased bean yield by 25%, a very big increase. This large boost in yield with the product substantiates results with other organic producers, which have shown similar large yield improvements with the program. The grower was surprised with the degree of yield increase, but the weigh wagon had been properly calibrated.

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2009 Crop Results

Vitazyme on Soybeans

Researcher: Nathan Temples
Farm cooperator: David Murray Farms
Location: Sikeston, Missouri
Variety: Dyna-Gro
Soil type: sandy loam
Planting rate: 60 lb/acre
Planting date: June18, 2009
Row-spacing: 30 inches
Irrigation: four times

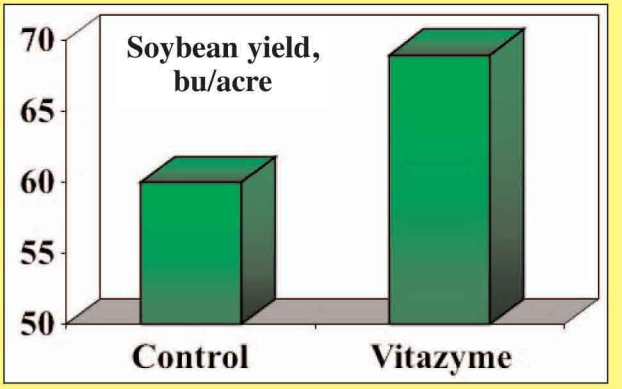
Experimental design: A soybean field was divided into Vitazyme treated (with the herbicide) and the untreated areas to determine the effects of the product on bean yield.

1. Control **2. Vitazyme**

Fertilization: unknown
Vitazyme application: 13 oz/acre with the herbicide, 21 days after planting
Harvest date: November 13, 2009
Yield results:

Treatment	Yield	Yield change
	bu/acre	
Control	60	—
Vitazyme	69	9 (15%)

Increase in soybean yield with Vitazyme: 15%



Conclusions: In this Missouri study, Vitazyme applied along with a herbicide increased soybean yield by 15% over the untreated control.

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2009 Crop Results

Vitazyme on Soybeans

Researcher: Nathan Temples *Farm cooperator*: Halford farms *Location*: Bell City, Missouri
Variety: Crows 4817 *Soil type*: gumbo (high clay) *Planting rate*: 150,000 seeds/acre
Planting date: June 3, 2009 *Row-spacing*: 30 inches *Irrigation*: none

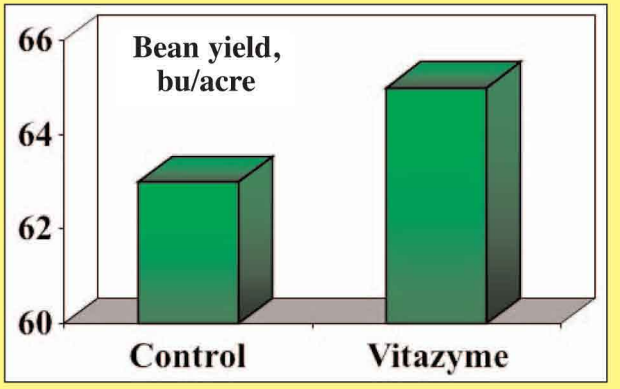
Experimental design: A 40-acre soybean field had 24 rows in the middle of the field treated with Vitazyme directly in the seed row. The objective was to evaluate the potential of this product to increase bean yields.

1. Control **2. Vitazyme**

Fertilization: unknown
Vitazyme application: 8 oz/acre on the seeds at planting
Harvest date: October 15, 2009
Yield results: Yields were determined by combining a strip in the 24 treated rows and an adjacent untreated strip.

Treatment	Yield	Yield change
	bu/acre	
Control	63	—
Vitazyme	65	2 (3%)

Increase in soybean yield with Vitazyme: 3%



Conclussions: This Missouri study proved that Vitazyme, applied at 8 oz/acre to the seeds at planting, increased yield by 3%.

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2009 Crop Results

Vitazyme on Soybeans

Researcher: Nathan Temples
Location: Arbor, Missouri
Planting rate: 140,000 seeds /acre
Planting date: May 20, 2009
Farm cooperators: Donnie and Chris Wondel, D and C Farms
Variety: Asgrow 4922
Row-spacing: 30 inches
Soil type: gumbo (high clay)
Irrigation: none

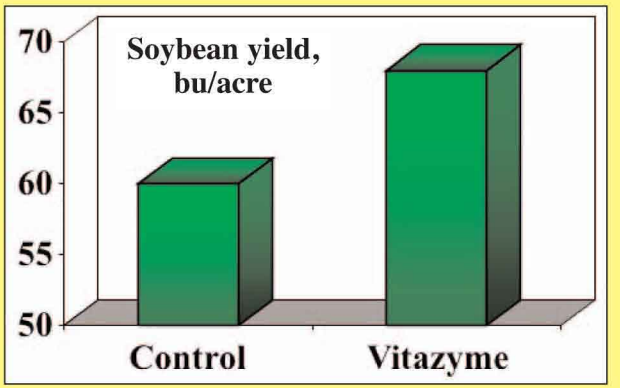
Experimental design: In a 55-acre soybean field, 24 rows were treated with Vitazyme on the seeds at planting, in an effort to evaluate the product's effects on soybean yield.

1. Control **2. Vitazyme**

Fertilization: unknown
Vitazyme application: 8 oz/acre on the seeds at planting
Harvest date: October 20, 2009
Yield results:

Treatment	Yield	Yield change
	---------bu/acre	----------
Control	60	—
Vitazyme	68	8 (13%)

Increase in soybean yield with Vitazyme: 13%



Conclusions: This Missouri soybean study, with Vitazyme applied to the seeds at planting at 8 oz/acre, resulted in a substantial 8 bu/acre yield increase (+13%). This increase occurred in spite of a very high bean yield, showing that even with maximum yield the product works very well.

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2007 Crop Results

Vitazyme on Soybeans

Researchers: Fred Vaughn and Greg Wilson
Organization: Vaughn Agricultural Research Services
Location: Branchton, Ontario, Canada
Variety: Pioneer 91M80
BBCH Scale: BSOY
Planting rate: 101 kg/ha
Planting depth: 3.5 cm
Row spacing: 76 cm
Planting date: May 24, 2007
Seedbed conditions: dry, fine
Soil temperature at planting: 28.6°C
Soil: silt loam (31.9% sand, 53.7% silt, 14.4% clay), 6.2 pH, 14.2 meq/100 g CEC, good fertility
Field preparation: cultivation twice
Previous crops: 2005, potatoes (with Dual + Sencor); 2006, winter wheat (with Cobutox 600)
Experimental design: A uniform site was divided into plots that were 3x6 meters (six rows), using four treatments with six replications in a randomized complete block design. The objective of the study was to determine Vitazyme's ability to improve soybean yield with two applications. The treatments were as follows:

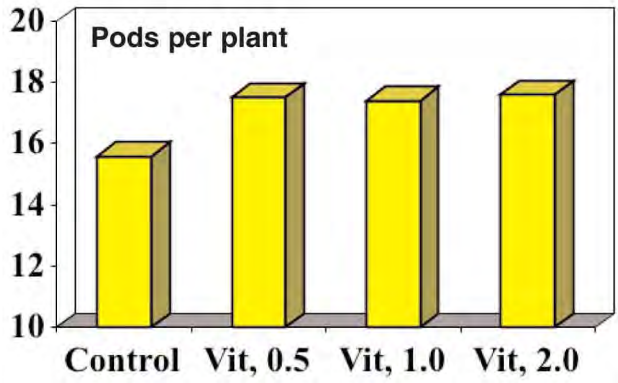
Treatment	At planting	Early bloom
	liters/ha	
1. Control	0	0
2. Vitazyme, 50%	0.5	0.5
3. Vitazyme, 100%	1.0	1.0
4. Vitazyme, 200%	2.0	2.0

Fertilization: 240 kg/ha of 6-24-24% N-P_2O_5-K_2O dry fertilizer spread over the trial site before planting
Vitazyme application: All rates were applied to appropriate plots on May 24 (to the seeds in the row) and June 26 (over the leaves and soil, using a 100 l/ha sprayer rate).
Crop emergence date: May 30, six days after planting
Weed control: Roundup (glyphosate) at 1 liter/ha on June 13, and at 1.5 liters/ha on July 19
Weather conditions: hot and dry during the middle and late part of the growing season
Harvest date: October 12, 2007. An area of 1.52 x 6.00 meters (the two center rows) was harvested for each plot.
Yield results: There were no significant differences in moisture content or bushel weight among the four treatments, so those values are not included here.

Pod Counts

Treatment	Pods/Plant*	Pod change
	pods	pods
1. Control	15.6 b	—
2. Vitazyme, 0.5 l/ha	17.5 a	1.9 (+12%)
3. Vitazyme, 1.0 l/ha	17.4 a	1.8 (+12%)
4. Vitazyme, 2.0 l/ha	17.6 a	2.0 (+13%)
LSD (P = 0.05)	1.7	
CV	8.24	
Bartlett's X2	3.899	
P (Bartlett's X2)	0.273	
Replicate F	5.022	
Replicate Prob (F)	0.0067	
Treatment F	2.626	
Treatment Prob (F)	0.0885	

*Average of 20 plants



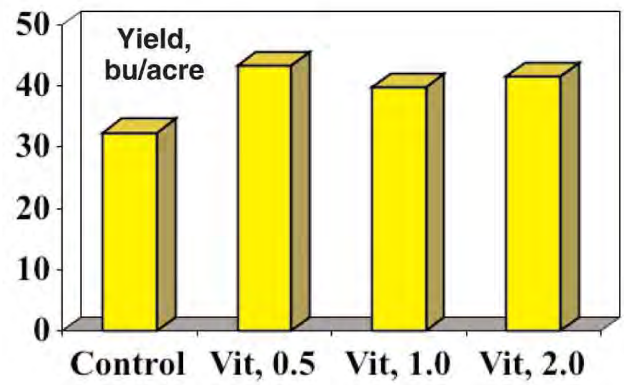
Increase in pod count

Vitazyme, 0.5 l/ha 12%
Vitazyme, 1.0 l/ha 12%
Vitazyme, 2.0 l/ha 13%

Vitazyme caused a 12 to 13% increase in pods per plant for the three treatment levels, which were significant at P = 0.05.

Soybean Yield

Treatment	Yield	Yield change
	bu/acre	bu/acre
1. Control	32.4 b	—
2. Vitazyme, 0.5 l/ha	43.3 a	10.9 (+34%)
3. Vitazyme, 1.0 l/ha	39.8 a	7.4 (+23%)
4. Vitazyme, 2.0 l/ha	41.5 a	9.1 (+28%)
LSD (P = 0.05)	3.68	
CV	7.63	
Bartlett's X2	1.472	
P (Bartlett's X2)	0.689	
Replicate F	2.146	
Replicate Prob (F)	0.1156	
Treatment F	15.358	
Treatment Prob (F)	0.0001	



Increase in soybean yield

Vitazyme, 0.5 l/ha 34%
Vitazyme, 1.0 l/ha 23%
Vitazyme, 2.0 l/ha 28%

All three Vitazyme treatments provided an increase in yield of from 23 to 34%, all of which were significantly different at 0.001%.

Income results: At a soybean price of $9.00/bushel, the increased income for the treatments is as follows:

Treatment	Yield increase	Income increase
	bu/acre	bu/acre
Vitazyme, 0.5 l/ha	10.9	98.10
Vitazyme, 1.0 l/ha	7.4	66.60
Vitazyme, 2.0 l/ha	9.1	81.90

Conclusions: Vitazyme applied to soybeans in this Canadian study, at 0.5, 1.0, and 2.0 liters/ha applied at planting and early bloom, brought about an excellent yield enhancement at all application levels: 23 to 34%. These yield increases resulted in improved crop income of from $66.60 to $98.10/acre, excellent increases for very nominal extra input costs. This study shows the great potential for Vitazyme to enhance the production of soybeans across the southern areas of Canada where this crop is grown.

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2006 Crop Results

Vitazyme on Soybeans

Agricultural Custom Research Education Services

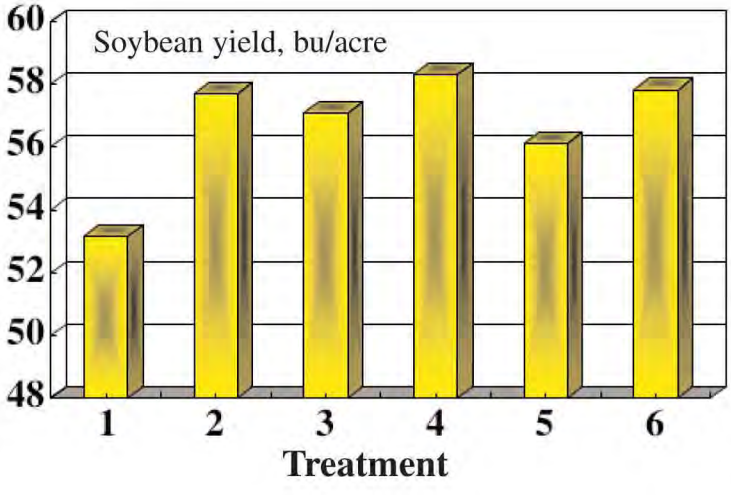
Researcher: Bert Schou, Ph.D. *Location*: Cedar Falls, Iowa *Variety*: Pioneer 92M72 (non-GMO)
Soil type: Floyd loam (pH 6.8, organic matter 4.2%, CEC 15.7, good fertility)
Previous crop: corn *Planting depth*: 1.5 inches *Planting rate*: 47 lb/acre
Row spacing: 30 inches *Planting date*: May 8, 2006 *Tillage*: conventional
Experimental design: A randomized complete block design with six replicates and six treatments was set up in a uniform area having 6-row plots of 15 x 40 feet (0.0138 acre). The purpose of the trial was to discover the effect of Vitazyme, Actinovate, glucose, and combinations of these products on soybean yield and bean moisture content. The Student-Newman-Keuls test was used to separate treatment means.

Treatment	Product	Rate
1	None	0
2	Vitazyme	13 oz/acre x 2
3	Actinovate	1 oz/acre x 2
4	Actinovate + Vitazyme	1 oz/acre + 13 oz/acre x 2
5	Actinovate + Vitazyme + Glucose	1 oz/acre + 13 oz/acre + 2.5 lb/acre x 2
6	Vitazyme + Glucose	13 oz/acre + 2.5 lb/acre x 2

Fertilization: none
Vitazyme application: 13 oz/acre on the seeds at planting, and on the leaves and soil at 3.5 trifoliates on June 28
Actinovate: Actinovate SP is a formulation of *Streptomyces lydicus* WYEC 108 that will populate the root zone to elicit soil pathogen control (Pythium, Rhizoctonia, Phytophthora, Veticillium, Fusarium, and other fungi); 1 lb/acre mixed with Vitazyme on May 8 at planting, and again on June 28 for a soil/foliar application.
Glucose: a microbial stimulant, applied with Vitazyme and Actinovate for both applications at 2.5 lb/acre
Harvest date: October 8, 2006
Yield and bean moisture results: The two center rows of each plot were harvested with a plot combine, and the beans were weighed with an electronic scale. Bean moisture was also determined at harvest for each plot.

Treatment	Bean yield*	Change	Bean moisture*	Change
	bu/acre	bu/acre	%	%-points
1. Control	53.15 b	—	10.43 a	—
2. Vitazyme	57.70 a	4.55 (+9%)	10.35 a	-0.08
3. Actinovate	57.10 a	3.95 (+7%)	9.82 a	-0.61
4. Actinovate + Vitazyme	58.33 a	5.18 (+10%)	9.82 a	-0.61
5. Actinovate + Vita. + Glucose	56.10 ab	2.95 (+6%)	10.07 a	-0.36
6. Vitazyme + Glucose	57.83 a	4.68 (+9%)	9.80 a	-0.63
LSD (P=0.05)	3.28		1.04	
Standard deviation	2.76		0.87	
Coeff. of variation	4.86%		8.68%	

*Means followed by the same letter are not significantly different according to the Student-Newman-Keuls-Test.



Increase in Bean Yield With...

Vitazyme 9%
Actinovate 7%
Vitazyme + Actinovate 10%
Vitazyme + Glucose 9%

All treatments but Treatment 5 significantly increased soybean yield at P=0.05, with the increases ranging from 6 to 10% above the control. Vitazyme plus Actinovate gave the greatest increase (+10%), but this increase was only slightly more than Vitazyme alone, Bean moisture drydown was not significantly affected by the treatments because all of the beans were dry at harvest, although all of the treatments produced slightly dryer beans, from 0.08 to 0.63 percentage point..

Income results: At $6.00/bu for soybeans, the following income increases have been calculated.

Treatment	Product	Income increase
2	Vitazyme	$27.30/acre
3	Actinovate	$23.70/acre
4	Actinovate + Vitazyme	$31.08/acre
5	Actinovate + Vitazyme + Glucose	$17.70/acre
6	Vitazyme + Glucose	$28.08/acre

Conclusions: In this replicated soybean study in Iowa, all but one treatment produced significant yield increases (P=0.05) of from 2.95 to 4.68 bu/acre (6 to 10%). The greatest increase was with Vitazyme + Actinovate, although Vitazyme alone produced a 9% yield increase. These yield increases produced income increases of from $17.70 to $28.08/acre. Grain moisture did not vary significantly among the eight treatments because all of the grain was harvested when almost completely dry, although all treatments produced somewhat dryer beans at harvest than did the untreated control..

This study shows that Vitazyme alone produced nearly the greatest yield improvement, and other treatments or combinations did not significantly exceed this result. The use of Vitazyme is a highly profitable practice in Iowa, and has been proven to consistently increase soybean yields and profits since 1995.

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2005 Crop Results

Vitazyme on Soybeans

Researcher/Farmer: Dale Carter *Location*: Coatesville, Indiana *Variety*: Pioneer 93 B68
Planting date: May 10, 2005 *Soil type*: Fincastle silty clay loam *Previous crop*: corn
Population: 179,000 seeds/acre *Row spacing*: 15 inches *Tillage*: no-till

Experimental design: A soybean field was treated on one part, across the rows, with Vitazyme, and the other part was left untreated.

1. Control **2. Vitazyme**

Fertilization: none (residual fertility from corn last year)
Vitazyme application: 13 oz/acre on the soil surface about one week before planting
Weather: cooler than normal

Results: About August 26 the data shown below was collected. Forty plants from each field area, closely separated, were dug with a potato fork — four plants per dig with 10 digs — and trifoliate leaves and pods were counted for the 40 plants.

Treatment	Trifoliates	Change	Pods	Change	Roots	Biological activity
	number/40 plants					
Control	420	—	1,100	—	Standard roots structure	No fungi seen; few sowbugs*
Vitazyme	520	100 (+24%)	1,330	230 (+21%)	Long,stronger main roots More fine roots	More fungal threads on corn residue; many sowbugs*

*Fungi are the first organisms to begin crop residue breakdown. Sowbugs consume the organic material that is breaking down.

Increase in trifoliate leaves: +24%

Increase in pods: +21%

Conclusions: This Indiana soybean study revealed that only one Vitazyme application at planting increased the number of trifoliate leaves by 24%, while pods were increased by 21%. In addition, root growth and soil biological activity were enhanced. Unfortunately a yield check could not be made because the product was applied across the rows, making it impossible to keep treatments separate while combining down the field.

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2005 Crop Results

Vitazyme on Soybeans

Agricultural Custom Research Education Services

Researcher: Bert Schou, Ph.D. *Location*: Cedar Falls, Iowa *Variety*: Pioneer 92M72 (non-GMO)
Soil type: Floyd loam (pH 6.8, organic matter 4.2%, CEC 15.7, good fertility)
Previous crop: corn *Planting depth*: 1.5 inches *Planting rate*: 49 lb/acre
Row spacing: 30 inches *Planting date*: May 10, 2005 *Tillage*: conventional
Experimental design: A Latin square design with eight replicates and eight treatments was set up in a uniform area having 6-row plots of 15 x 40 feet (0.0138 acre). The purpose of the trial was to discover the effect of Vitazyme, a new Vitazyme variant (Product X), a possible synergist with Vitazyme (Product Y), and another possible synergist (Product Z) on soybean yield and bean moisture content. The Student-Newman-Keuls test was used to separate treatment means.

Treatment	Product	Rate
1	None	0
2	Vitazyme	13 oz/acre x 2
3	Vitazyme + Product Y	13 oz/acre each x 2
4	Vitazyme + Product Y	6.5 oz/acre each x 2
5	Product Y	13 oz/acre x 2
6	Product X + Product Y	6.5 oz/acre each x 2
7	Product Z	16 oz/acre x 2
8	Vitazyme + Product Z	13 oz/acre (Vita.) + 16 oz/acre (Z) x 2

Fertilization: none
Vitazyme application: 13 oz/acre pr 6.5 oz/acre on the seeds at planting, and on the leaves and soil at 3.5 trifoliates
Product X application: 6.5 oz/acre on the seeds at planting, and on the leaves and soil at 3.5 trifoliates
Product Y application: 13 oz/acre or 6.5 oz/acre on the seeds at planting, and on the leaves and soil at 3.5 trifoliates
Product Z application: 16 oz/acre on the seeds at planting, and on the leaves and soil at 3.5 trifoliates
Harvest date: October 4, 2005
Yield results: The two center rows of each plot were harvested with a plot combine, and the grain was weighed with an electronic scale

Treatment	Bean yield*	Change	Moisture*	Change
	bu/acre	bu/acre	%	%
1. Control	39.3 b	—	15.45 a	—
2. Vitazyme	45.0 a	5.7 (+15%)	15.67 a	+0.22
3. Vita + Prod Y	45.4 a	6.1 (+16%)	15.41 a	-0.04
4. Vita + Prod Y (1/2 rate)	45.0 a	5.7 (+15%)	16.15 a	+0.70
5. Product Y	43.4 a	4.1 (+10%)	15.51 a	+0.06
6. Prod X + Prod Y (1/2 rate)	44.7 a	5.4 (+14%)	15.51 a	+0.06
7. Product Z	44.1 a	4.8 (+12%)	15.95 a	+ 0.50
8. Vita + Prod Z	45.0 a	5.7 (+15%)	16.04 a	+0.59
LSD (P=0.05)	2.37		1.158	
Standard deviation	2.34		1.146	
Coeff. of variation	5.32%		7.3%	

*Means followed by the same letter are not significantly different according to the Student-Newman-Keuls-Test.

All treatments significantly increased soybean yield at P=0.05, with the increases ranging from 10 to 16% above the control. Vitazyme plus Product Y at the full rates gave the greatest increases (+16%) while Product Y alone gave the smallest increase (+10%). Grain moisture drydown was not significantly affected by the treatments, likely because all of the beans were dry at harvest.

Yield Changes

Vitazyme ..... +15%
Vitazyme + Product Y
Full Rate ..... +16%
Half Rate ..... + 15%
Product Y ..... +10%
Product X + Product Y
Half rate ..... +14%
Product Z ..... +12%
Vitazyme + Product Z ..... +15%

Income results: At $4.50/bu for soybeans, the following income increases have been calculated.

Treatment	Bean increase	Extra income
	bu/acre	$/acre
2. Vitazyme	5.7	25.65
3. Vita + Prod Y	6.1	27.45
4. Vita + Prod Y (1/2 rate)	5.7	25.65
5. Product Y	4.1	18.45
6. Prod X + Prod Y (1/2 rate)	5.4	24.30
7. Product Z	4.8	21.60
8. Vita + Prod Z	5.7	25.65

Conclusions: In this replicated soybean study in Iowa, all treatments produced significant yield increases (P=0.05) of from 4.1 to 6.1 bu/acre (10 to 16%). The greatest increase was with Vitazyme + Product Y, although Vitazyme alone produced a 15% yield increase. These yield increases produced income increases of from $18.45 to $27.45/acre. Grain moisture did not vary significantly among the eight treatments because all of the grain was harvested when completely dry.

This study shows that Vitazyme alone produced nearly the greatest yield improvement, and other treatments or combinations did not significantly exceed this result.

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2004 Crop Results

Vitazyme on Soybeans

A Testimonial on Emergence and Yield

Researcher: Dennis Parrett
Location: near Cecelia, Kentucky
Variety: NK 39Q4
Row spacing: drilled in 7.5-inch rows with a no-till planter
Soil type: Crider silty clay loam
Planting date: May 5, 2003
Experimental design: A soybean field was planted with seed treated with dry inoculant plus straight, undiluted Vitazyme put into a planter box. After the planter ran out of treated seed, the last part of the field was planted with untreated seed.
Fertilization: unknown
Vitazyme application: 6 oz/acre of straight undiluted Vitazyme on the seeds in the planter box together with dry rhizobium inoculant; this gave very good seed contact for both the Vitazyme and the inoculant.
Germination time: The treated seeds had emerged by May 9, four days after planting, despite cold soil temperatures, which was several days before the untreated beans.

Days to emergence: 4 days after planting

Yield results: 56.8 bu/acre in a dry year. Surrounding fields yielded less, though exact yields are not known.
Conclusions: Vitazyme applied straight to seeds at planting, stimulated soybean germination by a great degree over the untreated soybeans, despite cold soil temperatures, and resulted in higher bean yields despite a very dry growing season.

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2003 Crop Results

Vitazyme on Soybeans *(Foliar vs. Soil Application)*

Researcher: Paul W. Syltie, Ph.D.
Location: Vital Earth Resources Research Greenhouse, Gladewater, Texas
Variety: unknown *Planting rate*: 10 seeds/pot thinned to 3 plants/pot
Soil type: Bowie very fine sandy loam *Planting date*: March 13, 2003 *Pot size*: 1 gallon
Experimental design: A greenhouse study was established to discover the relative effect of soil versus foliar application of Vitazyme on soybean growth. Ten replicates were established for each treatment in a complete block design. Temperatures were maintained at 55° to 80°F during the study, with no artificial light.

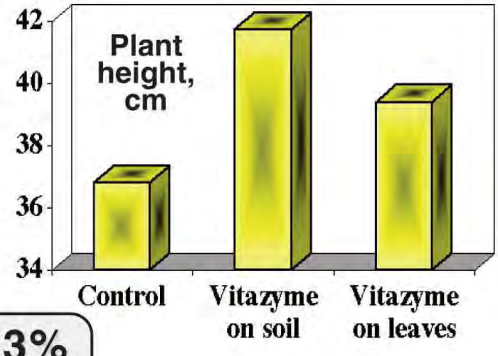
1. Control 2. Vitazyme on the soil 3. Vitazyme on the leaves

Fertilization: All plants were given 0.5 g/pot at planting of a 21-7-12% N-P_2O_5-K_2O pelleted, slow release fertilizer. This fertilizer gave an effective rate of 46 lb/acre of N, applied to the soil surface as a starter.
Vitazyme application: Vitazyme was applied to the soil surface only of Treatment 2 on March 27 when the first true leaves were fully expanded. It was also applied (a spray of a 1% solution) to the leaves of the plants of Treatment 3 on March 27; most of the spray beaded on the cotyledons and in the midrib of the undersides of the leaves. Care was taken to avoid applying any product to the soil surface.
Harvest date: April 23, 2003, 41 days after planting
Harvest results: The soybean roots were washed free of soil, the heights were measured, and then all plants were dried at about 115°F for one day, and weighed to the nearest 0.01 gram.

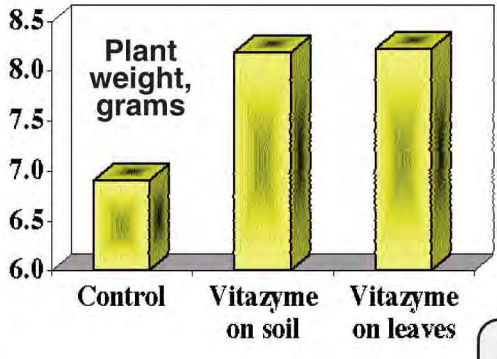
Plant Height

Treatment	Plant height*	Height change
	cm	cm
1. Control	36.8 b	—
2. Vitazyme on soil	41.7 a	4.9 (+13%)
3. Vitazyme on leaves	39.4 a	2.6 (+7%)

*Means followed by the same letter are not significantly different at P=0.10 according to the Tukey-Kramer Test. $LSD_{0.1}$=1.8 cm.



Plant height increase (soil applied): 13%



Plant Dry Weight

Treatment	Dry weight*	Weight change
	grams	grams
1. Control	6.90 b	—
2. Vitazyme on soil	8.18 a	1.28 (+19%)
3. Vitazyme on leaves	8.22 a	1.32 (+19%)

*Means followed by the same letter are not significantly different at P=0.1 according to the Tukey-Kramer Test. $LSD_{0.1}$=0.69 grams.

Dry weight increase (soil applied): 19%

Conclusions: Vitazyme applied to soybeans on either the foliage or soil in this greenhouse study showed a remarkably similar response for both methods. Both increases in dry matter accumulation were 19% above the control, and were highly significant. The increase in plant height was also highly significant for both soil and foliar applications of Vitazyme. It is concluded from this study that **either soil or foliar applied Vitazyme are equally effective in stimulating carbon fixation and plant growth of soybeans.** This study has given results similar to a parallel study on corn using soil or foliar applied product.

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2001 Crop Results

Vitazyme on Soybeans

Farmer: Blaine Nelson | *Location*: Wakefield, Nebraska | *Variety*: Rolling Meadows 279
Row spacing: 30 inches | *Population*: 150,000 seeds/acre | *Soil type*: silty clay loam
Planting date: May 15, 2001 | *Irrigation*: none | *Previous crop*: corn

Experimental design: A 94 acre field was treated entirely with Vitazyme except for one small 1 acre portion.

1. Control **2. Vitazyme**

Fertilization : none

Vitazyme treatment: 20 oz/acre sprayed over the leaves and soil along with Roundup Ultra herbicide on June 12, 28 days after planting

Growing season weather: hot and dry, especially during July and August, but with a very timely 3-inch rain in August

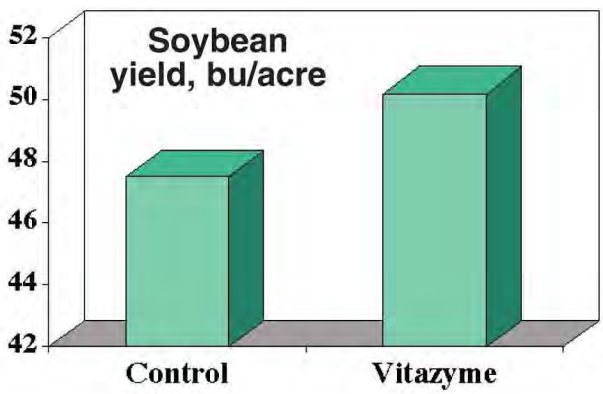
Harvest date: October 5, 2001

Growing season observations: **"Soon after applying Vitazyme it was obvious to notice that the treated plants were 2 to 3 inches taller, and were bigger and healthier."** — Blaine Nelson

Yield results: Areas were harvested and weighed on each side of the treatment boundary, and yields were calculated based on field measurements. Bean moisture contents were also determined.

	Control	Vitazyme	Change
		bu/acre	
Bean yield	47.5	50.2	2.7 (+6%)

Bean yield increase: 6%



Moisture content:

	Control	Vitazyme	Change
		% H_2O	
Bean moisture	11.6	11.2	0.4

Decrease in bean moisture: 0.4%

Income results: Estimated value of soybeans, before government payments: $4.20/bu. 2.7 bu/acre x $4.20/bu = **$11.34/acre more income**.

Conclusions: This Nebraska soybean study showed that only one application of Vitazyme can increase yield by 6% on a good year, which was very profitable. Two applications could have further increased the yield, especially during a year that is less than optimal.

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2000 Crop Results

Vitazyme on Soybeans (Organic)

Farmer: Mike Saeli *Location*: Savannah, New York *Variety*: Vinton (for tofu)
Planting date: *Row spacing*: 30 inches *Soil type*:
Experimental design: An area of a soybean field was treated with Vitazyme, while the rest of the field was left untreated.

1. Control **2. Vitazyme**

Fertilizer treatment: liquid fish with the seeds at 4 gal/acre
Vitazyme treatment: 13 oz/acre with the liquid fish on the seeds at planting
Harvest date: November 7, 2000
Leaf chlorophyll: On August 16, twenty leaves from each treatment were measured with a Minolta SPAD meter, and averaged

Leaf Chlorophyll

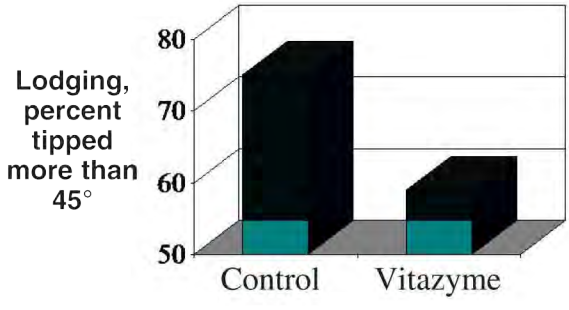
	Control	Vitazyme	Change
		SPAD units	
Leaf chlorophyll	46.9	49.2	+2.3

Leaf chlorophyll increase: 2.3 SPAD units

Lodging: At harvest time it was very apparent that the Vitazyme treatment had less lodging due to stronger stems. To evaluate lodging, a measurment was made from typical plants that were more or less than a 45 degree angle from the verticle.

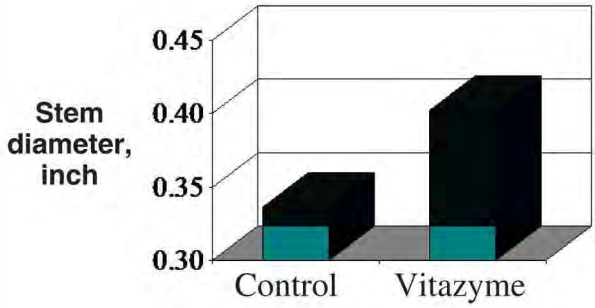
Lodging

	Control	Vitazyme	Change
		plants more than 45°	
Plants lodged	75%	59%	(–)16%



Decrease in lodging: 16%

Stem diameter: Since there was an obvious difference in stem diameter, seven typical plants from each treatment were measured.



Stem Diameter

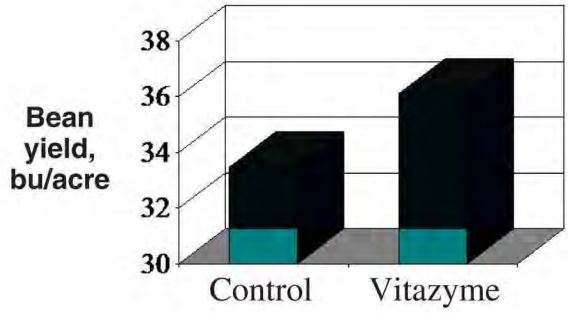
	Control	Vitazyme	Change
		inch	
Stem diameter	0.336 b	0.402 a	0.066(+20%)

Increase in stem diameter: 20%

Yield results: Fifteen rows that were 590 feet long were harvested from each treatment. The area harvested for each was 0.5079 acre.

Soybean yield

	Control	Vitazyme	Change
		lb	
Weight per test area	1,020	1,100	80(+8%)
		bu/acre	
	33.47	36.10	2.63(+8%)



Grain yield increase: 8%

Grain moisture content:

Grain Moisture

	Control	Vitazyme	Change
		%	
Grain moisture	14.70	14.45	0.25

Grain moisture decrease: 0.25%

Conclusions: Vitazyme applied to soybeans in this side–by–side field study produced more vigorous growth during the season, as a consequence of chlorophyll levels being higher due to a more active rhizosphere. Stem diameter was increased (by 20%), and as a result lodging was reduced (by 16%). Soybean yield increased by 2.63 bu/acre, which was sizable for this organic crop.

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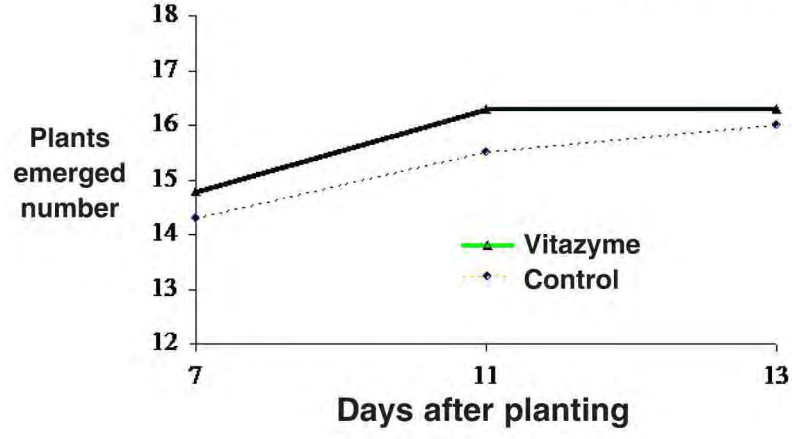
2000 Crop Results

Vitazyme on Soybeans (Tray Study)

Agricultural Custom Research and Educational Services

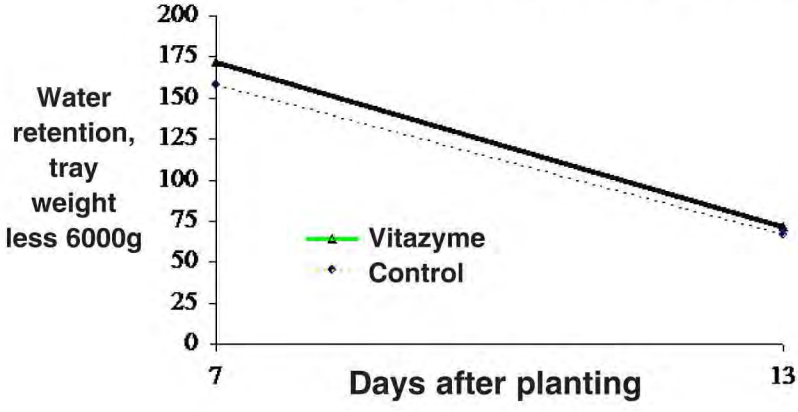
Researcher: Bertel Schou, Ph.D.
Location: Cedar Falls, Iowa
Variety: Unknown
Soil type: Maxfield silt loam, surface soil
Tray size and type: 10 x 21 inches, slotted tray inside a solid tray, and a paper liner below
Experimental design: Trays were placed under full-spectrum grow-lights that shone 14 hours per day, with an air temperature of 65 to 85°F. Each tray had 6,000 grams of the sieved silt loam soil, which formed a two-inch layer in which two furrows were made. Twenty seeds were placed every 2 inches in the two furrows and covered. Then a measured amount of water was added, first to obtain ideal planting conditions, and subsequent waterings were accounted for as well to give a net water usage. Typical field water loss is 0.25 to 0.35 in/day. Four replicates were used in the study. Measurements were taken 7, 11, and 13 days after planting.
Vitazyme application: The equivilant of 13 oz/acre Vitazyme was applied to the soil surface at planting.
Growth parameters measured:

Plants Emerged



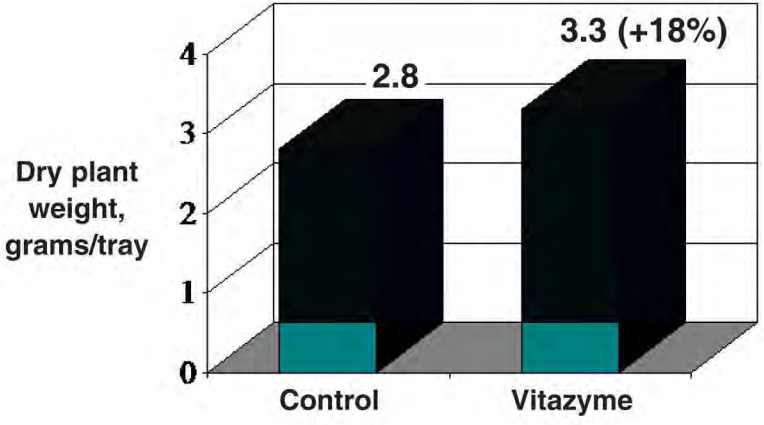
Vitazyme improved seed emergence and early growth vigor slightly throughout the 13-day growth period.

Soil and Plant Water Retention



The amount of water remaining in the trays, after additions were subtracted, was highest for the Vitazyme trays. This shows that Vitazyme reduced water loss from the soil and plants, and thus improved water use efficiency.

Dry Plant Weight – Day 13



At the conclusion of the study the Vitazyme treated seedlings had greater total weight, meaning their growth rate exceeded that of the control for the first 13 days after planting.

Dry weight increase: 18%

Conclusion: Vitazyme improved plant emergence in this soybean tray study. Also, these treated plants made more efficient use of water, and ended up producing greater dry matter (+18%) than the controls.

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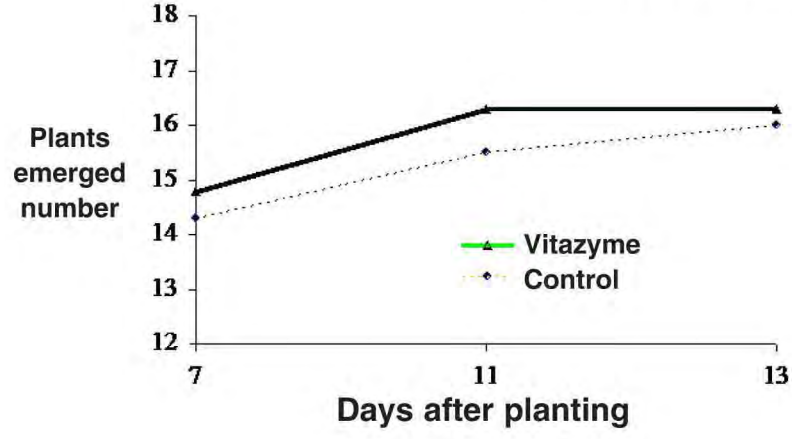
2000 Crop Results

Vitazyme on Soybeans (Tray Study)

Agricultural Custom Research and Educational Services

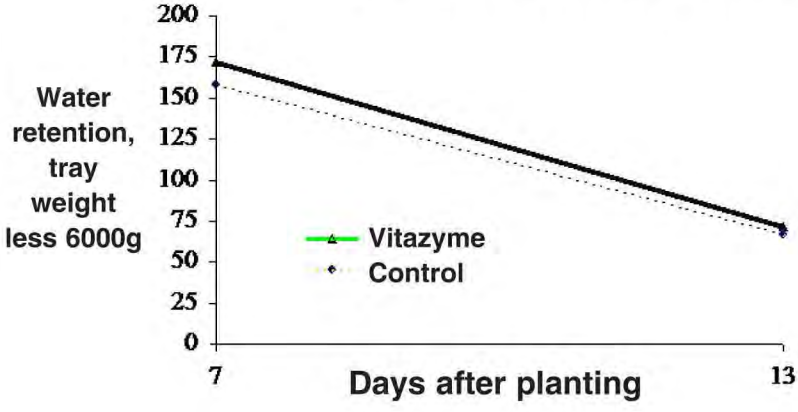
Researcher: Bertel Schou, Ph.D.
Location: Cedar Falls, Iowa
Variety: Kruger K 242 Roundup Ready
Soil type: Maxfield silt loam, surface soil
Tray size and type: 10 x 21 inches, slotted tray inside a solid tray, and a paper liner below
Experimental design: Trays were placed under full-spectrum grow-lights that shone 14 hours per day, with an air temperature of 65 to 85°F. Each tray had 6,000 grams of the sieved silt loam soil, which formed a two-inch layer in which two furrows were made. Twenty seeds were placed every 2 inches in the two furrows and covered. Then a measured amount of water was added, first to obtain ideal planting conditions, and subsequent waterings were accounted for as well to give a net water usage. Typical field water loss is 0.25 to 0.35 in/day. Four replicates were used in the study. Measurements were taken 7, 11, and 13 days after planting.
Vitazyme application: The equivilant of 13 oz/acre Vitazyme was applied to the soil surface at planting.
Growth parameters measured:

Plants Emerged



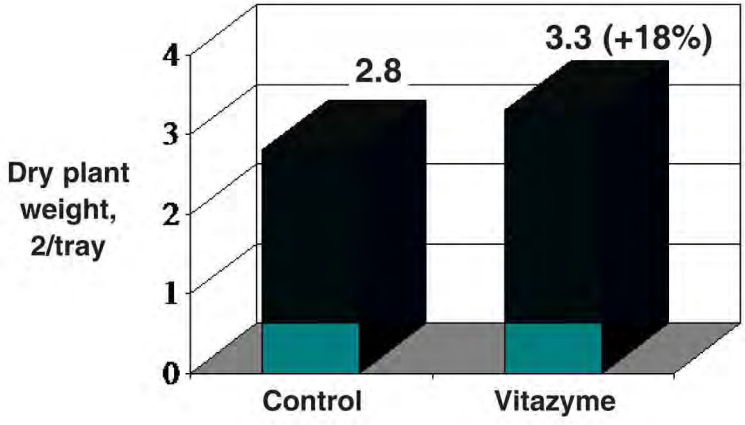
Vitazyme improved seed emergence and early growth vigor slightly throughout the 13-day growth period.

Soil and Plant Water Retention



The amount of water remaining in the trays, after additions were subtracted, was highest for the Vitazyme trays. This shows that Vitazyme reduced water loss from the soil and plants, and thus improved water use efficiency.

Dry Plant Weight – Day 13



At the conclusion of the study the Vitazyme treated seedlings had greater total weight, meaning their growth rate exceeded that of the control for the first 13 days after planting.

Dry weight increase: 18%

Conclusion: Vitazyme improved plant emergence in this soybean tray study. Also, these treated plants made more efficient use of water, and ended up producing greater dry matter (+18%) than the controls.

Income results: A corn price of $1.75/bu is estimated.

Conclusions: In this study evaluating Vitazyme and Actagro humic acids on corn yield and other parameters, grain yield was significantly increased with Vitazyme (+7%) and with humic acids (+8%), but not when the two products were combined. The grain per plant was also significantly increased with Vitazyme (+9%), showing that individual corn plants were larger and able to produce larger ears when treated with Vitazyme. This improvement did not occur with the other two treatments. Grain moisture at harvest, plant population, and grain test weight were not affected significantly by any of the treatments, though the product combination increased the test weight by 0.4 lb/bu over the control. Both Vitazyme and humic acids significantly improved corn production, but not a combination of the two, in this Iowa corn study. Vitazyme alone increased income by $13.65/acre.

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2000 Crop Results

Vitazyme on Soybeans

Farmer: Ron Stutzman, Brubaker Consulting Group Arkport, New York
Location: Stutzman Research Farm,
Variety: Golden Harvest 2170 Roundup Ready
Planting date: June 1, 2000
Soil type: silt loam
Row spacing: 30 inches
Planting population: 196,000 seeds/acre

Experimental design: A randomized complete block design was set up using a plot size of 10 x 50 ft. (0.0115 acre). Three treatments with four replicates (12 total plots) were selected.

1. Control **2. Vitazyme on seeds** **3. Vitazyme foliar**

Fertilization: Unknown

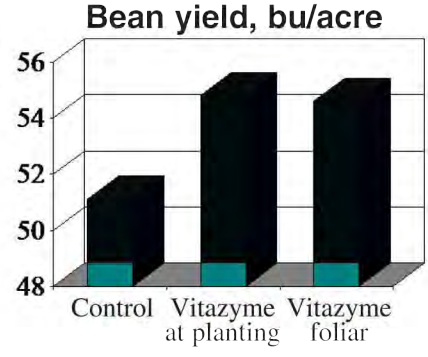
Vitazyme treatments: The seed treatment (Treatment 2) received 13 oz/acre concentrated on the seed row, and the foliar treatment (Treatment 3) was sprayed over the leaves and soil at a plant height of 15 inches.

Harvest date: November 3, 2000

Yield results: The test weight and grain moisture content of the soybeans did not vary much amongst the three treatments. Thus, these data are not included in this report. The soybeans were harvested with a plot combine.

	Control*	Vitazyme at planting*	Vitazyme foliar*
		bu/acre	
Soybean yield	51.1 a	54.8 a (+7%)	54.6 a (+7%)

* Means followed by the same letter are not significantly different at P=0.10 according to Tukey's Honestly Significance Difference Test. $LSD_{0.10}$=8.25.



Soybean yield increase (on seeds): 7%

Soybean yield increase (on leaves/soil): 7%

Income results: A price of $5.00/bu is estimated.

	Control	Vitazyme at planting	Vitazyme foliar
		$/acre	
Soybean yield	255.50	274.00	273.00

Income increase (on seeds): $18.50/acre

Income increase (on leaves/soil): $17.50/acre

Conclusions: Vitazyme at 13 oz/acre applied one time to the seeds, or to the leaves and soil at 15 inches plant height, produced nearly equal yield increases (7%, or about 3.6 bu/acre). This increase was highly profitable, the cost:benefit ratio being about 3.5:1. If the two applications had been made to the same treatments it is very likely the results would have been significantly better than either of Treatments 2 or 3.

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2000 Crop Results

Vitazyme on Soybeans

A testimonial

Farmer: Joe Ike
Researcher: Jake Gephart, Agway, Inc.
Variety: Asgrow Roundup Ready
Seeding rate: unknown
Location: Interlaken, New York
Soil type: unknown
Planting date: May 5, 2000
Row width: 30 inches
Experimental design: Vitazyme was applied on a portion of a 75-acre soybean field, while the rest of the field was left untreated.
Fertilization: unknown
Harvest date: November 3 and 4, 2000
Vitazyme application: 13 oz/acre with fertilizer, banded beneath the seeds

Yellow streaks developed early on in the plants across the field due to some sort of fungal attack during the cold, wet season. Later, Joe Ike noticed that the streaks in the field were gone where Vitazyme had been applied. **Vitazyme apparently produced a positive nutritional response with these soybeans that translated into disease resistance for whatever fungal organism was attacking these soybeans.**

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2000 Crop Results

Vitazyme on Soybeans

A testimonial

Farmer: Jim Clise
Researcher: Jake Gephart, Agway, Inc.
Varieties: Apk 25b Roundup Ready; Apk 198 Roundup Ready
Location: Waterloo, New York
Soil type: variable
Row width: 30 inches
Experimental design: All fields listed below were totally treated with Vitazyme
Fertilization amount: 250 lb/acre of 6-24-24% N-P_2O_5-K_2O, applied pre-plant, and incorporated
Vitazyme application: 13 oz/acre with Roundup (glyphosate) herbicide, just before canopy row closure

Field	Area	Planting date	Harvest date	Yield
	acres			bu/acre
1	50	June 26	November 13	65
2	25	June 14	November 11	44
3	14	June 14	November 12	23
4	100	June 15	November 14	53
5	12	June 17	November 16	30

Conclusions: According to Jake Gephart, **"Although the beans suffered white mold disease, the Vitazyme helped save the bean crop." This benefit was achieved because Vitazyme gave the beans a very vigorous start, enabling them to better resist the mold early on.** The very cool and wet growing season gave ample opportunity for fungal diseases to attack the crop in 2000.

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1999 Crop Results

Vitazyme on Soybeans

Farmer: John Smucker
Variety: APK 190 (Roundup Ready)
Planting date: May 17, 1999
Soil type: gravelly loam
Location: Leicester, New York
Supervisor: Harold Upton, Agway Inc.
Harvest date: November 5, 1999
Seeding rate: 190,000/acre (30-inch rows)

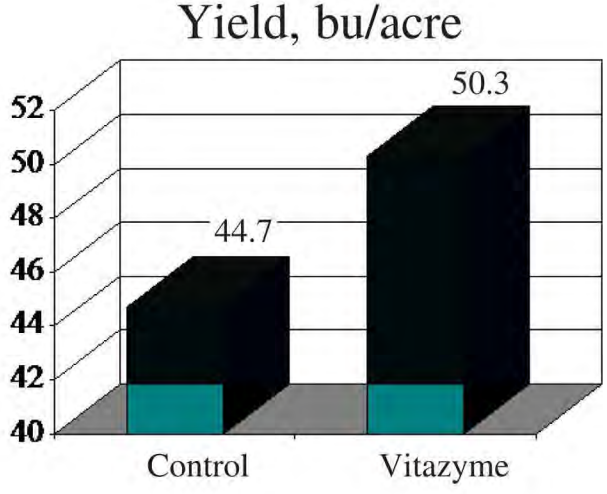
Experimental design: An 18-acre field was split into two equal parts, one half receiving Vitazyme and the other half receiving no treatment. At harvest, 0.7 acre was harvested from the treated side and 0.9 acre from the control side.

1. Control **2. Vitazyme**

Fertility treatments: 225 lb/acre 7-20-28 N-P_2O_5-K_2O, 0.35 lb/acre Mn, and 0.35 lb/acre Zn applied preplant
Vitazyme treatment: 13 oz/acre sprayed on the leaves and soil with Roundup (glyphosate) at early bloom
Yield results:

Treatment	Yield	Increase
	bu/acre	bu/acre
Control	44.7	---
Vitazyme	50.3	5.6 (+13%)

Yield increase: 13%



Income increase: A price of $5.50/bu is estimated.

Income increase: $30.80/acre

Comments: In spite of a hot and dry summer the soybean yield increase with Vitazyme was substantial, amounting to $30.80/acre at a price of $5.50/bu for soybeans. Mr. Smucker commented, "I don't know what that stuff is, but next year I want to use a lot of it." Within a few days of applying Vitazyme the sprayed leaves turned darker green, compared to the control soybean leaves.

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1998 Crop Results

Vitazyme on Soybeans (Organic)

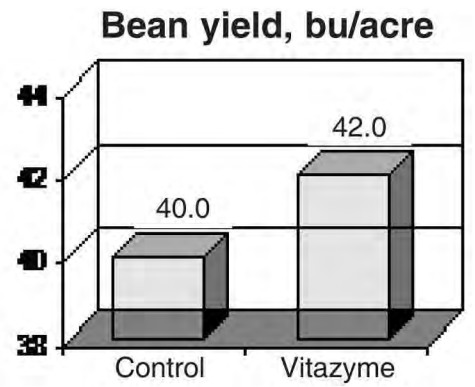
Farmer: Robin Hermanson *Location*: Garretson, South Dakota *Variety*: Ramy
Seeding rate: unknown *Previous crop*: spring wheat *Planting date*: unknown
Experimental design: A soybean field was divided into two portions, having the following treatments:

1. **Control**
2. **Vitazyme**

Fertilizer treatments: At planting, 1 gal/acre of liquid fish, an herbal blend, and 2 oz/acre of Nutrapathis Soil Conditioner were applied in an 8-inch band on the soil above the seed, and below the seed row in a band. Ten gallons of solution were used in each band.
Vitazyme applications: (1) 13 oz/acre along with the planting solution at planting, and (2) 7 oz/acre over the leaves and soil at early bloom.
Harvest date: unknown
Yield results:

	Control	Vitazyme	Increase
Yield, bu/acre	40.0	42.0	2 (+5%)

Yield Increase: 5%



Income results: The organic soybean price obtained by this grower is $19.00/bu.

	Control	Vitazyme	Increase
Total income	$760.00/acre	$798.00/acre	$38.00/acre

Income increase: $38.00/acre

Comments: Although the yield increase due to Vitazyme in this study was not remarkable, it was highly profitable. Quality parameters for the organically grown beans were not evaluated in this study. On August 28, chlorophyll readings using the Minolta SPAD meter on 20 randomly selected plants for each treatment showed 50.0 for Vitazyme and 49.2 for the control.

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1997 Crop Results

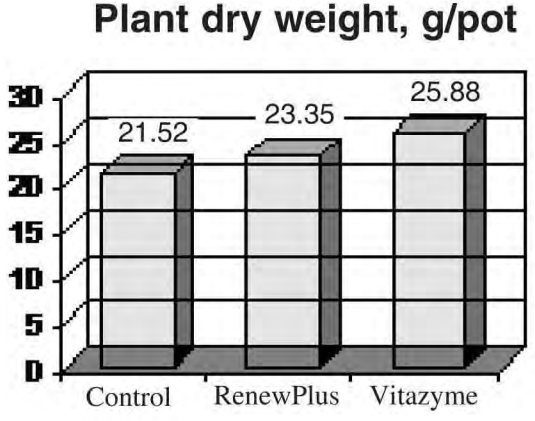
A Comparison of RenewPlus with Vitazyme on Soybeans

Researcher: Paul W. Syltie *Location*: Gladewater, Texas (Vital Earth Resources Research Center)
Variety: Pioneer 9592 *Seeding rate*: 10 seeds/pot, thinned to 3 plants/pot
Soil type: sandy loam (from Arkansas) *Planting date*: February 12, 1997 *Pot type:* one gallon
Vitazyme and RenewPlus treatments: 0.1% solution, 100 ml applied to each pot after planting and thorough watering *Harvest date*: April 8, 1997
Data collected: The roots were washed free of soil, and the plants were dried at about 115 degrees F in a drying oven, after which weights were taken.

Treatment	Dry weight*
Control	21.52 c
RenewPlus	23.35 b
Vitazyme	25.88 a
$LSD_{0.05}$	1.70

*Means followed by the same letter are not significantly different at P=0.05.

Yield Increase: 20%



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1998 Crop Results

Vitazyme on Soybeans

Iowa State University of Science and Technology

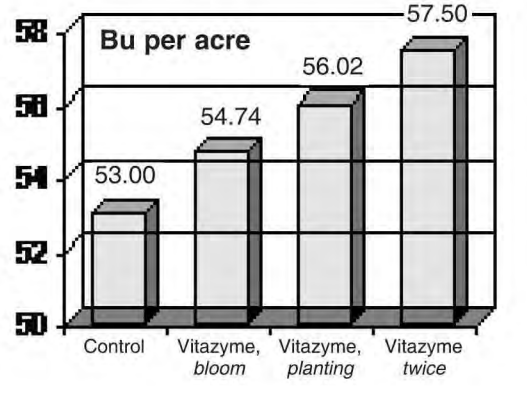
Researcher: Ivan E. Anderson, Ph.D. *Location*: Berkey Research Farm, Ames, Iowa
Seeding date: May 13, 1998 (adequate moisture) *Variety*: Prairie Brand B246
Seeding rate: 140,000 plants/acre *Row spacing and depth*: 30 inches, 1.5 inches deep
Experimental design: A randomized complete block design with six replications was set up on a Clarion loam, with plots 10 feet wide and 40 feet long (0.009183 acre; four rows per plot). Four treatments were used:

1. **Control (no Vitazyme)**
2. **Vitazyme at early bloom**
3. **Vitazyme on the seed at planting**
4. **Vitazyme on the seed at planting, and at early bloom**

Fertility and tillage treaments: Phosphorus and potassium levels were maintained above medium soil test levels.
Vitazyme applications: Vitazyme was applied to the seed row at planting at 15 oz/acre, and on the leaves and soil at early bloom at 15 oz/acre, to appropriate plots.
Harvest date: September 29
Yield results:

OVERALL RESULTS

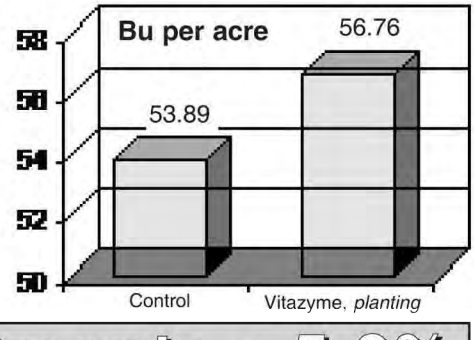
Treatment	Bean yield, bu/acre	Increase
1. Control	53.00	--
2. Vitazymeat bloom	54.74	1.74 (+3.3 %)
3. Vitazyme at planting	56.02	3.02 (+5.7 %)
4. Vitazyme twice	57.50	4.50 (+8.5 %)



Yield increase, Vitazyme twice: + 8.5%

SEED TREATMENT RESULTS

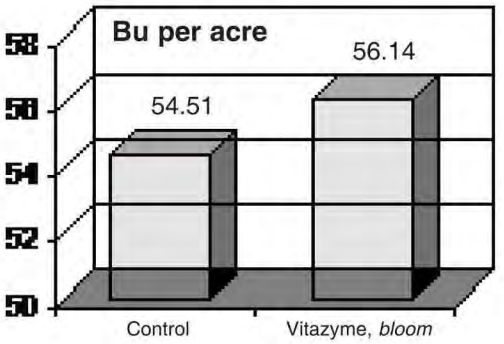
Treatment	Bean yield, bu/acre	Increase
1. Control	53.89	--
2. Vitazyme at planting	56.76	2.87 (+5.3 %)



Yield increase, seed treatment: + 5.3%

FOLIAR TREATMENT RESULTS

Treatment	Bean yield, bu/acre	Increase
1. Control	54.51	—
2. Vitazyme at bloom	56.14	1.63 (+3.0%)



Yield increase, foliar treatment:

Income results: "Overall results" are used here. Average soybean value in Iowa: about $6.00/bu.

Treatment	Income	Increase
1. Control	$318.00/acre	--
2. Vitazyme twice	$328.44/acre	$10.44/acre
3. Vitazyme at planting	$336.12/acre	$18.12/acre
4. Vitazyme at bloom	$345.00/acre	$27.00/acre

Income increase, Vitazyme twice: $27.00/acre

Conclusions: Vitazyme significantly increased soybean yields in central Iowa when applied on the foliage at early bloom, on the seeds at planting, and on both the seeds and foliage. The greatest increase was with both the seed and foliar applications. This dual application translated to a 4.5 bu/acre increase, or an increase in income of $27.00/acre. Vitazyme is therefore viewed as a highly profitable amendment for soybeans in central Iowa, as has been demonstrated in several other tests in the state as well.

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1997 Crop Results

Vitazyme on Soybeans

Researcher: William (Bill) Goodell
Location: Shortsville, New York
Seeding rate: 57 lb/acre
Seeding date: May 20, 1997
Row width: 7 inches
Variety: Terra 200
Experimental design: A field was split, half treated with Vitazyme and half left untreated.

1. **Control (no Vitazyme)**
2. **Vitazyme at planting**

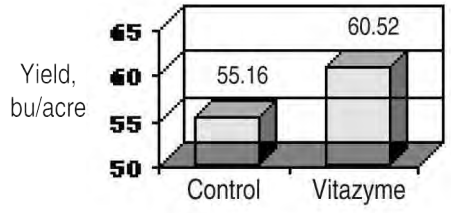
Fertility treatments: All of the field received 5.4 gal/acre 9-18-9 plus 2.6 gal/acre 0-0-30 on the seeds at planting.
Vitazyme application: 12 oz/acre along with the fertilizer at planting.
Soil: Ontario loam, 3 to 10% slope; 7.8 mg/100 g cation exchange capacity.
Tillage: conservation tillage (chisel plow)
Previous crop: corn
Harvest date: October 8, 1997
Yield results:

	Control	Vitazyme	Increase with Vitazyme
Soybean yield	55.16 bu/acre	60.52 bu/acre	5.36 bu/acre

Yield Increase: 10%

Income results: The price of corn in New York is about $7.00/bu.

	Control	Vitazyme
Soybean income	$386.12/acre	$423.64/acre



Income Increase: $37.52/acre

Leaf chlorophyll increase: An average chlorophyll value for 20 leaves was obtained for each treatment on July 13, 1997, using a Minolta SPAD meter.

	Control	Vitazyme
SPAD units of chlorophyll	41.7	43.8

Chlorophyll increase: 2.1 SPAD units

Comments: The cropping year was very favorable. Vitazyme treated plants were noticably bigger on July 13 than the control plants.

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1997 Crop Results

Vitazyme on Soybeans

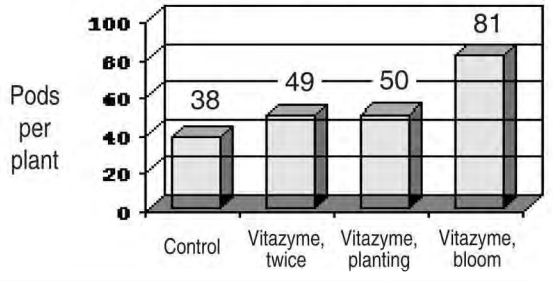
Researcher: Dan Easton, Easton Agri-Consulting, Inc
Seeding date: June 4, 1997 (adequate moisture) *Location*: Bagley, Iowa *Variety*: Pioneer RR soybeans
Seeding rate: 80,000 plants/acre *Row spacing and depth*: 30 inches, 1.5 inches deep
Experimental design: A randomized complete block design with six replications was set up on a Clarion loam, with plots 10 feet wide and 40 feet long (0.009183 acre).

Four treatments were used:

1. **Control (no Vitazyme)**
2. **Vitazyme on the seed at planting, and at early bloom**
3. **Vitazyme on the seed at planting**
4. **Vitazyme at early bloom**

Fertility and tillage treatments: Soils were sampled before planting and after harvest for analysis of basic soil parameters. No fertilizers were applied. The field was chisel plowed in the fall and disked in the spring.
Vitazyme applications: Vitazyme was applied to the seed row at planting at 13 oz/acre, and on the leaves and soil at early bloom (July 21) at 13 oz/acre, to appropriate plots.
Harvest date: October 20, 1997
Bean pod count results: Bean pods on representative plants from each treatment were counted on September 25.

Treatment	Average pods/plant	Increase
1. Control	38.0	—
2. Vitazyme twice	49.0	+29%
3. Vitazyme at planting	50.0	+32%
4. Vitazyme at bloom	81.0	+113%

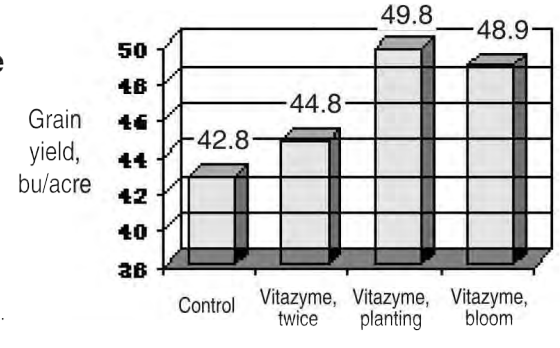


Pod increase (bloom application): 113%

Yield results:

Treatment	Grain yield*	Increase
	bu/acre	bu/acre
1. Control	42.8 c	—
2. Vitazyme twice	44.8 b	2.0 (+5%)
3. Vitazyme at planting	49.8 a	7.0 (+16%)
4. Vitazyme at bloom	48.9 a	6.1 (+14%)

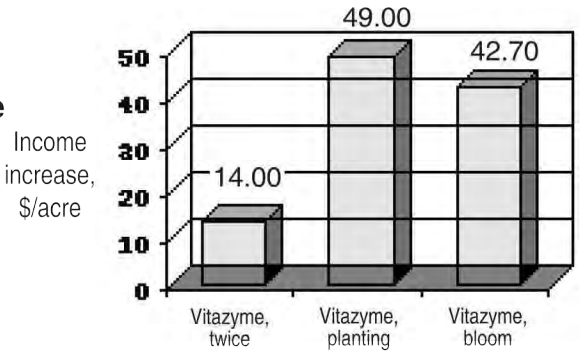
*Means followed by the same letter are not significantly different at P=0.05 (Duncan's Multiple Range Test).



Yield increase (planting application): 16%

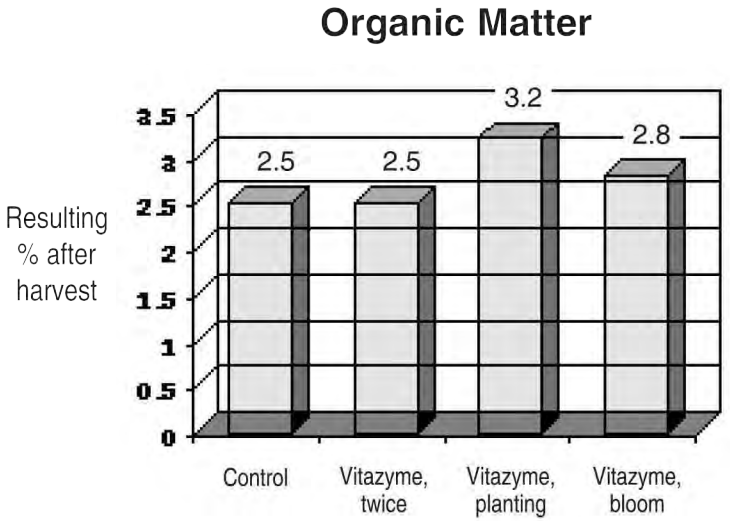
Income results: Average soybean value in Iowa: about $7.00/bu

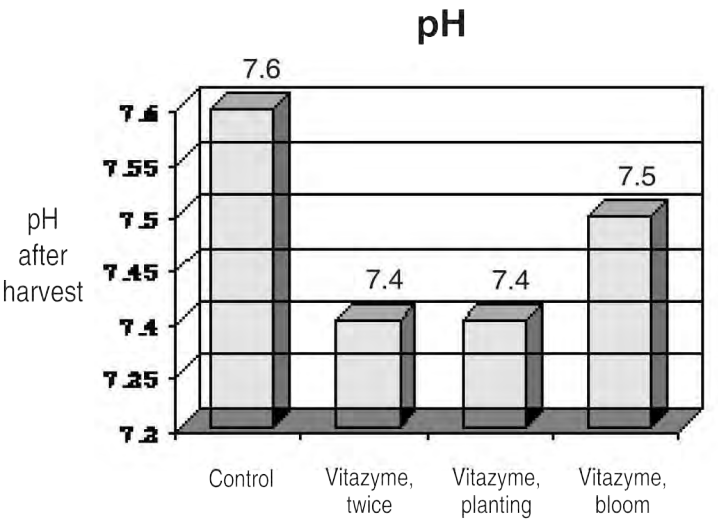
Treatment	Income	Increase
1. Control	$299.60/acre	—
2. Vitazyme twice	$313.60/acre	$14.00/acre
3. Vitazyme at planting	$348.60/acre	$49.00/acre
4. Vitazyme at bloom	$342.30/acre	$42.70/acre



Income increase (planting application): $49.00/acre

Soil test results: Changes in soil parameters from before planting to after harvest were similar for all treatments for P, K, Mg, Ca, and cation exchange capacity. Nitrate-N ended up slightly higher for all three Vitazyme treatments, but organic matter and pH levels showed greater differences.





Comments: The cropping year was excellent in central Iowa during 1997 despite a cool and wet spring.

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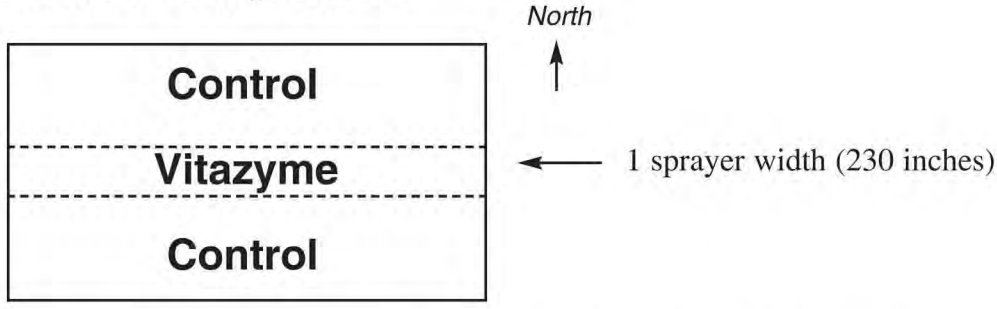
1997 Crop Results

Vitazyme on Soybeans

Researcher: Gerald Yoder
Location: Wellman, Iowa
Variety: Pioneer 9306
Seeding rate: 230,000 seeds/acre
Seeding date: May 1, 1997
Previous crop: corn
Row width: 7.5 inches
Tillage method: no-till
Experimental design: Two treatments were evaluated:

1. **Control (no Vitazyme)**
2. **Vitazyme sprayed once on the foliage and soil**



Vitazyme application: Vitazyme was applied to the foliage and soil at 13 oz/acre along with a herbicide spray when the soybeans were about one foot high.
Harvest date: October 2, 1997
Yield results: A weigh wagon was used to determine bean weights for strips harvested on both sides of the the applied Vitazyme strip.

	Control	Vitazyme
Soybean yield, north strip	67.62 bu/acre	69.82 bu/acre
Soybean yield, south strip	65.03 bu/acre	67.07 bu/acre
Average yield	**66.33 bu/acre**	**68.45 bu/acre (+2.12 bu/acre)**

Soybean yield increase: 4%

Income results: Farmgate value of soybeans, mid-Iowa: $7.00/bu

	Control	Vitazyme
Value of soybeans:	**$464.3/acre**	**$479.15/acre**

Income increase: $14.84/acre

Note: No sprayer cost is calculated, since Vitazyme was applied along with a herbicide.

Moisture at harvest:

	Control	Vitazyme
North strip	10.7%	10.2%
South strip	10.8%	10.0%
Average moisture	**10.8%**	**10.1%**

Moisture decrease: 0.7 percentage point

Leaf chlorophyll on August 17: An SPAD meter was used.

	Control	Vitazyme
SPAD units of chlorophyll (20 plants for each treatment)	**46.0**	**47.7**

Chlorophyll increase: 1.7 units

Pods: Five random plants from each treatment were selected, and pods were counted.

	Control	Vitazyme
Total pods	**166**	**250**

Pod number increase: 51%

Other observations and comments: Because the Vitazyme treated soybeans were drier at harvest, it may be presumed that they matured faster than the control beans. During August it was possible to view the field and pick out the treated strip due to a darker green color. The cropping year was excellent.

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1997 Crop Results

Vitazyme on Soybeans

Researcher: Waymond Lipsey, Agri-Research
Location: Danville, Iowa
Variety: Pioneer 9281 *Seeding date*: May 30, 1997
Seeding rate: 150,000 seeds/acre *Row width*: 30 inches
Experimental design: Four treatments were evaluated, in a completely randomized design having six seplications. Plots were 10 x 40 feet (0.0091827 acre).

1. **Control (no Vitazyme)**
2. **Vitazyme at 13 oz/acre at planting**
3. **Vitazyme at 13 oz/acre at early bloom**
4. **Vitazyme at 13 oz/acre at planting and at early bloom**

2	1	1	4	3	4
3	4	2	3	1	3
4	2	1	4	2	3
1	3	2	4	1	2

North ↑

Fertility treatments: none *Fertility level*: high *Tillage*: conventional
Soil type: Mahaska silty clay loam (pH = 6.8; cation exchange capacity = 20.8 meq/100 g.
Vitazyme application: Vitazyme was applied at 13 oz/acre at planting (directly on the seeds), at early bloom, or at both times.
Harvest date: October 1, 1997
Yield results: A plot combine was used to harvest the plots.

	Soybean yield	
Treatment	**lb/plot***	**bu/acre***
Control	24.0 c	43.56 c
13 oz/acre at planting	24.6 b	44.65 b
13 oz/acre at early bloom	25.5 a	46.28 a
13 oz/acre at planting and early bloom	25.8 a	46.83 a

*Means followed by the same letter are not significantly different at P=0.05.

Yield increase
At planting: 3%
At early bloom: 6%
At both times: 8%

Income results: The price of soybeans in Iowa is about $7.00/bu.

Treatment	**Soybean value**	**Increase in Value**
Control	$304.92/acre	0
13 oz/acre at planting	$312.55/acre	$7.63/acre
13 oz/acre at early bloom	$323.96/acre	$19.04/acre
13 oz/acre at planting and early bloom	$327.81/acre	$22.89/acre

Income increase
13 oz/acre
at early bloom
$19.04/acre

Comments: The year was very favorable for soybean yields.

Corn, Soybeans *with Vitazyme*

Glyphosate and AMPA Persistence and Distribution in Soils Under Field Conditions in the Midwestern USA

A University of Missouri Multi-Year Study, condensed from a Virtual Annual Meeting of the American Society of Agronomy, the Crop Science Society of America, and the Soil Science Society of America

Researchers: Robert Kremer, Division of Plant Sciences, University of Missouri, Columbia, Missouri. Timothy Reinbott, School of Natural Resources, University of Missouri, Columbia, Missouri. Manjula Nathan, Division of Plant Sciences, University of Missouri, Columbia, Missouri. Kelly Nelson, Division of Plant Sciences, University of Missouri, Columbia, Missouri. Paul Syltie, Vital Earth Resources, Inc., Gladewater, Texas. Xiaowei Pan, Agricultural Development Group, Eltopia, Washington. John Fagan, HRI Labs, Fairfield, Iowa.

Background Information

Many recent studies report persistent glyphosate and aminomethylphosphonic acid (AMPA) residues in field soils.

- Soil with >5-year glyphosate application history in Argentina, average concentrations of glyphosate and AMPA were 2300 and 4200 ug/kg, respectively; 25 to 1000 ug/kg soil in various soils.

Note the superior development of the corn ears on the right treated with Vitazyme.

Very limited information on effects of residual glyphosate/AMPA on soil biological activity or plant growth.

- Germination and early biomass accumulation in oat, faba bean, turnip rape decreased in greenhouse and field plot studies.
- "Low dose glyphosate" (ppb) in the presence of rhizosphere microbiome inhibits seedling growth.

"… the extensive use of glyphosate and the environmental risks associated with it warrant awareness among its user about its judicious utilization, and necessitate further intense investigations to mitigate, avoid, or remove the problems resulting from its use".

This Pioneer variety responded well to Vitazyme, as can be seen by the ear fill and degree of root development.

Management Considerations

- Residual glyphosate/AMPA effects on soil biology and non-genetically engineered (GE) crops when transitioning from GE with many years of Roundup herbicide applications to non-GE cropping systems with no Roundup.
- Practices for suppressing residual glyphosate/AMPA effects on crop growth.

Research studies performed by the University of Missouri involved the measurement of residual glyphosate/AMPA in soils

1. Use of a biostimulant to improve maize growth, soil health, and tolerance to glyphosate stress (field plots)
2. Mitigation of potential adverse effects of GE crop production for long-term improvement of soil health (farmer fields)

Research Objectives

1. Determine the impacts of residual glyphosate/AMPA on soil health after transition from a GE cropping system to a non-GE cropping system.
2. Determine the effects of a biostimulant (Vitazyme) on rhizosphere biology and crop growth in soils with residual glyphosate contents.

Plants treated with Vitazyme typically possess greater leaf area and more chlorophyll, both characteristics which are evident in this comparison. Note also more available nitrogen as evidenced by more leaves on the lower stalk.

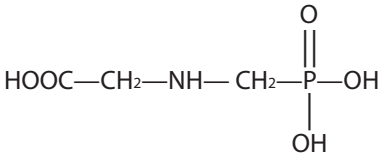
EXPERIMENTAL DESIGN

Sites, Soils, and Management:
Knox County, MO 2016, 2017
Soils: Mexico silt loam (fine, smectitic, mesic, Aeric Vertic Epiaqualfs)
Crops: Maize, soybean
Tillage: minimal, fertilizer based on soil test
Each field had received glyphosate-based herbicides in years prior to the study in 2016 and 2017. Half the plots received no glyphosate. Half the plots received brassinosteroid biostimulant (Vitazyme) at planting and foliar in the vegetative stage

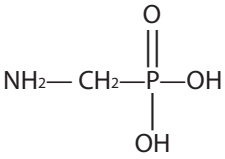
Delaware County, IA-2014-2019
Soils: Bassett-Olin Variant-Bertram-Lilah association- sandy loams
Crops: Maize, soybean
Minimum tillage: fertilizer based on soil test
Fields continuously cropped to GE varieties with annual applications of glyphosate-based herbicides for 19 years prior to transition to non-GE crops and termination of glyphosate use in 2016.

Soil & Rhizosphere Property Measurements
- Root Fusarium colonization
- Rhizosphere pseudomonad rhizobacteria
- Rhizosphere indole-acetic acid producing rhizobacteria
- Rhizosphere Mn transforming bacteria
- Soil glucosidase activity (soil microbial activity)
- Soil microbiome—phospholipid fatty acid (PFLA) profiles
- Soil microbial biomass ("Total PLFA")
- Soil organic C and active C
- Root biomass

Glyphosate Analysis
- Soil samples extracted with ethanol-acetonitrile
- Soil extracts injected into liquid chromatograph—tandem mass spectrometer for detection of glyphosate and AMPA product
- Limit of detection was <1.0 ng/g soil



Glyphosate

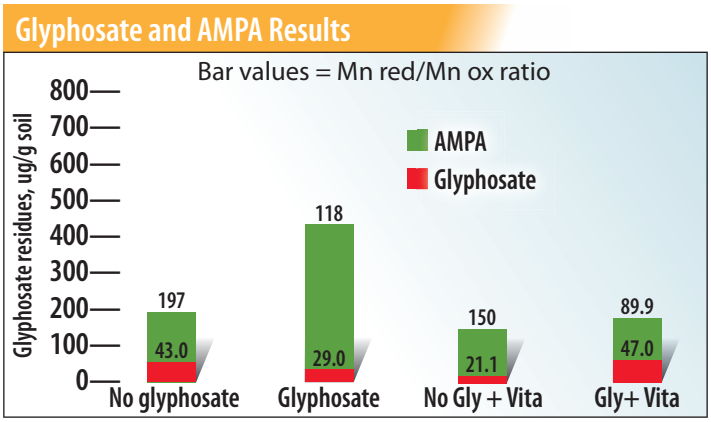


AMPA

The Vitazyme treated soybeans in Missouri have more leaf area and height, plus a higher chlorophyll content, indicative of a greater potential yield

Note the excellent pod formation along the entire stems of these Vitazyme treated soybeans, giving an excellent 60.1 bu/acre yield.

Glyphosate and AMPA results with Vitazyme at a Novelty, Missouri, test site.
Glyphosate and AMPA residues detected in soils of maize plots, averaged over treatments applied in 2017 at Greenley Memorial Research Center, Novelty, MO. Numbers above bars indicate standard deviation. Gly, Glyphosate: Glv+Bs, Glyphosate + Biostimulant

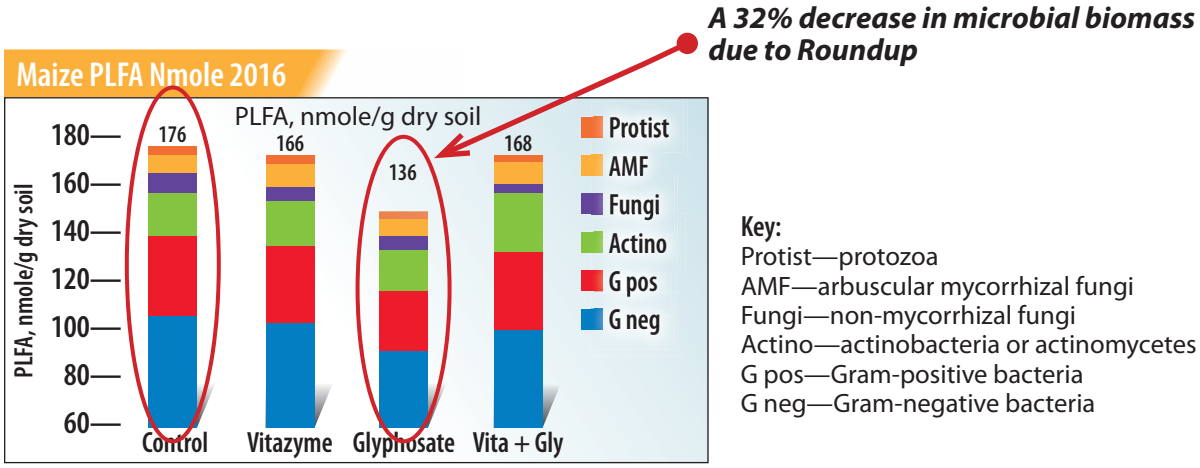


The mean soil glyphosate and AMPA concentrations for each treatment were associated with very high standard deviations, indicating considerable variable distribution within the experimental area regardless of application dosages or times of application.

Considerations from the Novetly, Missouri, field plot study:

- Vitazyme as a treatment to alleviate plant stress caused by glyphosat was confounded by residual herbicide in all plot soils.
- We assumed that glyphosate applied during the growing season interacted with root and rhizosphere microbiomes due to the systemic movement of the herbicide toward the root system, and its release into the rhizosphere.
- However, effects on microbiological activities cannot be correlated to soil glyphosate concentrations due to the unknown quantities of residual glyphosate and AMPA present in the rhizosphere in all plots from previous applications over the years.

Impact of Glyphosate on Rhizosphere Microbial Community (Diversity)



Key:
Protist—protozoa
AMF—arbuscular mycorrhizal fungi
Fungi—non-mycorrhizal fungi
Actino—actinobacteria or actinomycetes
G pos—Gram-positive bacteria
G neg—Gram-negative bacteria

Note potential protective effects of Vitazyme on microbiome diversity from the detrimental impact of glyphosate. Reduced microbial abundance = reduced degredation potential or rate.

Conclusion:

- Glyphosate persists in soils as a parent compound, and AMPA as well in fields receiving many applications and for years after termination.
- Distribution of glyphosate residues in soils is very heterogenous.
- The soil microbiome may mediate only one degradation pathway, resulting in the accumulation of the AMPA metabolite.
- Glyphosate residues may impact soil health and soil biology.
- Many soil factors (pH, SOM, nutrient concentrations, etc.) and management practices may confound overall effects of glyphosate.
- Management to avoid or overcome detrimental effects of persistent glyphosate residues in soils includes:
  - Build up soil organic matter (cover crops, organic amendments)
  - Utilize conservation practices including grass waterways
  - Use Vitazyme to enhance root growth
  - Enhance soil microbial diversity (cover crops, crop rotation)