Corn *with Vitazyme application*

Researcher: Brennan Lewis
Research organization: Department of Agronomy, Horticulture, and Plant Science, South Dakota State University, Brookings, South Dakota
Location: South Dakota State University Research Farm, Aurora, South Dakota
Variety: Dekalb DKC 47-85R1B
Plant population: 35,000 seeds/acre
Planting date: May 9, 2025
Row spacing: 30 inches
Soil type: Brandt silty clay loam
Previous crop: soybeans
Experimental design: A small-plot, irrigated, randomized, replicated (RCBD with four replicates) corn trial was established on the Aurora experimental farm, using plots that were 30 x 10 feet. The objective of the trial was to evaluate the effect of Vitazyme on the yield of corn at three nitrogen levels as compared to untreated corn at each level.

Treatment	Nitrogen	Vitazyme application	
		On seeds	Foliar at V6
	lb/acre N		oz/acre
1.	0	0	0
2.	0	X	13
3.	80	0	0
4.	80	X	13
5.	120	0	0
6.	120	X	13

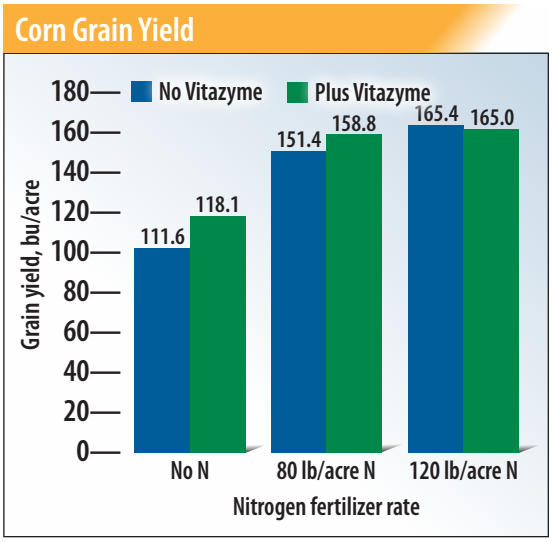
Fertilization: See the rates of N in the table. Urea was applied on June 10 at 174 lb/acre for the 80 lb/acre of N, and 260 lb/acre for the 120 lb/acre of N. Anvol Urease Inhibitor was added to the urea to slow N release.
Vitazyme application: See the table for applications. The seed treatment was accomplished by mixing 6 oz of Vitazyme in a bag of seed. The foliar sprays were performed using a sprayer at the V6 stage on July 10.
Irrigation: one irrigation on July 31 to supply 1.0 inch of water
Harvest date: October 15, 2025. The middle two rows were harvested for 20 feet to evaluate yield.
Yield results:

Improvements in root growth were especially noted in the no nitrogen plots in this South Dakota trial, where the treated corn yielded 6% more than the control.

Irrigated corn treated with Vitazyme produced larger and better filled ears than the untreated plants in this South Dakota trial.

Treatment	Grain Yield[1]	Yield change[2]
	bu/acre	bu/acre
1. No N	111.6 c	—
2. No N +Vitazyme	118.1 bc	6.5 (+6%)
3. 80 lb/acre N	151.4 abc	—
4. 80 lb/acre N +Vita	158.8 ab	7.4 (+5%)
5. 120 lb/acre N	165.4 a	—
6. 120 lb/acre N +Vita	165.0 a	-0.4 (0%)

[1]Means followed by the same letter are not significantly different according to the Tukey Post Hoc Test at P = 0.05. Plot variability was considerable so that significant differences appear only between the 0 and 120 lb/acre N rates.
[2]Comparisons are made within the same N level



Corn grain yield increase with reduced nitrogen fertilizer

No N..... 6%
80 lb/acre N..... 5%

Conclusions: A small-plot, replicated corn trial in east-central south Dakota, using a seed and foliar (at V6) Vitazyme program at three fertilizer nitrogen levels compared to untreated control nitrogen levels, revealed grain yield increases of 6% for no added N, and 5% for 80 lb/acre N. There was no yield change at the 120 lb/acre N rate. Although significant yield changes were not detected due to considerable plot variability, the trend was for sizable grain increases at the 0 and 80 lb/acre N rates. There was no increase at the 120 lb/acre N rate, which conforms with previous studies that have shown yield increases at reduced N rates but not at high fertilizer N rates.

Corn *with Vitazyme application—A Fertility Rate and Silicon Additive Study*

Researcher: Lance Taylor
Research organization: Crossroads Ag Research, Denver, Iowa
Field Location: Denver, Bremer County, Iowa
Variety: LG Seed 55C32 STX PRO
Planting date: May 6, 2025 ***Planting depth:*** 2 inches
Row spacing: 30 inches ***Seeding rate:*** 35,000 seeds/acre
Tillage: conventional ***Soil type:*** Clyde silty clay loam
Fertility level: good ***Soil drainage:*** excellent
Soil analysis: pH = 6.5, organic matter = 4.4%, cation exchange capacity = 21.2 meq/100 g, Bray P1 = 25 ppm, Bray P2 = 53 ppm, K = 133 ppm, Mg = 569 ppm, Ca = 2908 ppm (at 6 inches, Midwest Labs)
Experimental design: A small-plot corn trial, with plots being 15 x 30 feet (6 rows/plot, the center 2 harvested), using four replications in a randomized complete block design, was established to evaluate the effect of Vitazyme on the yield of corn over two fertility rates, with and without a silicon-based adjuvant.

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

Treatment	Vitazyme	Fertilizer		Nano Yield
		100%	60%	
1. Control, 100% fert	o	x	o	o
2. Control, 60% fert	o	o	x	o
3. Vitazyme, 100% fert	x	x	o	o
4. Vitazyme, 60% fert	x	o	x	o
5. Vita + Nano, 100% fert	x	x	o	x
6. Vita + Nano, 60% fert	x	o	x	x

The Crossroads Research corn trial showed that the silicon product added to Vitazyme significantly increased the grain yield at the 100% fertilizer level.

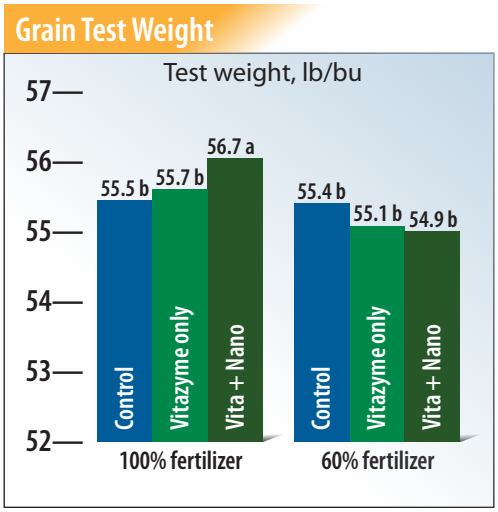
At the reduced fertilizer rate, sample ears reveal a progression of ear weight with Vitazyme, and then with Vitazyme plus the added silicon product.

Fertilization: 100% = 55 gal/acre 32-0-0, 150 lb/acre diammonium phosphate, and150 lb/acre KCl (0-0-60); 60% = 33 gal/acre 32-0-0, 90 lb/acre diammonium phosphate, and 90 lb/acre KCl (0-0-60)
Vitazyme application: 13 oz/acre (1 liter/ha) in-furrow at planting; 13 oz/acre (1 liter/ha) foliar sprayed at V6 on June 18
Vitazyme + Nano Yield application: 13 oz/acre (1 liter/ha) mixed with 1 oz/acre (0.08 liter/ha) of Nano Yield; 13 oz/acre (1 liter/ha) mixed with 1 oz/acre (0.08 liter/ha) of Nano Yield. Nano Yield is a silicic acid and aluminum sodium salt designed to improve the uptake of active agents by the plant.
Herbicide applications: May 18 – Corvus and Atrazine; June 11 – Callisto, Outlook, Atrazine, and Fultech C.C.; July 1- Status, Round Up, and AMS.
Growing season weather: average precipitation and temperature
Harvest date: October 11, 2025
Leaf chlorophyll results: No significant differences in leaf chlorophyll were detected among the six treatments at V8.
Grain Moisture content: No significant differences in grain moisture were detected among the six treatments.

Grain test weight results:

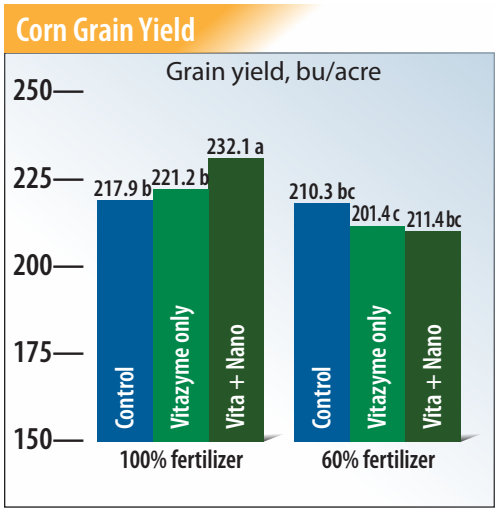
Treatment	Grain yield[1]	Yield change[2]
	lb/bu	lb/bu
1. Control, 100% fert	55.5 b	—
2. Control, 60% fert	55.4 b	—
3. Vitazyme, 100% fert	55.7 b	+ 0.2
4. Vitazyme, 60% fert	55.1 b	- 0.4
5. Vitazyme + Nano100% fert	56.7 a	+ 1.2
6. Vitazyme + Nano 60% fert	54.9 b	- 0.5

[1]Means followed by the same letter are not significantly different at P = 0.15 according to the Student-Newman-Keuls Test.
[2]Comparisons are made with the same fertilizer level.



Vitazyme coupled with Nano Yield significantly increased test weight above all five of the other treatments.

Grain Yield results: All yields are adjusted to 15.5 % grain moisture.



Treatment	Grain yield[1]	Yield change[2]
	bu/acre	bu/acre
1. Control, 100% fert	217.9 b	—
2. Control, 60% fert	210.3 bc	—
3. Vitazyme, 100% fert	221.2 b	+ 3.3(+2)
4. Vitazyme, 60% fert	201.4 c	- 8.9(-4%)
5. Vitazyme + Nano100% fert	232.1 a	+14.2(+7%)
6. Vitazyme + Nano 60% fert	211.4 c	+1.1(+1%)
LSD (P=0.15)	10.5	—
CV	4.55	—
Replicate probability (F)	0.1328	—
Treatment probability (F)	0.0097	—

[1]Means followed by the same letter are not significantly different at P = 0.15 according to the Student-Newman-Keuls Test.
[2]Comparisons are made with the same fertility level.

Fertilizer effects		
Three treatment at this level	Yield	
	Average	Change
	bu/acre	
100% fertilizer	223.7	16.0 (+ 8%)
60% fertilizer	207.7	—

Nano Yield effects		
Treatment	Yield	
	Average	Change
	bu/acre	
Control	214.1	—
Vitazyme alone	211.3	-2.8
Vita + Nano	221.8	+7.7 (+4%)

Conclusions: In this east-central Iowa small-plot corn study, Vitazyme at 13 oz/acre (1 liter/ha) in-furrow at planting and the same rate at V6 produced a modest yield increase with the 100% fertilizer rate of 3.3 bu/acre. For some unknown reason the yield with Vitazyme decreased compared to the untreated control at the 60% fertilizer rate. However, when a 1 oz/acre (0.08 liter/ha) Nano Yield addition was made to the Vitazyme, the grain yield was boosted significantly above the control and Vitazyme only at the 100% fertilizer level; at the 60% fertilizer level the grain yield was raised slightly. These results indicate that the Nano Yield adjuvant is aiding in the movement of Vitazyme's active agents (brassinosteroids, 1-triacontanol, and B-vitamins) into the corn plants to produce higher grain yield, and also greater test weight for the 100% fertilizer rate. These results point towards the considerable utility of adding Nano Yield to Vitazyme applications for corn production in the Upper Midwest.

Corn *with Vitazyme application—A Silicon Additive Study*

Researcher: Jonathan Jaschen
Research organization: Heritage Ag Research, Fairbank, Iowa
Location: Klinger, Iowa
Variety: PO5737PCE
Previous crop: soybeans
Planting date: May 16, 2025
Row width: 30 inches
Planting depth: 2.5 inches
Planting rate: 34,000 seeds/acre
Tillage: conventional
Soil type: Kilnger silty clay loam
Soil analysis: pH = 5.9, organic matter = 4.0%
Experimental design: A small-plot corn trial was established in east-central Iowa, utilizing plots that were 10x 40 feet, with four rows per plot and five replications in a randomized complete block design. The purpose of the trial was to evaluate the effectiveness of Vitazyme, with and without a silica-based adjuvant, on the yield of corn grain.

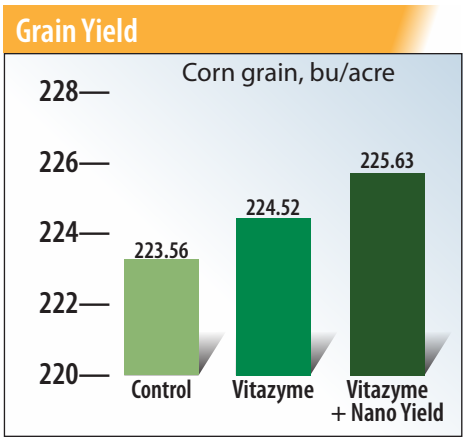
There is a progression in this photo of ear size and fill from the untreated control to the Vitazyme treated, and then the Vitazyme + Si treated corn.

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

Fertilization: Before planting, triple super phosphate at 145 lb/acre, MOP at 218 lb/acre, and gypsum at 125 lb/acre; at V1, side-dress of urea ammonium nitrate (32% N) at 50 lb/acre of N; at V7, Y-drop of urea ammonium nitrate at 130 lb/acre of N
Vitazyme application: 13 oz/acre (1 liter/ha) in-furrow at planting on May 16; 13 oz/acre (1 liter/ha) foliar sprayed at V5 on July 21
Nano Yield application: 1 oz/acre (0.08 liter/ha) mixed with Vitazyme for each of the two applications of Treatment 3, on May 16 and July 21. Nano Yield is a silicic acid and aluminum sodium salt designed to improve the uptake of active agents by the plant.
Growing season weather: very favorable in terms of temperature and precipitation, record yields for the area
Harvest date: October 13, 2025
Moisture content results: No significant differences in grain moisture content were detected. The range was 17.4 to 17.6%.
Grain test weight results: There were no significant differences in grain test weight for the three treatments. The range was 57.48 to 57.64 lb/bu.
Grain yield results:

Treatment	Grain Yield[1]	Yield change
	bu/acre	bu/acre
1. Control	223.56 a	—
2. Vitazyme	224.52 a	0.96 (+0.4%)
3. Vitazyme + Nano	225.63 a	2.07 (+1%)

[1]Means followed by the same letter are not significantly different at P = 0.10 according to the Student-Newman-Keuls Test.
LSD (0.10) = 5.07 bu/acre
CV = 1.92.



Plant health results: A drone was used to evaluate leaf chlorophyll, leaf N levels, and plant health during the growth period.

NDRE Results to Access Plant Health, Chlorophyll Content, and Nitrogen Levels (November 11)

Treatment	Value[1]
	NDRE
1. Control	4.552 b
2. Vitazyme	4.574 ab
3. Vitazyme + Nano	4.611 a

[1]Means followed by the same letter are not significantly different at P = 0.10 according to the Student-Newman-Keuls Test.
LSD (0.10) = 0.043
CV = 0.8

Notice the best root system with the Vitazyme + Si treatment on the right; there are more total roots and more root hairs that cause more soil to remain on the root balls.

At this late stage of development, the Vitazyme + Nano Yield treatment showed superior plant health, chlorophyll, and leaf N levels as compared to the untreated control.

Conclusions: This small-plot corn trial in east-central Iowa, which evaluated the effect of Vitazyme and Nano Yield adjuvant on corn grain yield, showed small yield benefits of up to 2.07 bu/acre for the Vitazyme + Nano Yield treatment. Vitzyme alone produced about a 1 bu/acre increase. These increases were not significant, but showed a trend of yield improvement for the two products, especially when combined. The very favorable low-stress growing conditions and high soil fertility (especially N) reduced the usual effectiveness of Vitazyme, since it performs best under stressful conditions. However, the small increases in yield show a positive trend even under maximum yield potential with optimal rain, temperature, and soil fertility in a record year of crop yields.

Corn *with Vitazyme application—A Nitrogen Rate Study Under Irrigation*

Researcher: Graig 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 DKC 47-85RIB (97 day)
Planting date: May 16, 2024
Seeing rate: 32,000 seeds.acre
Soil type: Brandt silty clay loam
Row spacing: 30 inches
Planting depth: 2 inches
Experimental design: A small-plot corn trial, with four replications in a randomized complete block design, was established using plots that were four rows wide and 20 feet long. During harvest the middle two rows of each plot were harvested for data collection. The purpose of the trial was to evaluate the effect of Vitazyme, applied at planting and foliar at V6, on grain yield for three nitrogen fertilizer rates.
Fertilization: 80 and 120 lb/acre of N as urea on the appropriate plots
Vitazyme application: 13 oz/acre (1 liter/ha) on July 10 at V8
Irrigation: as needed during the summer
Growing season weather: very warm temperatures during the summer, with erratic rainfall, and drought the last half of the summer.

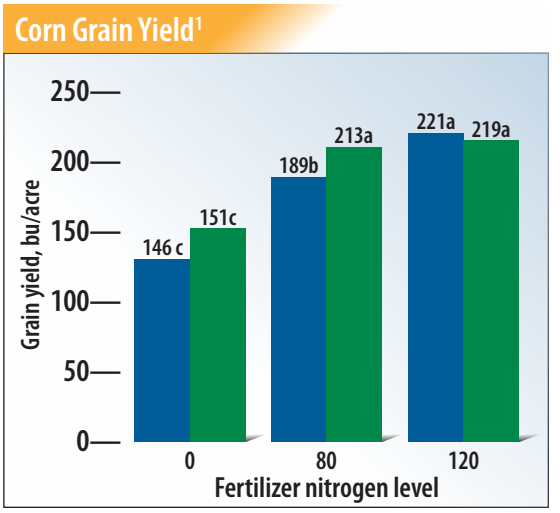
Treatment	Vitazyme	Fertilizer N lb/acre		
		0	80	120
1	o	x	o	o
2	x	x	o	o
3	o	o	x	o
4	x	o	x	o
5	o	o	o	x
6	x	o	o	x

The ear development with Vitazyme at all three nitrogen levels is superior to the untreated control ears.

The irrigated corn trial with three fertilizer N levels is shown here at the South Dakota State University experimental farm.

Notice the much greater root development of the treated corn plants having had Vitazyme applied at the V8 stage. The 80 lb/acre of N treatment gave the biggest yield increase, which was highly significant.

Yield results:



Treatment	Grain Yield[1]	Yield change
	bu/ha	bu/ha
1. No N	146 c	—
2. No N +Vitazyme	151c	5 (+3%)
3. 80 N	189 b	—
4. 80 N + Vitazyme	213 a	24 (+13%)
5. 120 N	221 a	—
6. 120 N + Vitazyme	219 a	-2 (-1%)

[1]Means followed by the same letter are not significantly different at P = 0.05 according to the Duncan Multiple Range Test.

Yield change with Vitazyme at three fertilizer N levels

No N..... +3%
80 lb/acre N..... +13%
120 lb/acre N.....-1%

There were no significant yield differences between the Vitazyme treated and untreated treatments for the 0 N fertilizer level and the 120 lb/acre level. However, at the 80 lb/acre fertilizer level there was a highly significant yield increase with Vitazyme, of 24 bu/acre (13%). The yield with Vitazyme at the 80 lb/acre N rate was statistically equivalent to the yield of both treatments at the 120 lb/acre N rate.

Conclusions: This small-plot replicated corn trial at South Dakota State University, using three fertilizer nitrogen (N) rates of 0, 80, and 120 lb/acre, with and without Vitazyme, revealed that the biostimulant did not affect yield at the 0 N and 120 lb/acre N rates. However, at the 80 lb/acre rate Vitazyme significantly boosted grain yield by 24 bu/acre over the untreated control treatment (Treatment 3). This yield was statistically equal to the yields of both the untreated and Vitazyme treated treatments at the 120 lb/acre N rates.

These results show that:

1. At least some N fertilizer is needed to gain a significant yield response with Vitazyme under these soil fertility conditions.
2. Vitazyme will significantly boost corn grain yield at less-than-optional fertilizer N applications (80 lb/acre), to equal the yield of grain at the optimal fertilizer N level of 120 lb/acre.
3. Under high or optimal fertilizer N applications (120 lb/acre), Vitazyme will not improve corn grain yields under the soil fertility levels experienced in this experiment.

Thus, Vitazyme improves the efficiency of nitrogen fertilizer use with corn when the nitrogen is at less than optional rates under irrigated conditions.

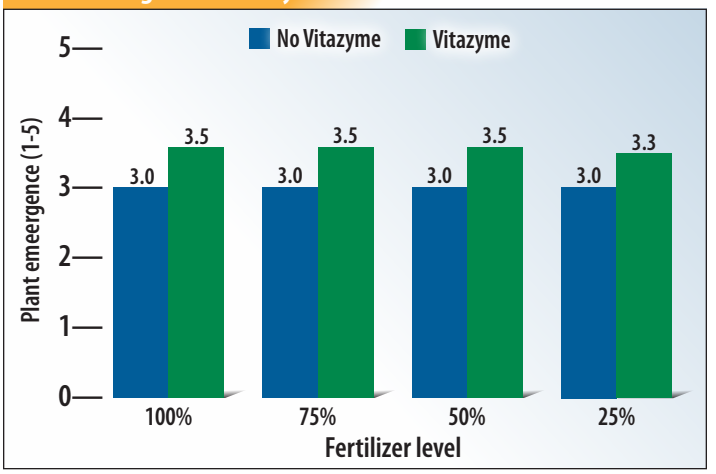
Corn *with Vitazyme application—A Fertilizer Efficiency Study*

Researcher: Bruce Kirksey, Ph.D.
Research organization: Agricenter International, Memphis, Tennessee
Location: Memphis, Tennessee
Variety: DKC 65-95VT2P ***Planting date:*** April 25, 2024 ***Planting rate:*** 34,000 seeds/acre
Row spacing: 30 inches ***Plant depth:*** 1.5 inches
Soil type: Falaya and Waverly silt loams
Soil character: pH = 6.5, organic matter = 1.8%, cation exchange capacity = 7.8 meq/100g, excellent fertility, good drainage
Tillage: conventional
Experimental design: A small plot experiment on corn was initiated, using four replications and eight treatments — four fertilizer levels either treated or not treated with Vitazyme — to evaluate the effect of this biostimulant on the emergence, plant vigor, leaf chlorophyll content, grain test weight, and yield of the crop. Special attention was focused on the ability of Vitazyme to improve fertilizer efficiency of use.

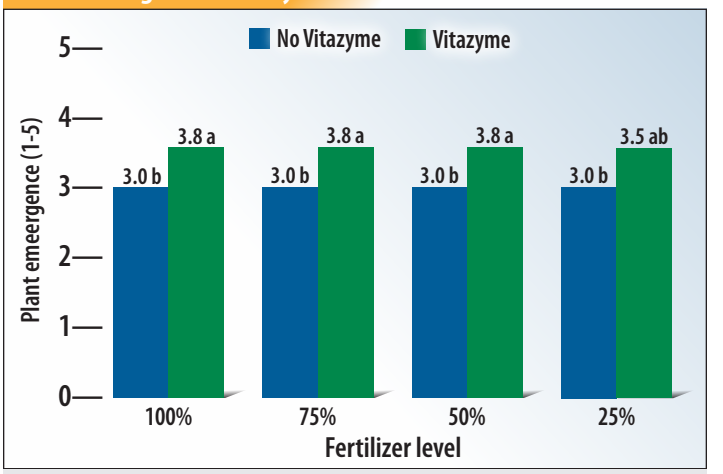
Treatment	Fertilizer	Vitazyme	
		In-furrow	Foliar
1. 100% fertilizer	100%	o	o
2. Vitazyme + 100% fertilizer	100%	x	x
3. 75% fertilizer	75%	o	o
4. Vitazyme + 75% fertilizer	75%	x	x
5. 50% fertilizer	50%	o	o
6. Vitazyme + 50% fertilizer	50%	x	x
7. 25% fertilizer	25%	o	o
8. Vitazyme + 25% fertilizer	25%	x	x

Fertilization: 100% = 200-60-60 lb/acre of N-P_2O_5-K_2O; 75% = 150-45-45 lb/acre of N-P_2O_5-K_2O; 50% = 100-30-30 lb/acre of N-P_2O_5-K_2O; 25% = 50-15-15 lb/acre of N-P_2O_5-K_2O.All fertilizer was applied in the liquid form.
Vitazyme applications: In-furrow at 13 oz/acre (1 liter/ha) on April 25 at planting; foliar at 13 oz/acre (1 liter/ha) on June 12, 48 days after planting at 6-8 leaves
Plant Emergence results: Emergence evaluations were made on May 2 and May 6, 7 and 11 days after planting, respectively.

Plant Emergence on May 2



Plant Emergence on May 6[1]

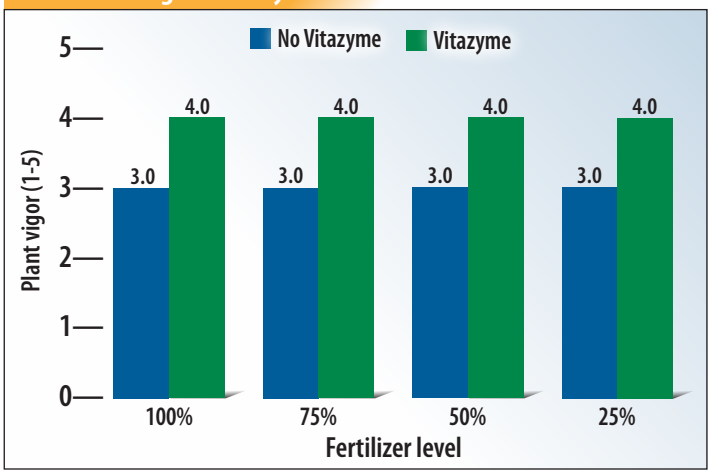


[1]Means followed by the same letter are not significantly different at P = 0.05 according to ANOVA. LSD (0.005) = 0.5, CV = 10.64, treatment prob (F) = 0.0034.

On May 2, the Vitazyme treated plots at all four fertilizer levels had significantly more emerged plants than the untreated plots. Seed contact with the product had a consistent but nonsignificant effect. This effect carried through even more intensively for the May 6 evaluation, with the Vitazyme treatments having significantly more emerged plants than the untreated treatment, except at the 25% fertilizer level.

Plant vigor results: Plant vigor evaluations were made on May 6 using a scale of 1 to 5

Corn Plant Vigor on May 6



Plant vigor was consistently greater with the Vitazyme treated plots versus the untreated plots at all fertilizer levels. Because there was no error variance in the statistical analysis, there was no ANOVA performed. However, the treatment differences are real.

Increase in plant vigor with Vitazyme: 33%

Leaf chlorophyll results: Using a Minolt SPAD meter, and 10 leaf determinations per plot, there were no significant difference among the treatments. However, at the 100% fertilizer level Vitazyme treated plants had a profoundly greater chlorophyll level than the untreated treatment: 34.5 vs. 28.2. This difference would be clearly visible to the eye in the field.

Increase in chlorophyl with Vitazyme, Treatment 2: 6.3 SPAD units

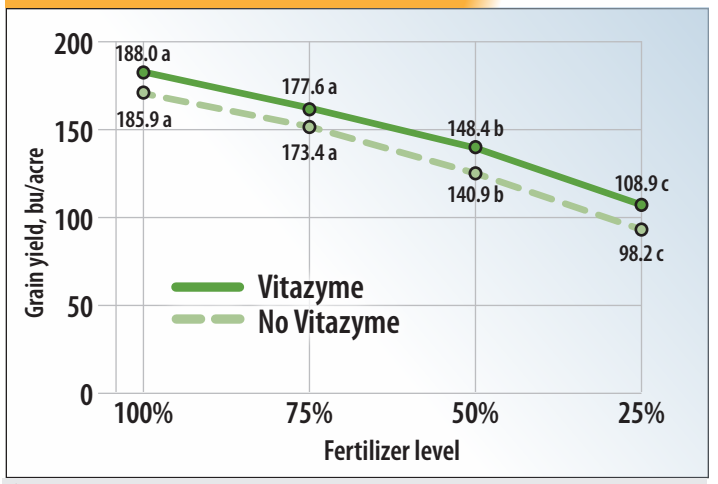
Grain moisture results: There were no significant differences among the treatments.

Grain yield results: The corn grain was harvested and weighed on August 27, 2024.

Statistical values

LSD (0.05)	17.8 bu/acre
CV	7.94
Replicate F	0.6072
Treatment F	0.0001

Corn Grain Yield[1]



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

Yield increases with Vitazyme at each fertilizer level

100% fertilizer	2.1 bu/acre (1%)
75% fertilizer	4.2 bu/acre (2%)
50% fertilizer	7.5 bu/acre (5%)
25% fertilizer	10.7 bu/acre (11%)

Vitazyme improved the corn grain yield at each fertilizer level, though not significantly. This increase was greatest at the 25% fertilizer level: 11%. The fertilizer treatments greatly improved grain yield.

Yield of corn for four fertilizer treatments, average of Vitazyme and untreated treatments

100% fertilizer	187 bu/acre
75% fertilizer	175.5 bu/acre
50% fertilizer	144.7 bu/acre
25% fertilizer	103.6 bu/acre

Conclusions: A small-plot replicated corn study in extreme western Tennessee, which evaluated the effect of Vitazyme applied in-furrow and foliar at four fertilizer levels, revealed consistent but non-significant yield increases of from 1 to 11%, the highest increase being at the 25% fertilizer rate. These results suggest an improvement in fertilizer use efficiency with Vitazyme. Plant emergence was significantly enhanced by Vitazyme at all fertilizer levels, as was plant vigor. These results show that Vitazyme is a highly effective management tool for corn production in the southern Mississippi River Valley.

Corn *with Vitazyme application—A Nitrogen Rate Study*

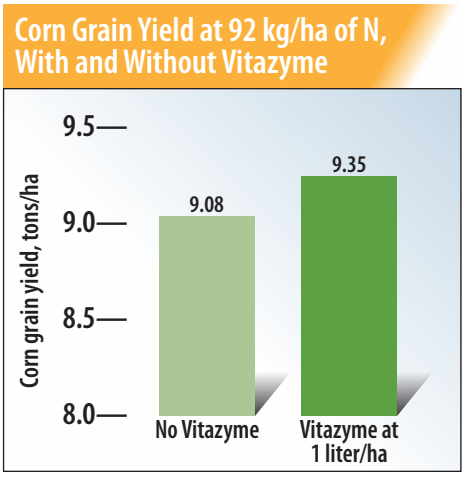
Researcher: Kernel personnel
Research organization: Kernel Company, Ukraine [Kernel is the largest producer of sunflower oil in Ukraine, and exports oils and grains worldwide, and provides storage for grains and seeds.]
Location of trial: Uman District, Cherkasy Region, Chorna Kamianka Village, Ukraine
Variety: Amarok 290
Planting date: unknown
Planting rate: unknown
Previous crop: unknown
Experimental design: A corn field in 2023 was divided into four sections, each receiving different N fertilizer or Vitazyme treatment, to determine the effect of these treatments on corn yield
Fertilization: nitrogen applied at the rates shown in the table (right).
Vitazyme application: Vitazyme applied at 1 liter/ha sprayed on the leaves and soil at the 10-leaf stage (BBCH 30) on June 23, 2023.

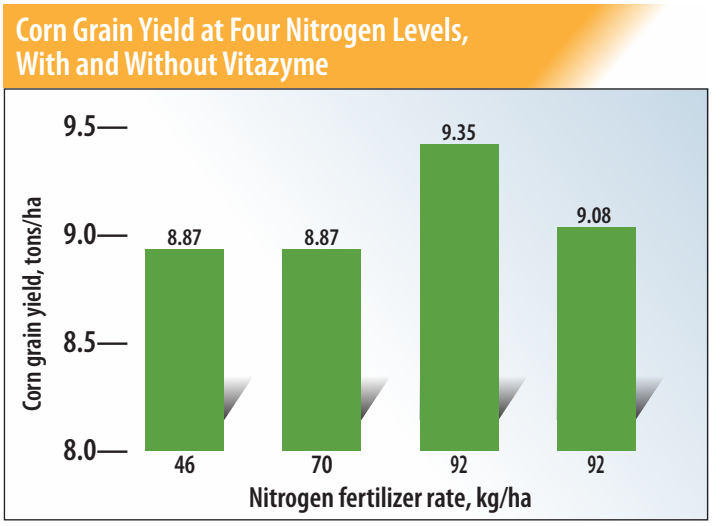
Treatment	Fertilizer rate	Vitazyme
	kg/ha of N/ha	liter/ha
1	46	1
2	70	1
3	92	1
4	92	0

Yield results:

Treatment	Grain yield	Yield change*
	tons/ha	tons/ha
1. 46 kg/ha N + Vita	8.87	—
2. 70 kg/ha N + Vita	8.87	o
3. 92 kg/ha N + Vita	9.35	+0.48 (+5%)
4. 92 kg/ha N	9.08	+0.21 (+2%)

*Yield changes are compared to Treatment 1, which has the lowest N fertilizer application.





Corn grain yield increase at the same nitrogen level: 0.27 ton/ha (+3%)

Conclusions: A corn trial in Ukraine, which evaluated grain yield at three nitrogen (N) fertilizer levels, and the effect of Vitazyme at the highest N level, showed that moving from 46 to 70 kg/ha of N did not increase yield with Vitazyme. However, at the 92 Kg/ha of N application, 1 liter/ha of Vitazyme applied at the 10-leaf stage improved the grain yield by 0.27 ton/ha, a significant 3% increase corn yield at fairly high N rates in Ukraine.

Corn *with Vitazyme application—A Nitrogen Rate Study Under Irrigation*

Researcher: Graig 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 DKC 47-85RIB (97 day)
Planting date: May 16, 2024
Seeing rate: 32,000 seeds.acre
Soil type: Brandt silty clay loam
Row spacing: 30 inches
Planting depth: 2 inches
Experimental design: A small-plot corn trial, with four replications in a randomized complete block design, was established using plots that were four rows wide and 20 feet long. During harvest the middle two rows of each plot were harvested for data collection. The purpose of the trial was to evaluate the effect of Vitazyme, applied at planting and foliar at V6, on grain yield for three nitrogen fertilizer rates.
Fertilization: 80 and 120 lb/acre of N as urea on the appropriate plots
Vitazyme application: 13 oz/acre (1 liter/ha) on July 10 at V8
Irrigation: as needed during the summer
Growing season weather: very warm temperatures during the summer, with erratic rainfall, and drought the last half of the summer.

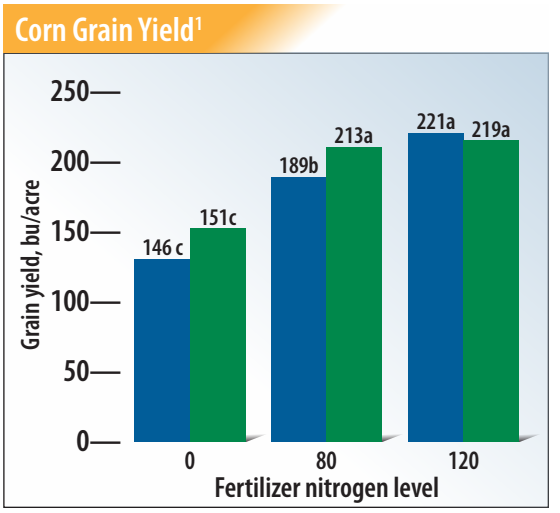
Treatment	Vitazyme	Fertilizer N lb/acre		
		0	80	120
1	o	x	o	o
2	x	x	o	o
3	o	o	x	o
4	x	o	x	o
5	o	o	o	x
6	x	o	o	x

The ear development with Vitazyme at all three nitrogen levels is superior to the untreated control ears.

The irrigated corn trial with three fertilizer N levels is shown here at the South Dakota State University experimental farm.

Notice the much greater root development of the treated corn plants having had Vitazyme applied at the V8 stage. The 80 lb/acre of N treatment gave the biggest yield increase, which was highly significant.

Yield results:



Treatment	Grain Yield[1]	Yield change
	bu/ha	bu/ha
1. No N	146 c	—
2. No N +Vitazyme	151c	5 (+3%)
3. 80 N	189 b	—
4. 80 N + Vitazyme	213 a	24 (+13%)
5. 120 N	221 a	—
6. 120 N + Vitazyme	219 a	-2 (-1%)

[1]Means followed by the same letter are not significantly different at P = 0.05 according to the Duncan Multiple Range Test.

Yield change with Vitazyme at three fertilizer N levels

No N..... +3%
80 lb/acre N..... +13%
120 lb/acre N.....-1%

There were no significant yield differences between the Vitazyme treated and untreated treatments for the 0 N fertilizer level and the 120 lb/acre level. However, at the 80 lb/acre fertilizer level there was a highly significant yield increase with Vitazyme, of 24 bu/acre (13%). The yield with Vitazyme at the 80 lb/acre N rate was statistically equivalent to the yield of both treatments at the 120 lb/acre N rate.

Conclusions: This small-plot replicated corn trial at South Dakota State University, using three fertilizer nitrogen (N) rates of 0, 80, and 120 lb/acre, with and without Vitazyme, revealed that the biostimulant did not affect yield at the 0 N and 120 lb/acre N rates. However, at the 80 lb/acre rate Vitazyme significantly boosted grain yield by 24 bu/acre over the untreated control treatment (Treatment 3). This yield was statistically equal to the yields of both the untreated and Vitazyme treated treatments at the 120 lb/acre N rates.

These results show that:

1. At least some N fertilizer is needed to gain a significant yield response with Vitazyme under these soil fertility conditions.
2. Vitazyme will significantly boost corn grain yield at less-than-optional fertilizer N applications (80 lb/acre), to equal the yield of grain at the optimal fertilizer N level of 120 lb/acre.
3. Under high or optimal fertilizer N applications (120 lb/acre), Vitazyme will not improve corn grain yields under the soil fertility levels experienced in this experiment.

Thus, Vitazyme improves the efficiency of nitrogen fertilizer use with corn when the nitrogen is at less than optional rates under irrigated conditions.

Corn *with Vitazyme application*

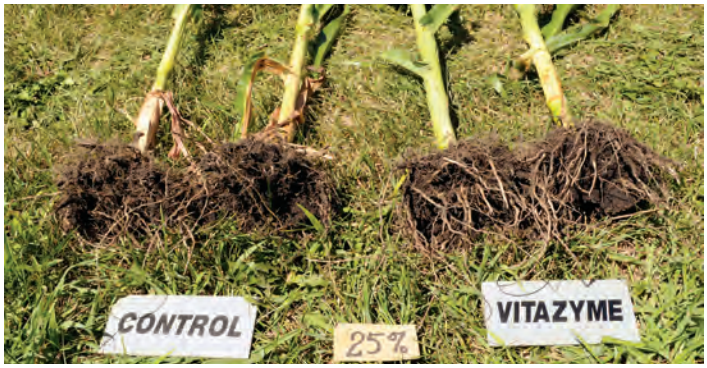
Researcher: Jonathan Jaschen ***Research organization:*** ACRES Research, Cedar Falls, Iowa
Location: Fairbank, Iowa ***Variety:*** P0339Q ***Planting date:*** May 22, 2023 ***Planting depth:*** 2.5 inches
Row spacing: 30 inches ***Planting rate:*** 34,000 seeds/acre ***Previous crop:*** soybeans
Soil: Marshan clay loam; 3.7% organic matter, 6.5 pH, 24 meq/100g cation exchange capacity

Experimental design: A small-plot replicated corn trial, using five replications and plots that were 30 x 15 feet (six rows/plot) was established as a randomized complete block design. The purpose of the trial was to evaluate the effect of Vitazyme, applied at different times and ways, over four fertilizer rates, to determine the effect of the product on nitrogen utilization.

Fertilization: See the table to the right.

Treatment	Nitrogen application	Vitazyme application[1]	Vitazyme timing[2]	Fertilizer		
				N	P_2O_5	K_2O
	% of optimum	ounces/acre		lb/acre		
1. 100% fert	100	0	0	180	83	60
2. 100% fert + Vita	100	13	in-furrow + foliar	180	83	60
3. 75% fert	75	0	0	120	62	45
4. 75% fert + Vita	75	13	in-furrow + foliar	120	62	45
5. 50% fert	50	0	0	90	41	30
6. 50% fert + Vita	50	13	in-furrow + foliar	90	41	30
7. 25% fert	25	0	0	60	20	15
8. 25% fert + Vita	25	13	in-furrow + foliar	60	20	15

[1]13 oz/acre = 1 liter/ha; [2]in-furrow application applied at planting on May 22; foliar application sprayed on June 20 at the 6-leaf stage.



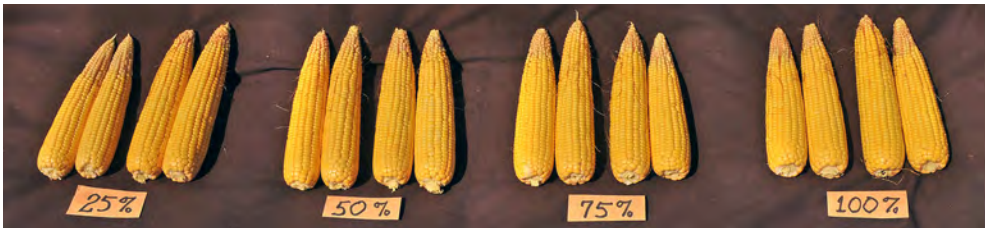
At 25% fertilizer, the root, stalk, and ear development are clearly superior with Vitazyme treatment.

At 50% fertilizer, once again the roots, stalks, and ears are clearly superior for the Vitazyme treated plants.

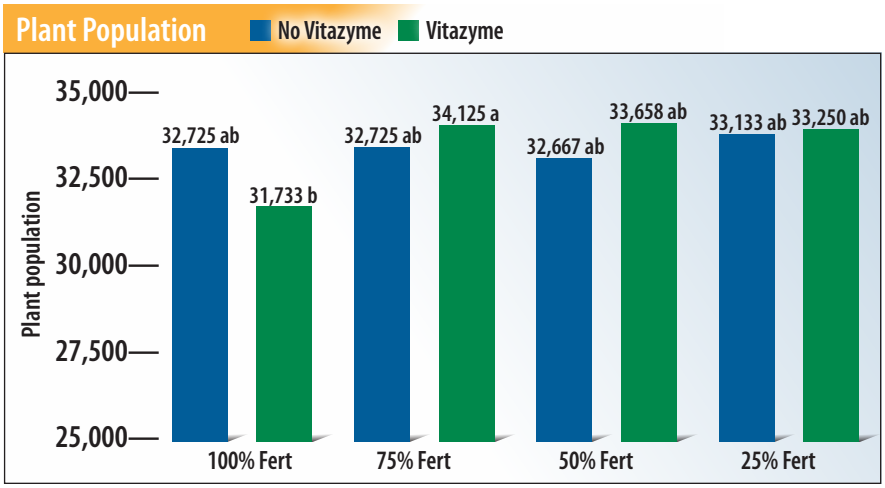
At 75% fertilizer, note that there is a clear improvement in the roots, stalks, and ears for the Vitazyme treatment

Even at 100% fertilizer the growth of the plants and ears is superior with Vitazyme, as proven by the yields that were harvested at maturity.

Notice the improvement in corn ear size and filling with Vitazyme for each of the four fertilizer levels. Vitazyme application increased the grain yield at all fertilizer levels except 50%.

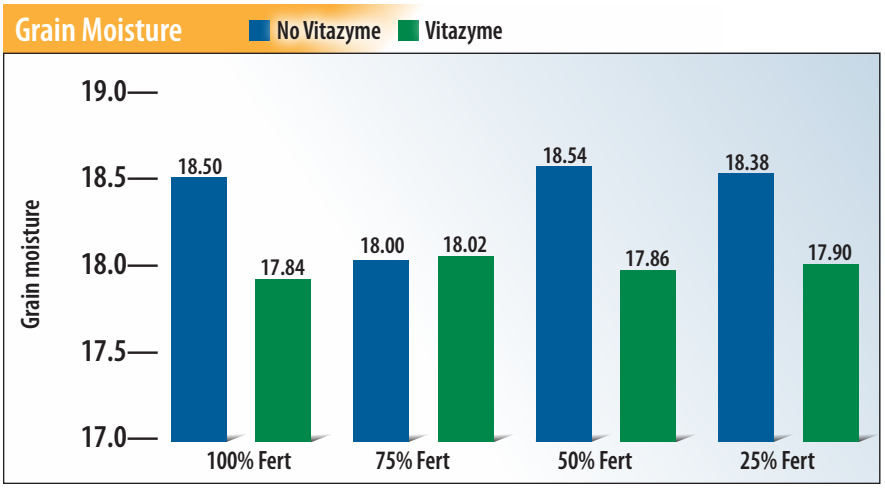


Herbicide applications: Unknown
Growing season weather: favorable throughout the growing season.
Harvest date: October 24, 2023. An MF8 plot combine was used to harvest an area of 5 x 30 feet for each plot.
Plant population results: Plant populations for the eight treatments ranged from 31,733 to 34,125 plants/acre. The values are shown in the graph below.



For some unknown reason there was a significant reduction in plant population for the 100% fertilizer + Vitazyme treatment (2). This was significantly less than the 75% fertilizer + Vitazyme treatment (4) by 2,392 plants/acre.
LSD (0.05) = 1 ,202 plants/acre.

Grain test weight results: There were no significant differences in test weight among the eight treatments. The weights ranged from 59.34 to 60.50 lb/bu.
Grain moisture content results: The grain moisture content at harvest for the eight treatments did not differ significantly, but there was a definite trend towards dryer grain with the Vitazyme treatments.



Average reduction in grain moisture content at harvest with Vitazyme: 0.45%

LSD (0.10) = 0.73%.

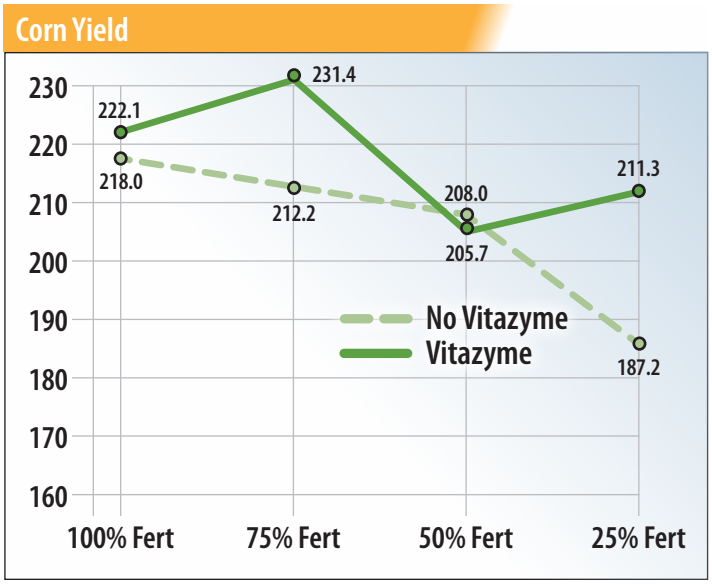
Grain moisture change at harvest with Vitazyme

100% fertilizer ..... -0.66 %-points
75% fertilizer ..... +0.02 %-points
50% fertilizer .....-0.68 %-points
25% fertilizer .....-0.48 %-points

The trend is definitely towards dryer, more mature grain with Vitazyme at all but the 75% fertilizer level, where the two treatments are essentially identical

Grain yield results:

Treatment	Grain yield*	Yield change at the same level
	bu/acre	bu/acre
1. 100% fertilizer	218.0 a	—
2. 100% fertilizer +Vitazyme	222.1 a	4.1 (+2%)
3. 75% fertilizer	212.2 ab	—
4. 75% fertilizer +Vitazyme	231.4 a	19.2 (+9%)
5. 50% fertilizer	208.0 ab	—
6. 50% fertilizer +Vitazyme	205.7 ab	2.3 (-1%)
7. 25% fertilizer	187.2 b	—
8. 25% fertilizer +Vitazyme	211.3 ab	24.1 (+13%)
LSD (0.10)	17.4	—
CV	7.61	—
Replicate probability (F)	5.236	—
Treatment probability (F)	0.0117	—



Change in yield with Vitazyme at the same fertilizer level

100%..... +2%
75%..... +9%
50%.....–1%
25%..... +13%

As can be clearly seen from the line graph, Vitazyme maintained an additional efficiency of fertilizer utilization at all but the 50% fertilizer level, where the treated and untreated plots were nearly equal.

Conclusions: This small-plot corn trial in east-central Iowa in 2023 compared the effects of Vitazyme, applied at 13 oz/acre (1 liter/ha) in-furrow at planting and again at V 6, with no Vitazyme at fertilizer levels of 100%, 75%, 50%, and 25% of the optimum fertilizer rate for a high yield potential. There were no significant effects for grain test weight, but a non-significant but positive effect on reducing grain moisture at harvest. This reduction averaged 0.45 percentage-point. Effects of Vitazyme on yield were noted at the 100% fertilizer level (+ 2%), 75% level (+ 9%), and the 25% level (+13%); at the 50% level the yields of the Vitazyme and untreated treatments were only 1% different. These results show that the brassinosteroids, 1-triacontanol, B-vitamins, and other components of Vitazyme, applied at very low levels, are very capable of improving fertilizer use at all application levels, especially at low fertilizer rates. In this study, the 25% fertilizer plus Vitazyme treatment increased the yield by 24.1 bu/acre, which, at a price for corn at $4.75/bu, gives an income increase of $114.48 for an investment of about $15.00 in Vitazyme. The cost: benefit is about 7.6:1. The highest yield attained in this study was at the 75% fertilizer level — 231.4 bu/acre — which had received two applications of Vitazyme. Compared to the 75% fertilizer control, a yield increase of 19.2 bu/acre netted $91.20/acre more income, giving a cost: benefit of about 6.1:1. These results show the great efficacy of Vitazyme in reducing the need for high levels of fertilizer, especially nitrogen, to attain optimum yield, since both the 100% and 75% fertilizer plus Vitazyme treatments exceeded the 100% fertilizer only yield.

Corn *with Vitazyme application*

Researcher: Bruce Kirksey,Ph.D. ***Research organization:*** AgriCenter International, Memphis, Tennessee
Location: Memphis Tennessee ***Variety:*** DKC 65-95VT2P ***Planting date:*** May 26, 2023
Planting depth: 1.5 inches ***Planting rate:*** 34,000 seeds/acre ***Tillage:*** conventional
Row spacing: 30 inches ***Conditions at planting:*** excellent ***Row spacing:*** 30 inches
Soil traits: Falaya silt loam, 1.3% organic matter, pH 7.3, cation exchange capacity 6.8 meq/100g, good drainage, excellent fertility.
Experimental design: : A small-plot corn trial was established using plots that were 10 x 30 feet, with four 30-inch rows per plot. Four replications were used for each treatment. The purpose of the trial was to evaluate the effect of four fertilizer rates, from 25 to 100% of normally applied rates for optimal yield, on the yield of grain, to reveal the effect of Vitazyme, applied in-furrow and foliar, on the efficiency of fertilizer use.
Fertilizer and Vitazyme applications: See the table below.

Treatment	Fertilizer application	Vitazyme application[1]	Vitazyme timing[1]	Fertilizer applications
				At planting Sidedressed
	% of optimum	oz/acre		lb/acre N-P_2O_5-K_2O
1. Control -100% fertilizer	100	0	0	40-60-60 150
2. 100% fertilizer + Vitazyme	100	13	in-furrow + foliar	40-60-60 150
3. 75% fertilizer	75	0	0	30-45-45 113
4. 75% fertilizer + Vitazyme	75	13	in-furrow + foliar	30-45-45 113
5. 50% fertilizer	50	0	0	20-30-30 75
6. 50% fertilizer + Vitazyme	50	13	in-furrow + foliar	20-30-30 75
7. 25% fertilizer	25	0	0	10-15-15 38
8. 25% fertilizer + Vitazyme	25	13	in-furrow + foliar	10-15-15 38

[1]13 oz/acre = 1 liter/ha. In-furrow application was made at planting on May 26; foliar spray was made at the 6-8 leaf stage on June 28.

Weed control: herbicides
Growing season weather: favorable, with adequate moisture, though summer temperatures were somewhat above normal.
Harvest date: October 20, 2023, with an Almaco plot combine. The harvested area for each plot was two rows (5 feet), 30 feet long, or 0.00344 acre. The center two rows of each plot were harvested, for 30 feet.
Grain moisture results: Grain moisture varied from 12.90% to 14.29%, the highest value for the 100% fertilizer without Vitazyme control. No differences were significant, however.
Grain Test weight results: Grain test weights varied from 54.8 to 57.7 lb/bu, but were not significantly different among the eight treatments.
Grain yield results:

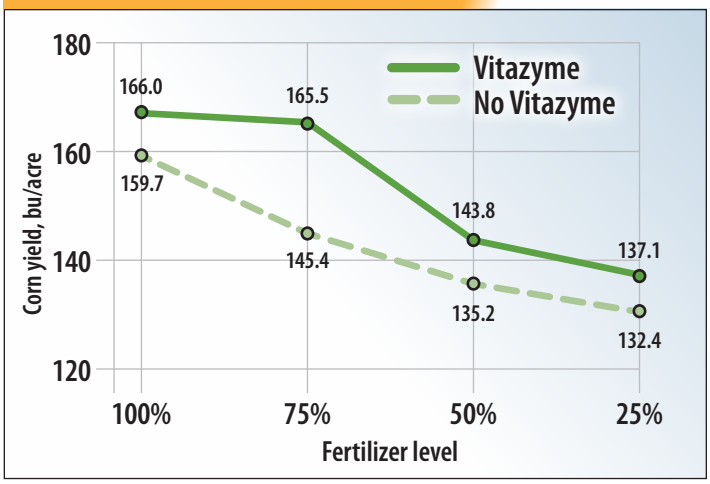
Treatment	Grain yield*	Yield change at the same fertilizer level
	bu/acre	bu/acre
1. 100% fertilizer	159.7 a	—
2. 100% fert +Vitazyme	166.0 a	6.3 (+4%)
3. 75% fertilizer	145.4 b	—
4. 75% fert +Vitazyme	165.5 a	20.1 (+14%)
5. 50% fertilizer	135.2 b	—
6. 50% fert +Vitazyme	143.8 b	8.6 (+6%)
7. 25% fertilizer	132.4 b	—
8. 25% fert +Vitazyme	137.1 b	4.7 (+4%)
LSD (P=0.05)	13.3	
CV	6.08	
Replicate probability (F)	0.2678	
Treatment probability (F)	0.0001	

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

Change in yield with Vitazyme at the same fertilizer level

100% fertilizer 4%
75% fertilizer 14%
50% fertilizer 6%
25% fertilizer 4%

Corn Yield



At all fertilizer levels, Vitazyme increased the grain yield. The increase varied from 4 to 14%, the greatest increase being at the 75% fertilizer level, where the yield was about the same as for the 100% fertilizer with Vitazyme treatment. Even though the yield differences were significant only at the 75% fertilizer level, the differences were consistently in favor of the Vitazyme treatment.

Conclusions: A small-plot corn study was conducted on a fertile, well-drained Falaya silt loam in far western Tennessee. The growing season was favorable with adequate rainfall. Vitazyme was applied to each of four fertilizer levels — 100%, 75%, 50%, and 25% — at 13 oz/acre (1 liter/ha) in-furrow at planting, and sprayed on the leaves at the 4 to 6-leaf stage. At harvest, grain moisture and test weight did not differ significantly, but grain yield was boosted by 4 to 14% for the four fertilizer levels. The greatest increase (14%) occurred at the 75% fertilizer level, where the 165.5 bu/acre yield essentially equaled the 166.0 bu/acre yield with 100% fertilizer plus Vitazyme. This increase was highly significant. Increases with Vitazyme at the other fertilizer levels varied from 4 to 6%. These results show the highly consistent effect of Vitazyme, applied twice during the growth cycle, to increase corn grain yield in western Tennessee.

The corn plants treated with Vitazyme and 50% fertilizer are taller with more biomass, have a greater root mass, and produced noticeably larger ears than the untreated plants on the left.

Notice the greater root mass for the plants that received Vitazyme on the seeds and leaves, versus the untreated plants on the left at 50% fertilizer.

The Vitazyme treated ears, at the 50% fertilizer level, have considerably more grain that the untreated ears on the left.

Corn *with Vitazyme application*

Researcher: Y.A. Veklenko, Ph.D., Department Head of Food Crops, Haymaking, and Pastures

Research organization: National Academy of Agrarian Sciences of Ukraine, Institute of Food and Agriculture of Podillya Region, Vinnytsya, Ukraine

Location of trial: Bokhonyky Village, Vinnytsya Rayon, Vinnytsya Oblast, Ukraine

Climatic zone: forest-steppe

Planting date: May 6, 2022

Seeding rate: 65,000 seeds/ha

Varieties: DKS 3400 (Bayer) and SG 189 (FarmSaat AG), both mid-season maturity

The roots, stalks, and ears of the Vitazyme treated corn are superior at both nitrogen levels for both varieties.

Soil characteristics: gray forest soil, medium-loam, 2.2-2.4% organic matter, 5.2-5.4 pH, 9.0-11.2 mg/kg easily hydrolyzable N, 8.1-11.6 mg/kg exchangeable K, and 12.1-14.2 mg/kg mobile P

Previous crop: winter wheat

Cultivation: spring plowing to 20-22 cm, spring cultivation to 10-12 cm, pre-seeding cultivation to 5-7 cm

Experimental design: A research field at the Vinnytsya Institute of Food and Agriculture was allocated to two replications for each variety in an experiment utilizing Vitazyme Bio, as a foliar spray, at two nitrogen fertilizer rates, to determine the effects of this biostimulant on plant characteristics — especially those relevant to silage production — as well as on grain yield and economic values. Each of the varieties was arranged according to the diagram shown. Each plot covered an area of 44.8 m^2.

Treatment	Corn variety		Fertilizer treatment (NH_4NO_3)		Vitazyme
	DKS 3400	SG 189	60 kg/ha	120 kg/ha	1 liter/ha
1	x	—	x	—	—
2	x	—	x	—	x
3	x	—	—	x	—
4	x	—	—	x	x
5	—	x	x	—	—
6	—	x	x	—	x
7	—	x	—	x	—
8	—	x	—	x	x

Plot Diagram

Rep 1	120 N + Vita	60 N	Rep 1
	120 N	60 N + Vita	
	60 N + Vita	120 N	
	60 N	120 N + Vita	
Rep 2	120 N + Vita	60 N	Rep 2
	120 N	60 N + Vita	
	60 N + Vita	120 N	
	60 N	120 N + Vita	
	DKS -3400	SG 189	

Each plot was 2.8 x 16.0 m, or 44.8 m^2.

Fertilization: See the treatment table above. Fertilizers were applied at V 4-V 5

Vitazyme application: 1 liter/ha on the leaves and soil at V 6-V 7, using a hand-operated sprayer

Herbicide application: Adengo herbicide at 0.5 liter/ha preemergent. This herbicide contains 225 g/liter of isoxaflutole, 90 g/liter of thiencarbazone-methyl, and 150 g/liter of cyprosulfamide.

Growing season weather: Precipitation was ample to excessive most of the growing season, and temperatures were somewhat above average, leading to favorable growing conditions.

Harvest dates: The data for the silage study were collected on August 28, 2022, for variety SG 189, while the grain yield data were collected on November 10,2022.

Silage Production

These evaluations were conducted only with SG 189, and were performed at BBCH stage 85 (dough stage; kernels are yellowish to yellow, with about 55% dry matter).

Treatment	Plant height*	Total leaves*	Leaves beneath the ear*	Node number*
	cm	number	number	number
5. N = 60	237.9 b	13.0 b	6.3 b	12.7 b
6. N = 60+ Vita	242.7 a (+2%)	13.9 a (+7%)	7.0 a (+11%)	13.5 a (+6%)
7. N = 120	246.5 a (+4%)	14.5 a (+12%)	7.6 a (+21%)	14.3 a (+13%)
8. N = 120+ Vita	248.7 a (+5%)	14.8 a (+14%)	7.9 a (+25%)	14.6 a (+15%)

*Means followed by the same letter are not significantly different at P = 0.05 according to the Fisher Test.

Treatment	Leaf area*	Leaf area*	Leaf area index
	dm^2/plant	m/ha X 1,000	number
5. N = 60	57.06 b	35.05 b	3.50
6. N = 60+ Vita	63.48 a (+11%)	39.22 a (+12%)	3.92 (+12%)
7. N = 120	67.23 a (+18%)	41.30 a (+18%)	4.13 (+18%)
8. N = 120+ Vita	68.60 a (+20%)	42.16 a (+20%)	4.22 (+21%)

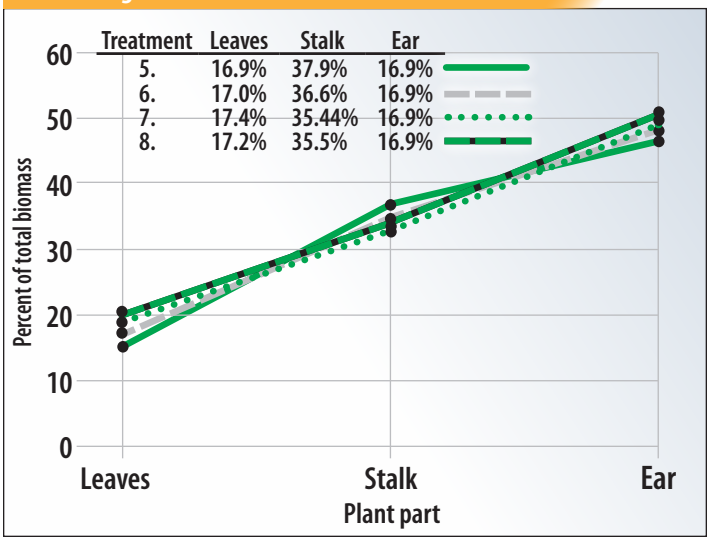
*Means followed by the same letter are not significantly different at P = 0.05 according to the Fisher Test.

Treatment	Silage moisture	Silage weight	Weight increase
	%	tons/ha	tons/ha
5. N = 60	66.1	43.47	—
6. N = 60+ Vita	66.4	46.64	3.17 (+7%)
7. N = 120	66.6	48.51	5.04 (+12%)
8. N = 120+ Vita	66.6	50.84	7.37 (+17%)

Parameter	Plant parameter increases with Vitazyme at two N levels	
	At 60 kg N/ha	At 120 kg N/ha
Plant height	2%	5%
Leaf number	7%	14%
Leaves below the ear	11%	25%
Node number	6%	15%
Leaf area	11%	20%
Leaf area index	12%	21%
Silage weight	7%	17%

In every case these percentages are significantly greater with Vitazyme at both nitrogen levels.

Percentage of Plant Biomass with Various Treatments

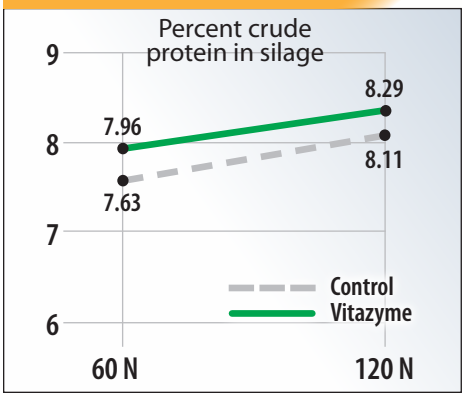


Note that the leaf percentage and ear percentage both increase with N level and Vitazyme, while the stalk percentage decreases for both.

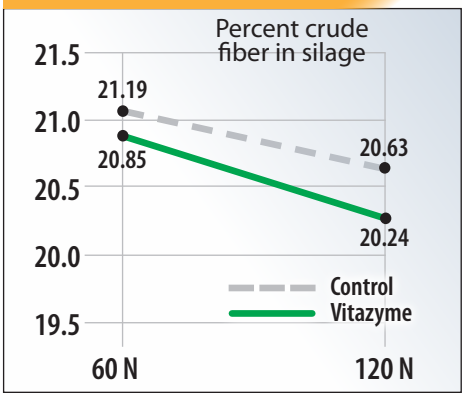
Silage Quality and Feeding Value

All of these evaluations were made on the SG 189 variety. The 120 lb N/ha rate was sampled at the 10-11 leaf stage rather than the 6-7 leaf stage.

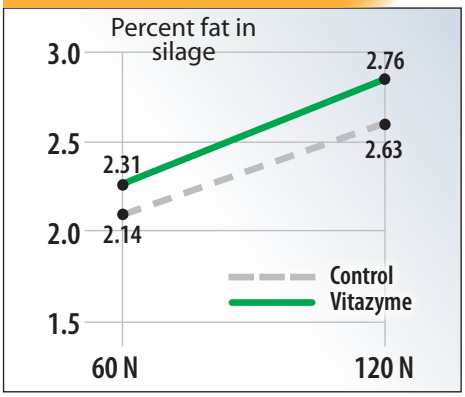
Crude Protein



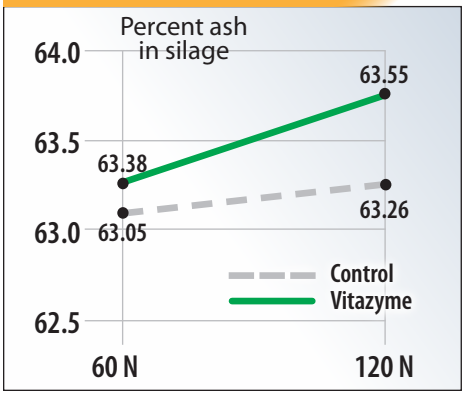
Crude Fiber



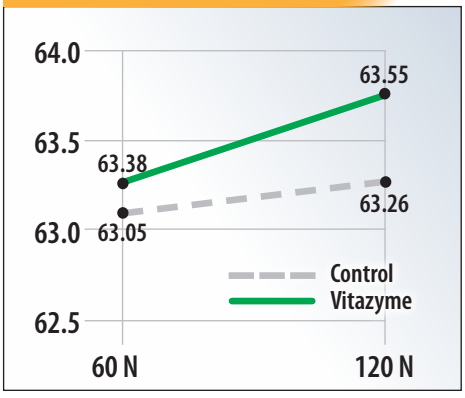
Crude Fat



Ash



NES



The silage quality was improved in every case with Vitazyme, at both N levels. Protein fat, ash, and NES all increased while fiber decreased.

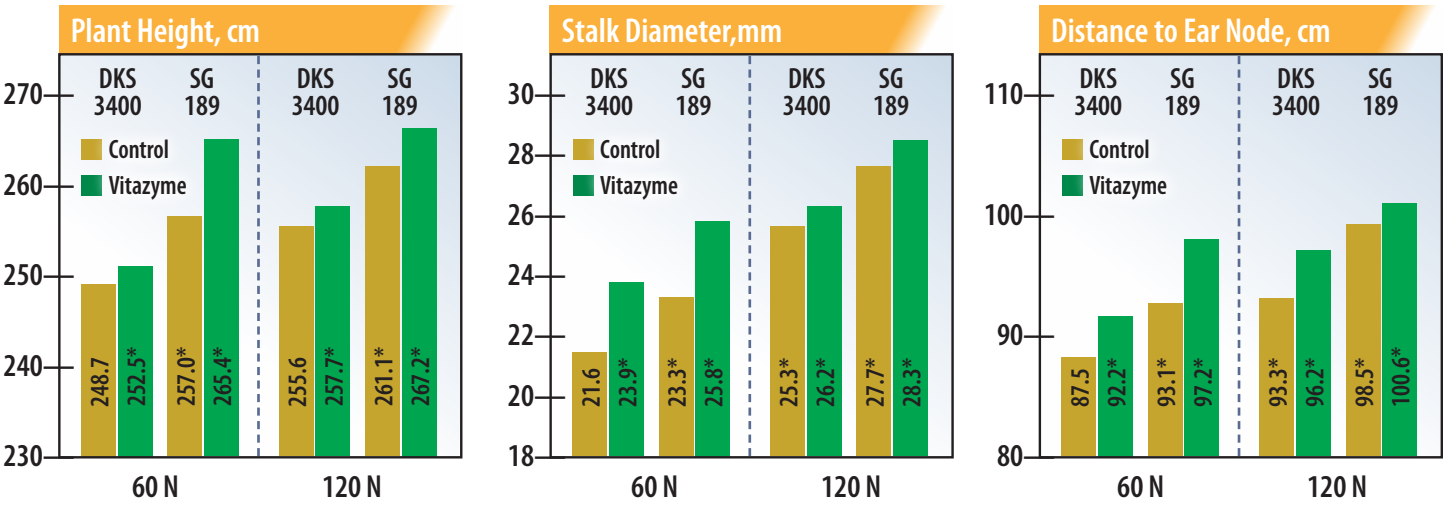
Treatment	Feed units			Crude protein		Digestible protein per food unit
	units/kg of dry matter	tons/ha	tons/ha change	tons/ha	tons/ha change	grams
5.	0.54	8.11	—	1.13	—	71.37
6.	0.57	9.12	+1.01	1.25	+0.12	74.09
7.	0.59	9.71	+1.60	1.34	+0.21	75.26
8.	0.61	10.39	+2.28	1.43	+0.30	76.34

In all cases with the higher N rate and Vitazyme-Bio application, these nutritional feeding parameters increased.

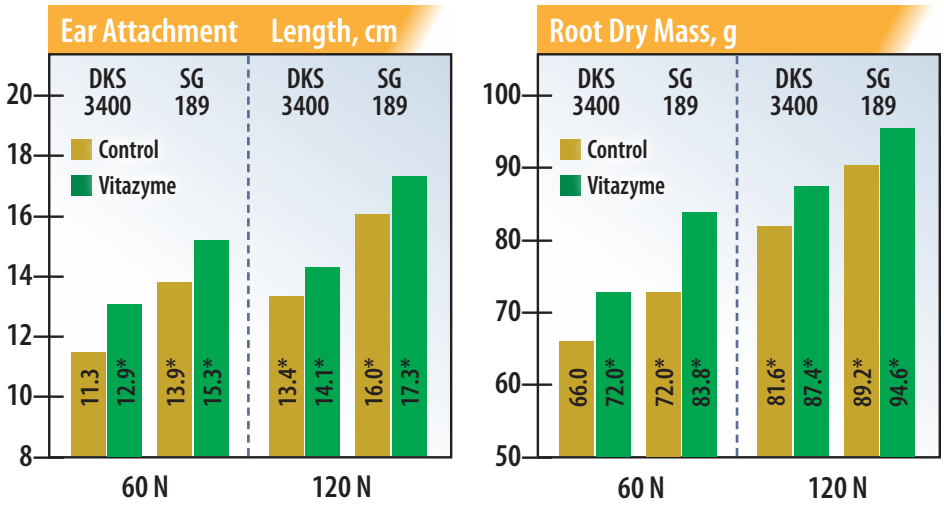
Grain Production

The corn allowed to fully nature for both varieties was harvested on November 10, 2022.

Plant characteristics:



Increase with Vitazyme	DKS 3400	SG 189
Plant height		
60 N	2%	3%
120 N	3%	1%
Stalk diameter		
60 N	11%	11%
120 N	4%	2%
Ear node distance		
60 N	5%	4%
120 N	3%	2%
Ear attachment length		
60 N	14%	10%
120 N	5%	8%
Dry root mass		
60 N	9%	16%
120 N	7%	6%



*Means are greater than the control at P = 0.05.

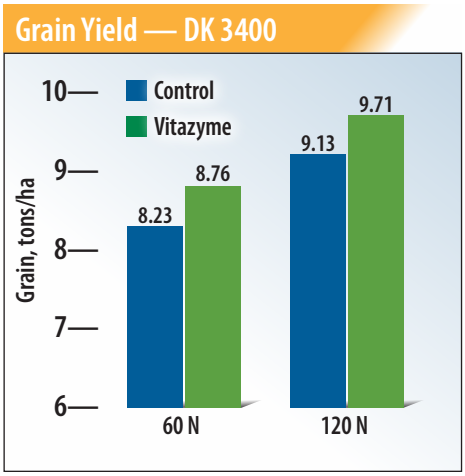
All parameters were significantly increased with Vitazyme application.

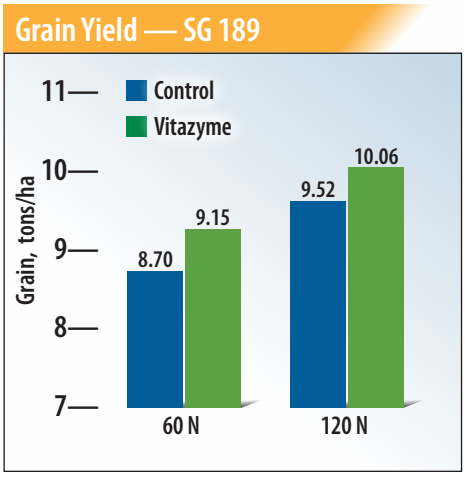
Ear and grain characteristics: Grain moisture did not vary significantly among the eight treatments.

Yield results:

Treatment	Variety	Yield[1]	Yield change
		t/ha	t/ha
1. N = 60	DK 3400	8.23 d	—
2. N = 60 + Vita	DK 3400	8.76 c	0.53 (+ 6%)
3. N = 120	DK 3400	9.13 b	0.90 (+ 11%)
4. N = 120 + Vita	DK 3400	9.71 a	1.48 (+ 18%)
5. N = 60	SG 189	8.70 d	—
6. N = 60 + Vita	SG 189	9.15 c	0.45 (+ 5%)
7. N = 120	SG 189	9.52 b	0.82 (+ 9%)
8. N = 120 + Vita	SG 189	10.06 a	1.36 (+ 16%)

[1]LSD (0.05) = 0.32 t/ha. Means followed by the same letter are not significantly different at P=0.05 according to the Student—Newman Keuls Test.



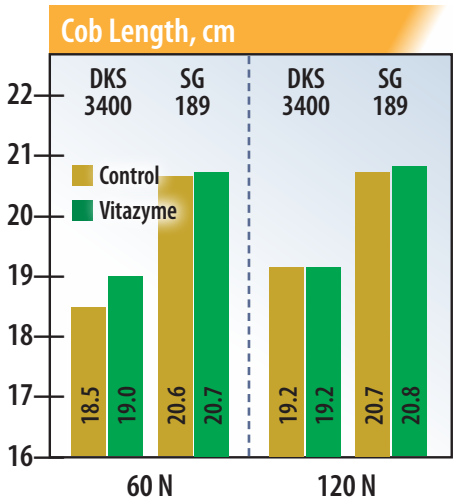


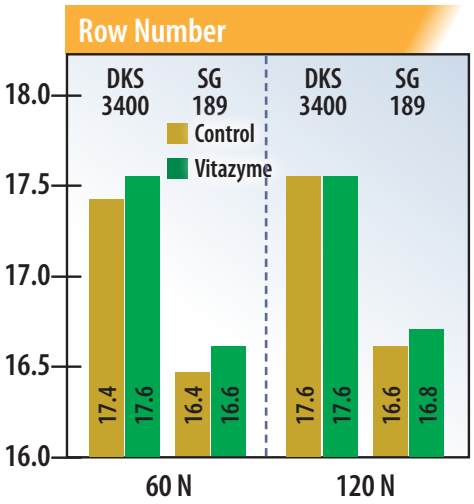
Increased in grain yield with Vitazyme.

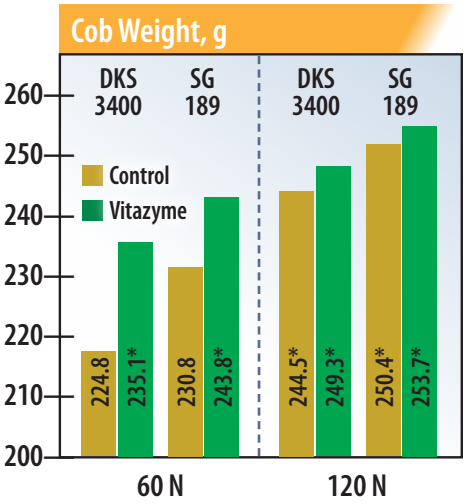
DK 3400 — 60 kg/ha N ..... +6%
120 kg/ha N ..... +18%

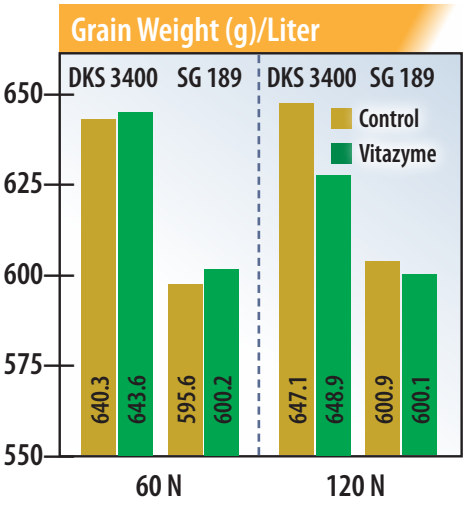
SG 189 — 60 kg/ha ..... +5%
120 kg/ha N ..... +16%

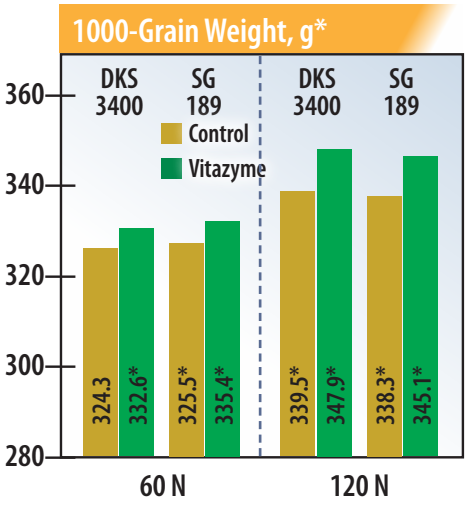
Vitazyme with both varieties significantly increased grain yield, by up to 18%.











*Means are greater than the control at P = 0.05.

Increase with Vitazyme	DKS 3400	SG 189
Cob length		
60 N	3%	0%
120 N	0%	0%
Row number		
60 N	1%	1%
120 N	0%	1%
Cob weight		
60 N	5%	6%
120 N	2%	1%
Grain weight		
60 N	0.5%	1%
120 N	3%	0%
1000-grain weight		
60 N	3%	3%
120 N	2%	2%

There was little effect of nitrogen level or Vitazyme on cob length, row number, or grain weight per liter, but cob weight and 1000-grain weight were both positively affected by Vitazyme, and cob weight by N level as well.

Conclusions: A small-plot study in Ukraine at the Institute of Food and Agriculture in the Podillya Region used a single application of Vitazyme at 1 liter/ha at the 6-7 leaf stage of corn. Two corn varieties were used, one for silage and grain and the other for grain only. Nitrogen applications of 60 and 120 kg/ha were applied to both varieties, and growth, plant characteristics, and grain parameters were measured. It was shown that plant height, leaf number, node number, and leaf area were all significantly increased with both Vitazyme and N; Vitazyme increased these values at both N levels. Silage production increased from 43.47 tons/ha at 60 kg/ha N without Vitazyme to 46.64 kg/ha with Vitazyme applied, to 48.51 tons/ha with 120 kg/ha of N alone, and 50.84 tons/ha with Vitazyme at this higher N rate. Silage quality was also improved with both N and Vitazyme in terms of protein, fat, ash, NES, and feed value (digestibility). Grain production was likewise improved at both N levels, and Vitazyme increased the grain yield for both varieties at both N levels by 5 to 18%. These increases were a reflection of taller plants having a greater stalk diameter, greater root mass (up to 16%), longer and heavier cobs having slightly more rows, with heavier grain and greater grain density (weight/liter). These results show that Vitazyme use in Ukraine on corn is a highly effective means of producing higher yielding, more nutritious grain and biomass of both silage and grain.

Corn *with Vitazyme application*

Researchers: Bence Kiraly, Natalia Simon, and Jeno Simon
Research organization: Syntech Research Group, 6636 Martely, hrsz.; 013818, Hungary; Vital Earth Resources, Inc., Gladewater, Texas, USA
Location: Hodmezovasarhely-Erzsebet, Csongrad-Csanad, Hungary
Variety: Pioneer P9903 (*Zea Mays*) ***Planting date:*** April 19,2022
Row spacing: 75 cm ***In-row spacing:*** 20 cm ***Planting depth:*** 5 cm
Planting rate: 66,665 seeds/ha ***Soil traits:*** clay loam chernozem; good fertility; fair drainage
Tillage: conventional
Experimental design: A small-plot experiment with corn was set up using plots that were 3 x 10 meters ($30m^2$), having six replications. Four treatments were applied in a randomized complete block design, with the objective of determining the effects of Organic Vitazyme and Terra-Sorb Foliar on the yield and other parameters of corn.

Organic Vitazyme and Terra-Sorb Foliar on the yield and other parameters of corn

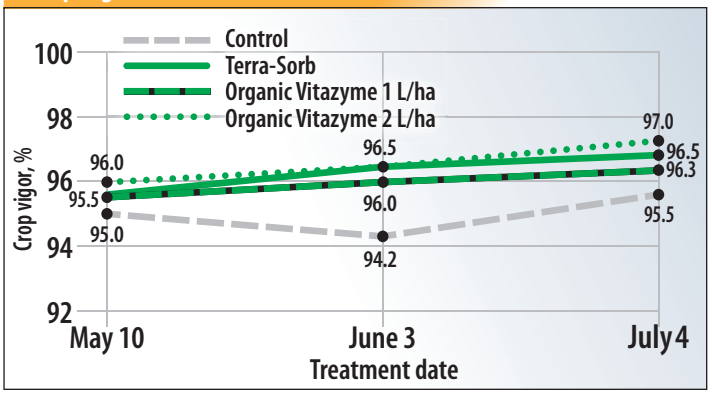
Treatment	Rate	Stage of growth	Date of treatment
1. Control	0	—	—
2. Terra-Sorb Foliar	1 liter/ 100 kg seed	Seed treatment	April 19
3. Organic Vitazyme	1 liter/ha	Seed treatment	April 19
4. Organic Vitazyme	2 liters/ha	Seed treatment	April 19

Fertilization: Unknown
Organic Vitazyme application: See the treatments above. Organic Vitazyme was applied as concentrated product on the seeds to achieve the desired 1 or 2 liters/ha rates.
Terra-Sorb Foliar application: Terra-Sorb Foliar is a formulation of mostly free amino acids that, when sprayed on leaves, will increase chlorophyll and photosynthesis, improve fruit set, and promote plant recovery during times of stress. It was applied at 1 liter/100 kg of seed.
Herbicide application: Laudis at 2 liters/ha on May 5
Insecticide application: Sumi Alfa 5 EC at 0.2 liter/ha on July 15
Growing season weather: normal
Phytotoxicity results: No phytotoxicity was detected for either product in the three treatments.
Crop vigor results:

Treatment	Rate	Assessment date*		
		May 10	June 3	July 4
	L/ha	%	%	%
1. Control	0	95.0 a	94.2 b	95.5 a
2. Terra-Sorb	1	95.5 a	96.5 a	96.5 a
3. Organic Vita	1	95.5 a	96.0 a	96.3 a
4. Organic Vita	2	96.0 a	96.5 a	97.0 a
LSD (P=0.10)		1.2	1.4	1.7
CV		1.19	1.43	1.72
Treatment F		0.5289	0.0296	0.4862

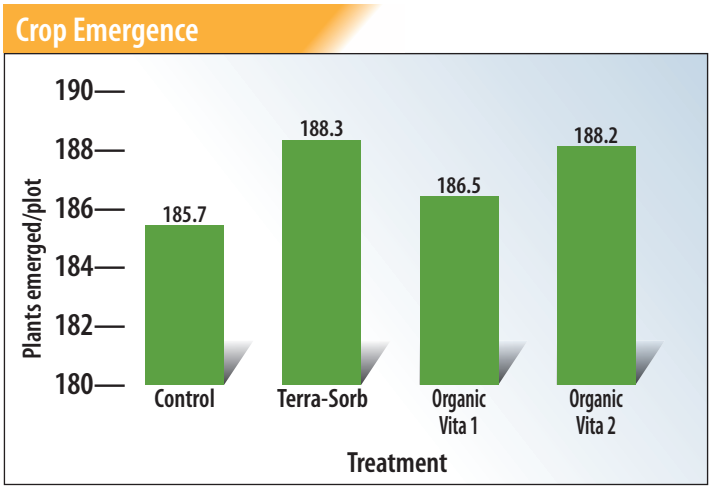
*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls Test.

Crop Vigor



All three of the treatments improved crop vigor above the control, with the Organic Vitazyme application at 2 liters/ha showing the best overall effect over the two-month period assessed.

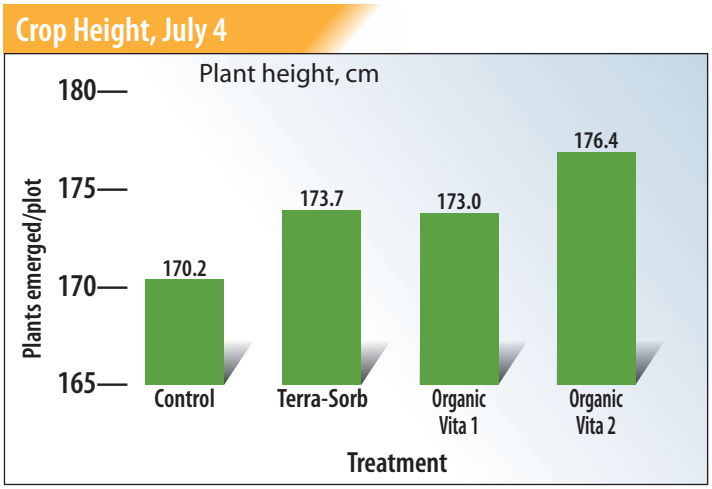
Crop emergence results: Although the differences in crop emergence on May 10 were not significant, all three treatments exceeded the control, as shown in the graph below.



Crop height results: Fifty plants were measured and averaged for each plot on each date.

Treatment	Rate	Assessment date*	
		May 10	July 4
	L/ha	cm	cm
1. Control	0	5.7 b	170.2 b
2. Terra-Sorb	1	5.9 a	173.7 ab
3. Organic Vita	1	5.8 b	173.0 ab
4. Organic Vita	2	5.9 a	176.4 a
LSD (P=0.10)		0.1	29.
CV		1.15	1.66
Treatment F		0.0010	0.0171

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

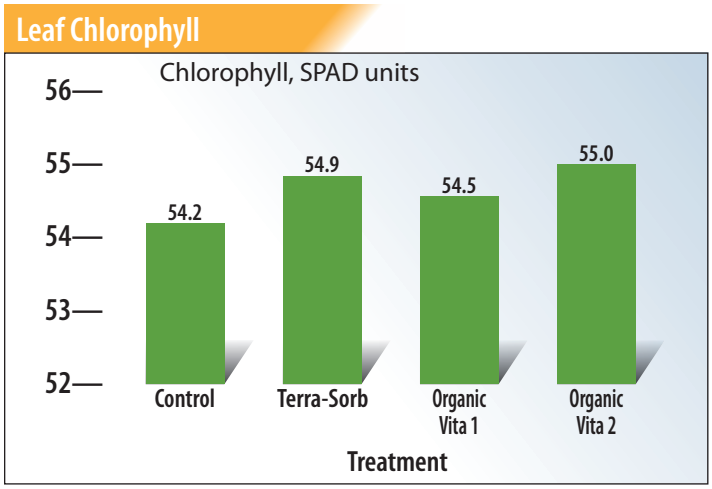


Organic Vitazyme at 2 liter/ha significantly increased corn height at both dates above the control, as did Terra-Sorb on May 10. All treatments produced taller plants on both dates.

Leaf chlorophyll results: On June 3 a Minolta SPAD meter was used to measure leaf chlorophyll of 20 plants per plot, and the results were averaged.

Treatment	Rate	Leaf chlorophyll*
	L/ha	SPAD units
1. Control	0	54.2 b
2. Terra-Sorb	1	54.9 a
3. Organic Vita	1	54.5 ab
4. Organic Vita	2	55.0 a
LSD (P=0.10)		0.5
CV		0.9
Treatment F		0.0592

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

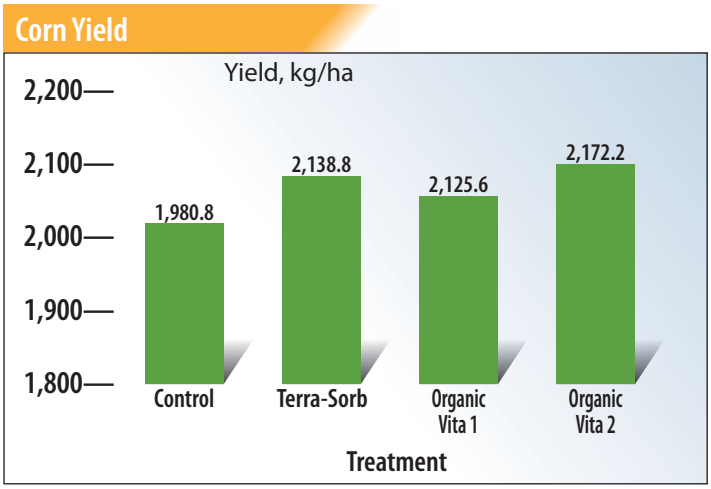


All treatments increased leaf chlorophyll in the small corn pants, 15 days after planting, especially the Terra-Sorb and Organic Vitazyme at 2 liters/ha, which increases were significant.

Grain yield results: The plots were harvested on September 13, 2022.

Treatment	Rate	Grain yield*
	L/ha	kg/ha
1. Control	0	1,980.8 b
2. Terra-Sorb	1	2,138.8 ab
3. Organic Vita	1	2,125.6 ab
4. Organic Vita	2	2,172.2 a
LSD (P=0.10)		180.0
CV		8.45
Treatment F		0.2926

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



All treatments increased corn grain yield above the control, by 10% with Organic Vitazyme at 2 liters/ha — a significant increase — by 8% for Terra-Sorb, and by 7% for Organic Vitazyme at 1 liter/ha.

Increase in grain yield

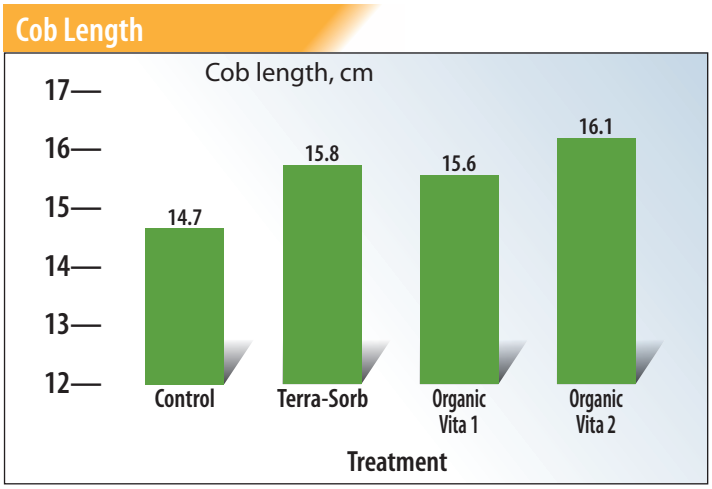
Terra-Sorb ..... 158.0 kg/ha (+8%)
Organic Vita, 1 liter/ha..... 144.8 kg/ha (+7%)
Organic Vita, 2 liters/ha ..... 191.4 kg/ha (+10%)

Grain moisture results: There were no significant differences in grain moisture at harvest for any of the treatments, although Terra-Sorb and organic Vitazyme at 1 liter/ha reduced grain moisture by 0.8 to 1.0%.

Cob length results: Fifty ears were measured and averaged for each plot.

Treatment	Rate	Cob length*
	L/ha	cm
1. Control	0	14.7 b
2. Terra-Sorb	1	15.8 a
3. Organic Vita	2	15.6 a
4. Organic Vita	2	16.1 a
LSD (P=0.10)		0.5
CV		2.89
Treatment F		0.0005

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



The size of the cob was significantly increased above the control by all three treatments, but especially by the Organic Vitazme treatment at 2 liters/ha (+ 10%).

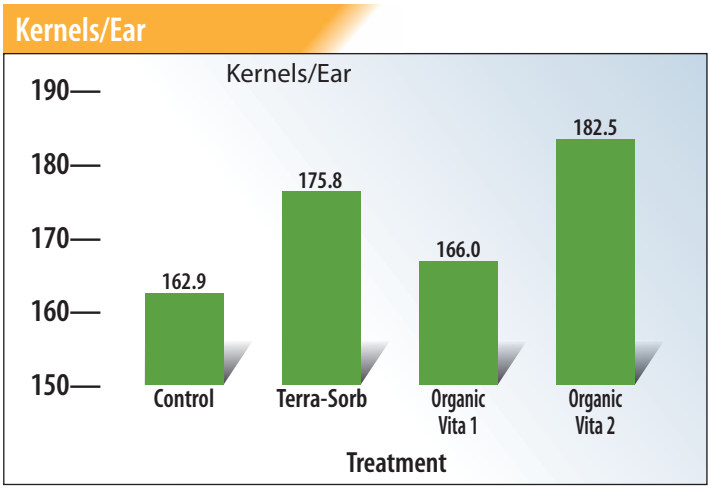
Increase in cob length

Terra-Sorb .....1.1 cm (+7%)
Organic Vita, 1 liter/ha.....0.9 cm (+6%)
Organic Vita, 2 liters/ha .....1.4 cm (+10%)

Kernels per ear results: The number of kernels per ear were counted for 50 plants per plot, and averaged.

Treatment	Rate	Kernels/ear*
	L/ha	number
1. Control	0	162.9 b
2. Terra-Sorb	1	175.8 ab
3. Organic Vita	1	166.0 b
4. Organic Vita	2	182.5 a
LSD (P=0.10)		12.8
CV		7.38
Treatment F		0.0620

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



All treatments increased the number of corn kernels per ear, especially Organic Vitazyme at 2 liters/ha, which increased the number by 12% above the control.

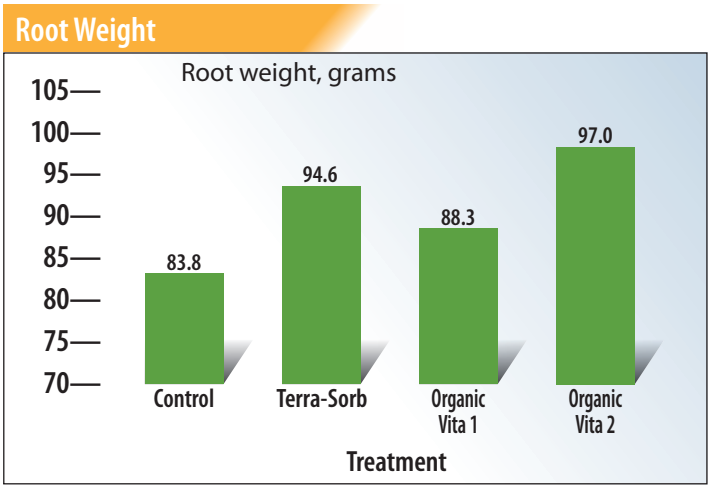
Increase in kernels/ear

Terra-Sorb..... 12.9 (+8%)
Organic Vita, 1 liter/ha ..... 3.1 (+2%)
Organic Vita, 2 liters/ha.... 19.6 (+12%)

Root weight results: Twenty corn plant root masses were weighed for each plot, and averaged.

Treatment	Rate	Root weight*
	L/ha	grams
1. Control	0	83.8 c
2. Terra-Sorb	1	94.6 ab
3. Organic Vita	1	88.3 bc
4. Organic Vita	2	97.0 a
LSD (P=0.10)		6.5
CV		7.01
Treatment F		0.0109

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



All treatments exceeded the control for root weight increases, and both Terra-Sorb and Organic Vitazyme at 2 liters/ha significantly improved root mass, by 13% and 16%, respectively.

Increase in root weight

Terra-Sorb..... 10.8 (+13%)
Organic Vita, 1 liter/ha ..... 4.5 (+5%)
Organic Vita, 2 liters/ha.... 13.2 (+16%)

Grain starch content results: There were no significant differences among the treatments for grain starch content.

1,000-grain weight results: There were slight but non-significant increases in the 1,000-grain weight for all three treatments versus the control.

Conclusions: A small-plot corn study in Hungary in 2022 compared the crop's response to Terra-Sorb Foliar, Organic Vitazyme at 1 liter/ha, and Organic Vitazyme at 2 liters/ha, all three applied to the seeds at planting. The Organic Vitazyme at 2 liters/ha proved to be the superior treatment for all parameters that produced an improvement, including crop vigor (1.5 percentage points), crop height (6.2 cm), leaf chlorophyll (0.8 SPAD units), grain yield (+ 10%), cob length (+ 10%), kernels/ear (+ 12%), and root weight (+ 16%). Many of these responses were significant. The next best treatment was Terra-Sorb, followed by Organic Vitazyme at 1 liter/ha. These results show the efficacy of Organic Vitazyme, and to a lesser extent Terra-Sorb, as biostimulants for corn production in Hungary.

Corn *with Vitazyme application*

Researcher: Jonathan Jaschen ***Research organization:*** ACRES Research, Cedar Falls, Iowa
Location: Fairbank, Iowa ***Variety:*** P03390 ***Planting date:*** May 30, 2022 ***Planting depth:*** 2 inches
Row spacing: 30 inches ***Planting rate:*** 34,000 seeds/acre ***Previous crop:*** soybeans
Soil: Marshan clay loam; 3.7% organic matter, 6.5 pH, 24 meq/100g cation exchange capacity
Experimental design: A small-plot replicated corn trial, using five replications and plots that were 30 x 15 feet (six rows/plot) was established as a randomized complete block design in a field without a previous history of plot work. The purpose of the trial was to evaluate the effect of Vitazyme, applied at different times and ways, over four fertilizer rates, to determine the effect of the product on nitrogen utilization.

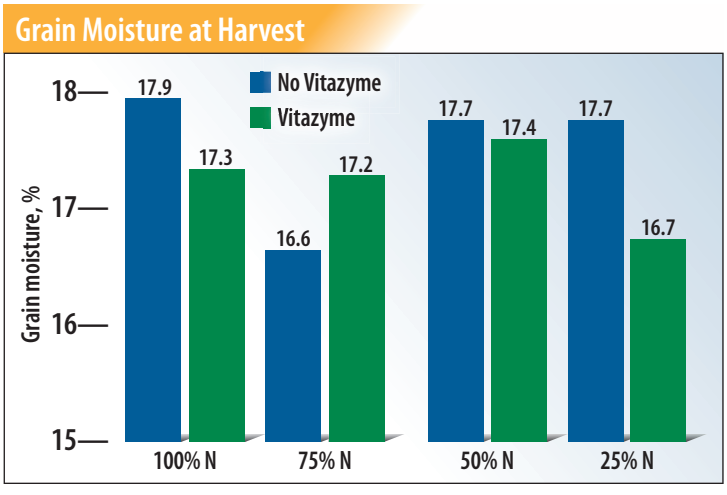
At 50% of the optimum nitrogen rate, Vitazyme greatly improved root and overall plant development.

Treatment	Nitrogen application	Vitazyme application[1]	Vitazyme timing[2]	Fertilizer nitrogen
	% of optimum	ounces/acre		lb of N/acre
1. 100%	100	0	0	180
2. 100% + Vitazyme	100	13	in-furrow + foliar	180
3. 75% N	75	0	0	120
4. 75% N + Vitazyme	75	13	in-furrow + foliar	120
5. 50%	50	0	0	90
6. 50% + Vitazyme	50	13	in-furrow + foliar	90
7. 25%	25	0	0	60
8. 25% N + Vitazyme	25	13	in-furrow + foliar	60

[1]13 oz/acre = 1 liter/ha; [2]in-furrow application applied at planting on May 30; foliar application sprayed on Juy 1 at the 6-leaf stage.


Even at 100% of the optimal nitrogen rate, Vitazyme improved ear fill (Vitazyme on the right, control on the left).

Fertilization: See the table above.
Herbicide applications: May 16, Harness Xtra (1.2 quarts/acre) + DiFlex (8 oz/acre) + AMS (17 lb/100 gal. of water); June 15, Harness Max (1.2 quarts/acre) + FS Max Supreme (2.8 pints/acre) + Infantry 4L (15 oz/acre) + Roundup Powermax 3 (22 oz/acre)
Growing season weather: favorable throughout the growing season.
Harvest date: November 4, 2022. An MF3 plot combine was used to harvest an area of 5 x 32 feet for each plot.
Grain moisture results: Values ranged from 16.6% to 17.9% with no significant differences among the eight treatments. However, except for the 75% N rate, Vitazyme tended to lower the moisture content at harvest.



Average grain moisture

No Vitazyme 17.5%
With Vitazyme 17.2%

Note the much greater ear size with Vitazyme at the 50% nitrogen level, showing improved N utilization with reduced N.

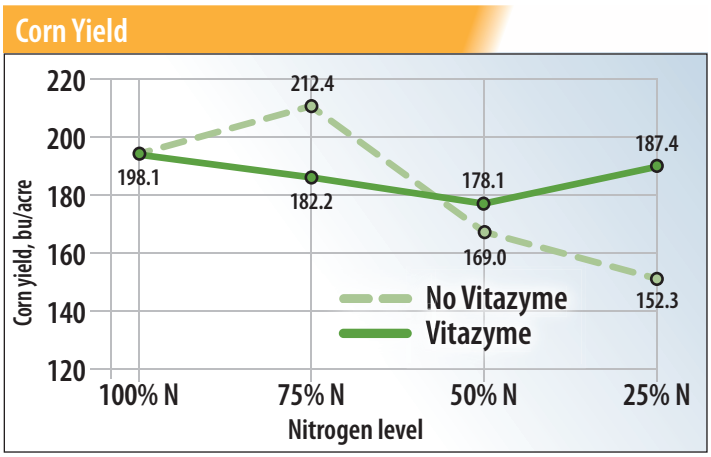
This replicated small plot corn trial in northeastern Iowa revealed the potential of Vitazyme to improve nitrogen efficiency of use.

Grain test weight results: Values for test weight ranged from 59.46 lb/bu to 60.40 lb/bu, with no significant differences or discernible pattern among the eight treatments.

Grain yield results:

Treatment	Grain yield*	Yield change at the same N level	
	bu/acre	bu/acre	
1. 100% N	198.09 ab	—	—
2. 100% N + Vitazyme	197.99 ab	(-) 0.10	(0%)
3. 75% N	212.36 a	—	—
4. 75% N + Vitazyme	182.19 ab	(-) 30.17	(-14 %)
5. 50% N	168.96 ab	—	—
6. 50% N + Vitazyme	178.13 ab	9.17	(+5%)
7. 25% N	152.30 b	—	—
8. 25% N + Vitazyme	187.35 ab	35.05	(+23%)
LSD (0.05)	33.41		
CV	13.97		
Replicate probability (F)	0.0003		
Treatment probability (F)	0.0306		

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



Change in yield with Vitazyme % at same N level

100% N..... no change
75% N.....-14%
50% N..... + 5%
25% N..... + 23%

All yields but the 25% N treatment without Vitazyme were statistically equal, and showed the typical yield response increase with decreasing N levels. While the yields of both the untreated plots were the same at 100% N, the yield without Vitazyme at 75% N was anonalously high; the reason is unknown. At both the 50% and 15% N levels, the yield was boosted with Vitazyme, by 5% N and by 23% N.

Conclusions: A small-plot replication corn trial in east-central Iowa, using four levels of applied nitrogen (N) corresponding to 100, 75, 50, and 25% of the 180 lb/acre of N 100% rate, during a favorable cropping year, and using a Vitazyme seed treatment at 13 oz/acre plus a 13 oz/acre foliar treatment at V6 at each N level, revealed large yield increases with Vitazyme at the 50% N level (5%) and the 25% N level (23%). There was no yield change with Vitazyme at the 100% N level. At the 75% N level there was a grain yield increase without Vitazyme of 14.3 bu/acre above the 100% N yield; the reason for this anomaly is not known.

While no means were significantly different at P = 0.05, except for the 25% N treatment without Vitazyme being less than the 75% N treatment without Vitazyme, these results generally reveal the tendency of Vitazyme to improve the grain yield more at lower available N levels than at higher levels. These results show the trend for Vitazyme at less than optimum nitrogen levels to improve the efficiency of nitrogen use.

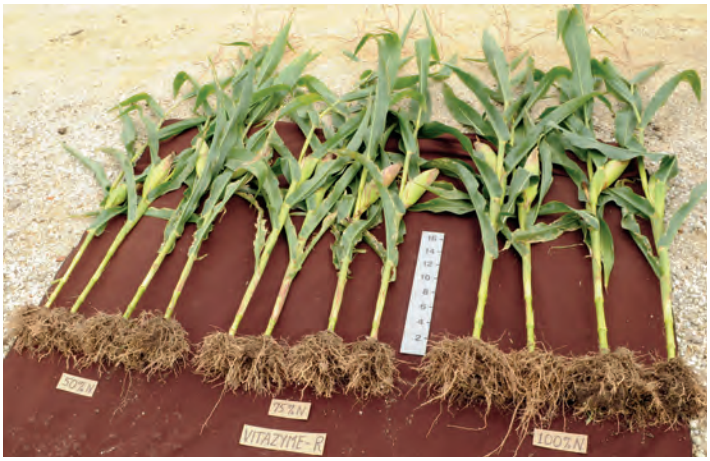
Grain moisture at harvest tended to be less with Vitazyme than without it, but test weight was not changed.

Corn *with Vitazyme application—A Preliminary Report On a Comprehensive Study*

Researcher: Robert Kremer, Ph.D., and Timothy Reinbolt
Research organization: School of Natural Resources and Division of Plant Science and Technology, University of Missouri, Columbia, Missouri
Location: Bradford Research Farm, Columbia, Missouri
Variety: yellow dent
Experimental design: A small-plot corn trial, with four replications in a randomized complete block design, was established, using three fertilizer levels, to determine the effects of Vitazyme on fertilizer use efficiency as well as yield and growth parameters.

Treatment	Percent of fertilizer	Vitazyme[1]	Fertilizer additions[2]		
			N	P	K
	%		lb/acre	lb/acre	lb/acre
1. 50% fertilizer	50	0	32.6	18.5	18.5
2. 50% fert + Vita	50	x	32.6	18.5	18.5
3. 75% fertilizer	75	0	24.4	13.8	13.8
4. 75% fert + Vita	75	x	24.4	13.8	13.8
5. 100% fertilizer	100	0	16.3	9.3	9.3
6. 100% fert + Vita	100	x	16.3	9.3	9.3

[1]See the Vitazyme application regime below.
[2]See the fertilizer application regime and materials below.



Corn plants dug from the three fertilizer rates reveal superior root and top growth for the Vitazyme treated palnts at each level. The treated plants are on the right for each fertilizer treatment

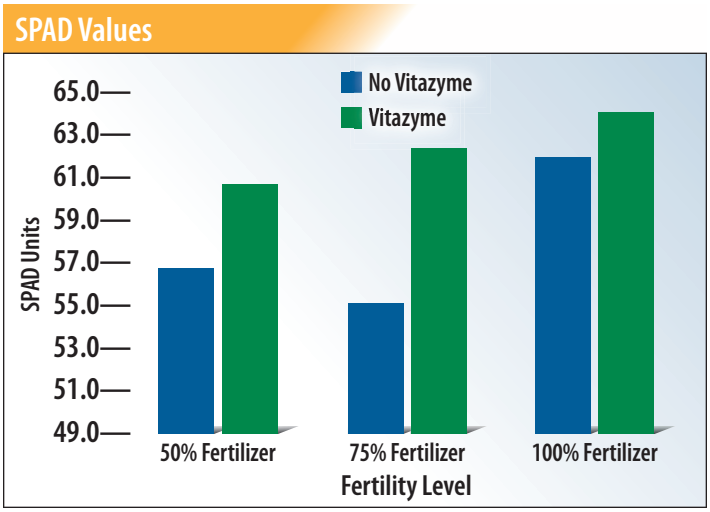
Notice the vastly superior root development of the Vitazyme treated plants after a seed and a foliar treatment

Ear development was greatly enhanced by Vitazyme treatment at each fertilizer level, as shown here at the 75% level. This improvement in yield was 30% for 100% fertilizer

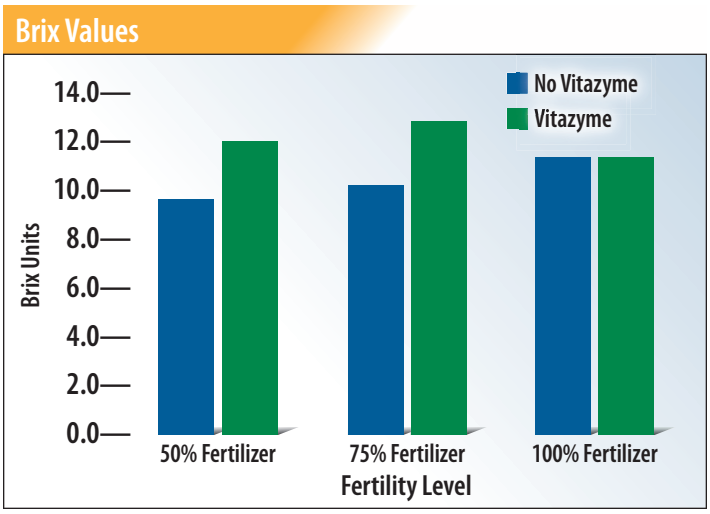
Notice the vastly superior root development of the Vitazyme treated plants after a seed and a foliar treatment

Fertilizer applications: Nitrogen (N) was applied as urea, phosphorus (P) was applied as diammonium phosphate (DAP),and potassium (K) was applied as potassium chloride (KCl). Values in lb/acre are as elemental.
Vitazyme treatments: Treatment 2, 4, and 6 received a Vitazyme seed treatment at 13 oz/acre (1 liter/ha), as well as a foliar treatment of 13 oz/acre (1 liter/ha) at the 6-leaf stage.

Leaf chlorophyll results: Minolta SPAD meter readings were taken for the six treatments during the vegetative stage, which showed increased leaf chlorophyll with Vitazyme above the respective untreated control treatments for all three fertilizer levels.



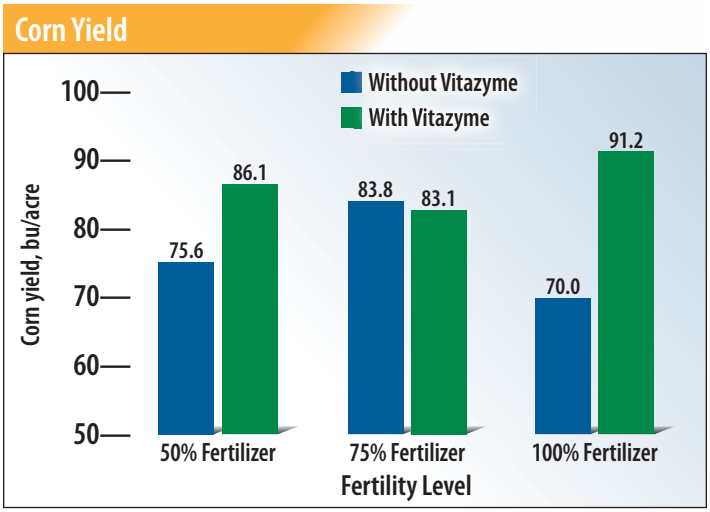
Tissue Brix results: During the vegetative state, tissue sap for each treatment was analyzed for dissolved solids, showing increased dissolved solids for the 50% and 75% fertilizer treatments, respective to the non-Vitazyme treated controls



Yield results:

Treatment	Corn yield[1]	Yield change
	bu/acre	bu/acre
1. 50% fertilizer	75.6 b	—
2. 50% fert + Vita	86.1 a	10.5 (+14%)
3. 75% fertilizer	83.8 a	—
4. 75% fert + Vita	83.1 a	(-) 0.7 (-1%)
5. 100% fertilizer	70.0 b	—
6. 100% fert + Vita	91.2 a	21.2 (+30%)

[1]Means followed by the same letter are not significantly different at P=0.10.
Using the data for 50% and 100% fertilizer only, the differences between Vitazyme-treated and untreated treatments is significant at P=0.03.



Yield increase with Vitazyme

50% fertilizer 14%
100% fertilizer 30%

Note: The values for 75% fertilizer are anomalous.

Conclusions: A replicated small-plot study at the University of Missouri, using Vitazyme as a seed and foliar treatment, revealed that this product significantly increased grain yield at the 50% fertilizer (+14%) and 100% fertilizer (+30%) applications. A lack of similar responses at the 75% fertilizer level is anomalous. Yields were reduced due to unfavorable planting conditions caused by excessive rainfall at planting time. Chlorophyll levels increased at all fertility levels with Vitazyme, and Brix values increased with the product at the 50 and 75% fertilizer applications. Analyses on rhizosphere organisms and grain quality were not available at the time of this report, but will be reported in future publications. Vitazyme is shown to be a highly effective means of improving the utilization of fertilizer applications for corn in Missouri.

Corn *with Vitazyme application*

Researcher: Bruce Kirksey,Ph.D. ***Research organization:*** AgriCenter International, Memphis, Tennessee
Location: Memphis Tennessee ***Variety:*** DK 64-69 ***Planting date:*** June 15, 2022
Planting population: 34,000 seeds/acre ***Planting depth:*** 1.5 inches ***Row spacing:*** 30 inches
Soil: Falaya silt loam, 1.8% organic matter, 6.5 pH, 7.8 meq/100 g cation exchange capacity, good drainage, excellent fertility
Experimental design: A small-plot randomized complete block experimental design was established, using four replications, with four rows per plot of 10 x 30 foot plots, to evaluate the effect of Vitazyme on the effectiveness of this product to improve the utilization of fertilizer with reduced fertilizer applications.

Treatment	Percent of optimum fertilizer	Vitazyme application		Fertilizer application			Nutrient level
		In-furrow	Foliar	Urea	18-46-0	KCl	$N-P_2O_5-K_2O$
	%	oz/acre	oz/acre	lb/acre	lb/acre	lb/acre	lb/acre
1. 100% fertilizer	100	0	0	391	130	100	203-60-60
2. 100% fertilizer + Vita	100	13	13	391	130	100	203-60-60
3. 75% fertilizer	75	0	0	293	98	75	152-45-45
4. 75% fertilizer + Vita	75	13	13	293	98	75	152-45-45
5. 50% fertilizer	50	0	0	195	65	50	102-30-30
6. 50% fertilizer + Vita	50	13	13	195	65	50	102-30-30
7. 25% fertilizer	25	0	0	98	32	25	51-15-15
8. 25% fertilizer + Vita	25	13	13	98	32	25	51-15-15

Fertilizer applications:
See the amounts in the table above.
Vitazyme applications: The in-furrow application was at 13 oz/acre (1 liter/ha) at planting on June 15. The foliar application was sprayed on at 13 oz/acre (1 liter/ha) at the 6 to 8-leaf stage on July 15.
Growing season weather:
Soil moisture at planting was good, but rainfall during June was only 0.94 inch (normal of 4.71 inches), causing considerable moisture stress. Added to this were high temperatures during June, July,and August, with 29 days in July between 90 and 100 degrees F.
Harvest date: November 14, 2022. The center two rows of each plot were harvested, for 30 feet.
Grain moisture results: There were no significant differences in grain moisture at harvest for all treatments. Values ranged from 13.80 to 14.14%.

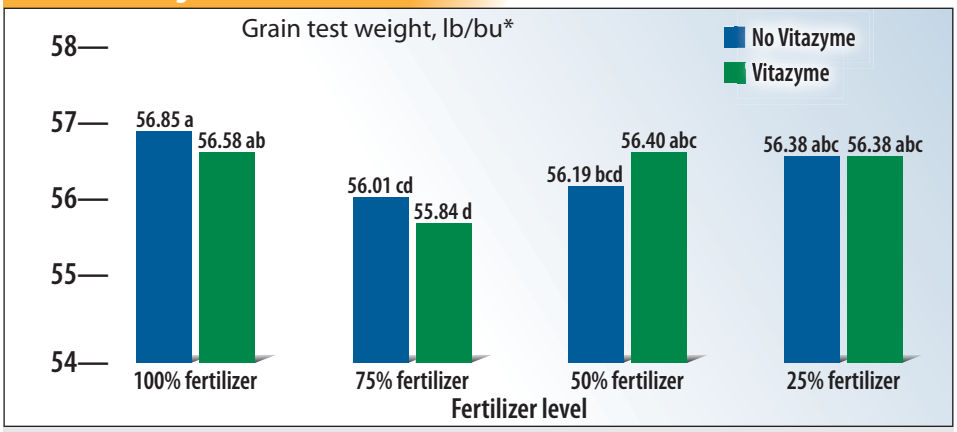
Note that at all fertilizer levels, Vitazyme increased the ear size and kernel weight compared to the untreated control.

At the 25% fertilizer level, Vitazyme greatly expanded the root mass, giving an excellent 15% grain increase above the untreated control.

With 75% of the optimal fertilizer applied, Vitazyme increased the root mass significantly, as it did at all fertilizer levels.

Grain Test weight results: There were no significant differences in test weight among the eight treatments, the values ranging from 55.84 to 56.85 lb/bu.

Grain Test Weight



*Means followed by the same letter are not significantly different at P=0.05.
LSD (0.50 lb/bu
CV = 0.61
Treatment F = 0.0130

Even at 100% of the applied fertilizer, Vitazyme improved ear size, giving a 15% yield increase compared to the untreated control.

Though differences in grain test weight were small, there was a significantly lower test weight for the grain at 75% fertilizer, and at 50% with Vitazyme. The reason for this slight reduction is not known.

Grain yield results:

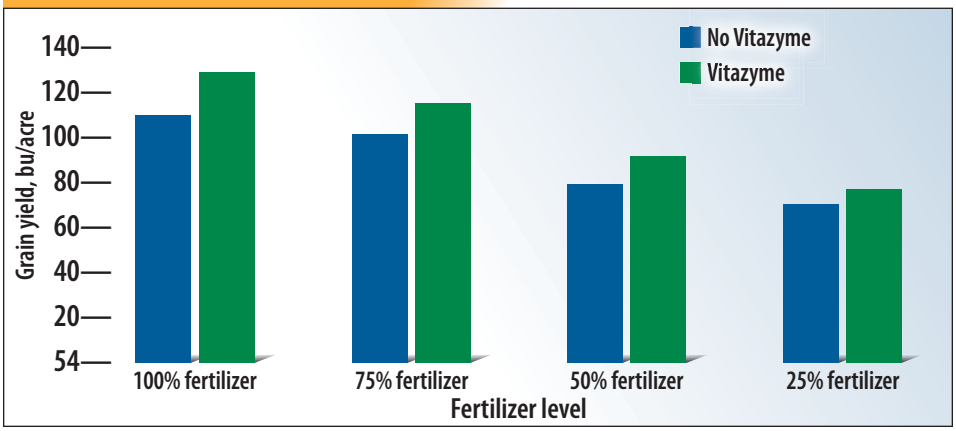
Treatment	Grain yield[1]	Yield change[2]
	bu/acre	bu/acre
1. 100% fertilizer	110.5 c	—
2. 100% fertilizer + Vitazyme	126.8 a	16.3 (+15%)
3. 75% fertilizer	101.2 d	—
4. 75% fertilizer + Vitazyme	118.3 b	17.1 (+17%)
5. 50% fertilizer	79.3 f	—
6. 50% fertilizer + Vitazyme	91.0 e	11.7 (+15%)
7. 25% fertilizer	68.6 g	—
8. 25% fertilizer + Vitazyme	78.9 f	10.3 (+15%)
LSD (P=0.05)	7.02	
CV	4.93	
Replicate probability (F)	0.2104	
Treatment probability (F)	0.0001	

[1]Means followed by the same letter are not significantly different at P=0.05.
[2]Comparisons are made at the same fertilizer level.

Grain yield increase with Vitazyme

100% fertilizer 15%
75% fertilizer 17%
50% fertilizer 15%
25% fertilizer 15%

Corn Grain Yield



There are major significant differences between the various treatments, and at each fertilizer level the grain yield was significantly increased (P = 0.05) by 15 to 17%. The increases ranged from 10.3 to 17.1 bu/acre.

Conclusions: A small-plot corn trial, using four replications in a randomized complete block design, was conducted in western Tennessee on a Falaya silt loam soil. Weather conditions were hot and dry during the mid-summer growth period, which limited yield responses compared to normal years, but during this stressful year Vitazyme, applied in-furrow, and foliar at the 6 to 8-leaf stage, proved to consistently increase the yield by 15 to 17% (10.3 to 17.1 bu/acre) at each of the four fertilizer levels utilized. All of these increases at all four fertilizer levels were highly significant, indicating the ability of Vitazyme's active agents — brassinosteroids, 1-triacontanol, and B-vitamins — to positively impact growth factors that reduce heat and moisture stress, and increase the utilization of fertilizer elements. This program is therefore shown to be an excellent adjunct to farmers' corn production programs in the lower Mississippi River Valley.

Corn *with Vitazyme application*

Researcher: Jonathan Jaschen ***Research organization:*** ACRES Research, Inc., Cedar Falls, Iowa
Location: Fairbank, Iowa ***Variety:*** P0622Q (*Zea mays L.*) ***Plant population:*** 34,000 plants/acre
Planting depth: 25 inches ***Row spacing:*** 30 inches ***Tillage:*** conventional ***Planting date:*** April 30, 2021

Experimental design: A small-plot replicated corn trial was established in a randomized complete block design, using six replications, with plots that were 15 x 30 feet (450 ft^2). The purpose of the trial was to evaluate the effect of Vitazyme, alone and combined with PurYield slow-release polymer-coated urea or urea alone, on the yield of the corn.

1. ***Urea***
2. ***Urea + Vitazyme in-furrow***
3. ***Urea + PurYield***
4. ***Urea + PurYield + Vitazyme in-furrow***
5. ***Urea + Vitazyme impregnated into PurYield***

Treatment	Urea,[1] untreated	Urea,[1] PurYield	Urea,[2] Vita +PurYield	Vitazyme,[3] in-furrow
	lb/acre N	lb/acre N	lb/acre N	oz/acre
1. Urea	150	0	0	0
2. Urea + Vitazyme in-furrow	150	0	0	13
3. Urea + PurYield	75	75	0	0
4. Urea + PurYield+ Vitazyme in-furrow	75	75	0	13
5. Urea + Vitazyme impregnated into PurYield	75	0	75	0

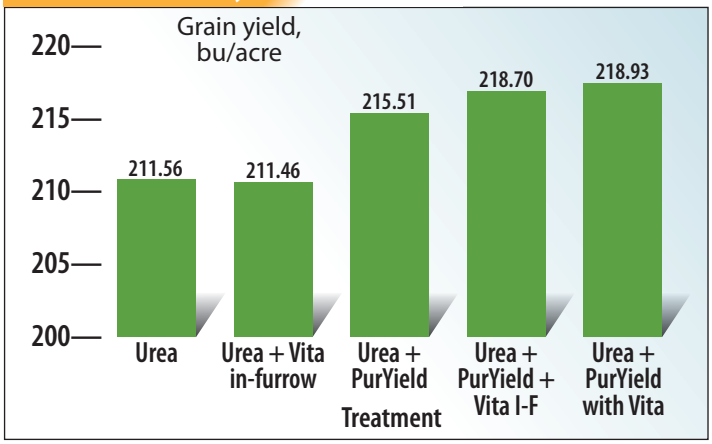
[1]Urea (46-0-0% N-P_2O_5-K_2O) was applied April 21 to the soil surface, 9 days before planting. The PurYield release time was 15 days.
[2]Vitazyme was incorporated into the PurYield fertilizer, 15 day release time.
[3]13 oz/acre at planting.

Fertilization: Nitrogen was applied at 150 lb/acre as urea, alone or encapsulated in a polymer as PurYield. Treatment 5 had Vitazyme added to the urea and polymer at the factory.
Vitazyme application: Treatments 2 and 4 received Vitazyme in-furrow along with the seed at planting on April 30.
Weed control: May 12— Degree Xtra pre-emergent herbicide at 3.2 qt/acre; June 18— Calisto Xtra post- emergent herbicide at 22 oz/acre + RoundUp herbicide at 32 oz/acre
Harvest date: October 18, 2021. The middle four rows of each plot were harvested for data; harvested area: 5 x 30 ft (150 ft^2)
Grain moisture results: There were no significant differences in grain moisture among the five treatments.
Yield results: Grain yields are adjusted to 15.5% moisture.

Treatment	Yield*	Yield change	
	bu/acre	bu/acre	
1. Urea	211.56 a	—	
2. Urea + Vita in-furrow	211.46 a	(-) 0.10	(0)
3. Urea + PurYield	215.51 a	3.95	(+1.9%)
4. Urea + PurYield+ Vita in-furrow	218.70 a	7.14	(+3.4%)
5. Urea + PurYield with Vita	218.93 a	7.37	(+3.5%)
LSD (0.05)	14.65		
CV	5.65		
Treatment F	0.7086		

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

Corn Grain Yield (dry)



Yield increase

Urea + PurYield vs. Urea + PurYield + Vitazyme
3.19 bu/acre (+1.5%)

Yield increase

Urea vs. Urea + PurYield
3.95 bu/acre (+9%)

Growing conditions for 2021: Rainfall and temperatures were good throughout the growing season, though a severe windstorm blew over many of the stalks after the corn had mostly matured. Though harvesting of the lodged crop was rather difficult, the results were not adversely affected.

Conclusions: A small-plot replicated corn trial in eastern Iowa in 2021 compared the effects of nitrogen fertilizer-applied as urea alone or in a 50-50 combination with polymer-coated, slow release urea called PurYield—with Vitazyme in-furrow at planting, and Vitazyme incorporated directly into the PurYield urea polymer. Yield results showed no significant differences, but trends in the data revealed the following.

- PurYield at 50% of the urea N had a tendency to increase the yield (Treatment 1 vs. Treatment 3), by 3.95 bu/acre, indicating that more N was being utilized and not lost due to leaching or denitrification.
- Vitazyme applied in-furrow at planting along with urea and PurYield, compared to those same N applications with Vitazyme (Treatment 3 vs. Treatment 4) boosted the yield by 3.19 bu/acre (+ 1.5%).
- Vitazyme applied either in-furrow or incorporated into the PurYield urea polymer (Treatment 4 and 5) produced about equal yield increases above 50% urea N and 50% PurYield N, showing that Vitazyme incorporated into the urea polymer was not inactivated during the manufacturing process.

While the yield increases of PurYield slow-release N and Vitazyme were not significant in this trial, they show that these two products are very compatible when applied separately or incorporated.

Corn *with Vitazyme application*

The top row of corn ears represents urea at 150 lb/acre with Vitazyme in-furrow, while the less filled ears below received the same urea application but no Vitazyme. Note the better ear fill with Vitazyme.

Vitazyme applied either in-furrow with the seed, or directly into the PurYield polymer urea, produced the same excellent responses to root and ear development.

Researcher: Jonathan Jaschen
Research organization: ACRES Research, Inc., Cedar Falls, Iowa
Location: Cedar Falls, Iowa ***Variety:*** P0622Q (*Zea mays L.*) ***Plant population:*** 34,000 plants/acre
Planting depth: 2.5 inches ***Row spacing:*** 30 inches ***Tillage:*** conventional ***Planting date:*** May 8, 2021

Experimental design: A small-plot replicated corn trial was established in a randomized complete block design, using six replications, with plots that were 15 x 30 feet (450 ft^2). The purpose of the trial was to evaluate the effect of Vitazyme, alone and combined with PurYield slow-release polymer-coated urea or urea alone, on the yield of corn.

1. ***Urea***
2. ***Urea + Vitazyme in-furrow***
3. ***Urea + PurYield***
4. ***Urea + PurYield + Vitazyme in-furrow***
5. ***Urea + Vitazyme impregnated into PurYield***

Treatment	Urea,[1] untreated	Urea,[1] PurYield	Urea,[2] Vita +PurYield	Vitazyme,[3] in-furrow
	lb/acre N	lb/acre N	lb/acre N	oz/acre
1. Urea	150	0	0	0
2. Urea + Vitazyme in-furrow	150	0	0	13
3. Urea + PurYield	75	75	0	0
4. Urea + PurYield+ Vitazyme in-furrow	75	75	0	13
5. Urea + Vitazyme impregnated into PurYield	75	0	75	0

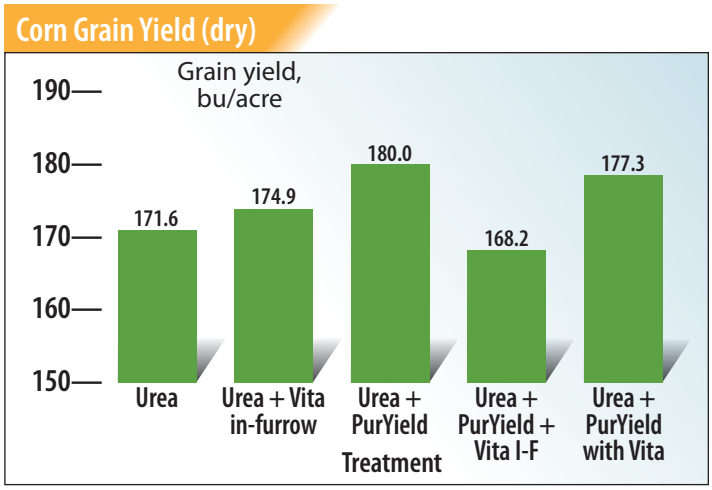
[1]Urea (46-0-0% N-P_2O_5-K_2O) was applied April 21 to the soil surface, 9 days before planting. The PurYield release time was 15 days.
[2]Vitazyme was incorporated into the PurYield fertilizer, 15 day release time.
[3]13 oz/acre at planting.

Fertilization: Nitrogen was applied at 150 lb/acre as urea, alone or encapsulated in a polymer as PurYield. Treatment 5 had Vitazyme added to the urea and polymer at the factory.
Vitazyme application: Treatments 2 and 4 received Vitazyme in-furrow along with the seed at planting on May 8.
Weed control: May 11—Degree Xtra pre-emergent herbicide at 3.2 qt/acre; June 18—Calisto Xtra post-emergent herbicide at 22 oz/acre + RoundUp Powermate at 32 oz/acre
Harvest date: October 18, 2021. The middle four rows of each plot were harvested for data; harvested area: 5 x 30 ft (150 ft^2)
Grain moisture results: There were no significant differences in grain moisture among the five treatments. However, Treatment 4, PurYield with Vitazyme in-furrow, produced the dryest corn, being 0.79 percentage point dryer than Treatment 3, which had the same fertility regime but without Vitazyme (17.08%) vs. 16.29%), which was significant at P=0.12 and within the 0.65% LSD.

Yield results: Grain yields are adjusted to 15.5% moisture.

Treatment	Yield*	Yield change	
	bu/acre	bu/acre	
1. Urea	171.6 a	—	
2. Urea + Vita in-furrow	174.9 a	+ 3.3	(+1.9%)
3. Urea + PurYield	180.0 a	+ 8.4	(+4.9%)
4. Urea + PurYield+ Vita in-furrow	168.2 a	- 3.4	(- 2.0%)
5. Urea + PurYield with Vita	177.3 a	+ 5.7	(+3.3%)
LSD (0.05)	10.3		
CV	4.9		
Treatment F	0.1761		

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



Growing conditions for 2021: Rainfall and temperatures were good throughout the growing season.

Conclusions: A small-plot corn trial, utilizing urea, polymer-coated urea (PurYield) having a 15 day release period, along with Vitazyme either in-furrow at planting or incorporated into the polymer granule, revealed no significant yield differences at P=0.05. However, Vitazyme in-furrow increased the yield above the control by 3.3 bu/acre (1.9%), and 50% PurYield urea produced an 8.4 bu/acre increase above the control (4.9%). When Vitazyme was applied in-furrow along with 50% urea as PurYield. The yield for some unknown reason was depressed, but when Vitazyme was incorporated into the PurYield granule, the yield responded by 9.1 bu/acre (5.3%) above the Vitazyme in-furrow treatment with the same urea applications. These results indicate no loss of Vitazyme effectiveness when incorporated into the PurYield polymer urea granule, and the possible effectiveness of PurYield delayed release urea to improve corn yields.

Corn Grain Yield Increase with Comparisons

***Trt. 1 vs. Trt. 2*—Urea vs. Vitazyme + Urea**
3.3 bu/acre (+1.9%)
***Trt. 1 vs. Tr. 3*—Urea vs. 50% PurYield**
8.4 bu/acre (+4.9%)
***Trt. 4 vs. Trt. 5*— 50% PurYield + Vitazyme in-furrow vs. 50% PurYield with Vitazyme incorporated**
9.1 bu/acre (+5.3%)

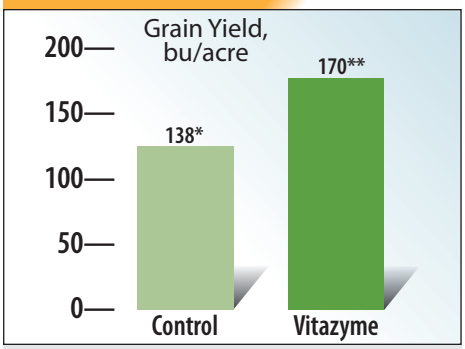
Corn *with Vitazyme application*

Researchers: Dr. Alberto M. Garcia Munguia ***Research Organization:*** University of Aguascalientes, Agricultural Sciences Center, Phytotechniques Department, Jesus Maria, Aguascalientes, 20131, Mexico
Location: Municipality of Guasave, Sinaloa State, Mexico ***Variety:*** Pioneer P3260W ***Planting date:*** December 8, 2020
Planting rate: 90,000 seeds/ha (26.235 kg of seed)
Experimental design: A small-plot corn study was situated in a randomized block design, with four replications. Plots were four rows wide, the row distance being 0.8 meter, giving a 3.2 meter plot width that was 5.0 meters long. Each plot was 16m^2, and each treatment totaling 64m^2.

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

Vitazyme application: (1) a seed treatment just before planting of 0.25 liter/ha (4 oz/acre) in 0.25 liter/ha of water to achieve good seed coverage; (2) a foliar spray of 1.0 liter/ha (13 oz./acre), 30 days after planting, using a 400 liter/ha (40 gallon/ha) spray volume and cone nozzles.
Fertilization: unknown, but uniform over all areas
Results: The corn crop was harvested and evaluated on May 17, 2021, 160 days after planting.

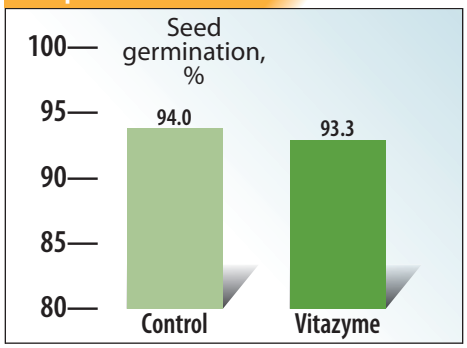
Grain Yield



*8.7 MT; **10.7 MT.

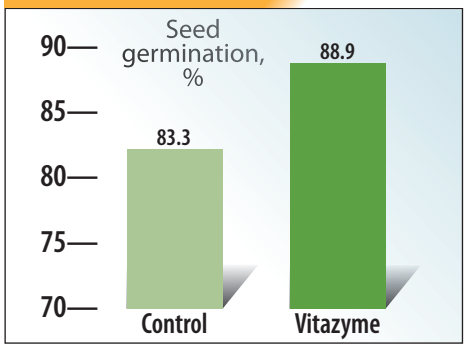
Grain yield increase with Vitazyme: 23%

Pre-plant Germination*



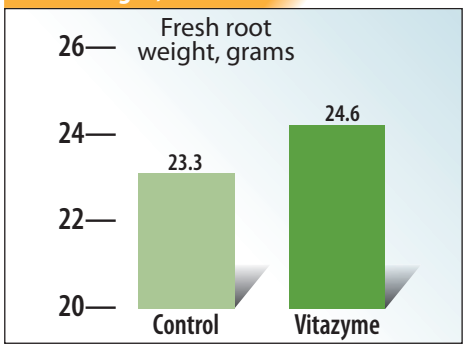
Pre-plant seed germination decrease with Vitazyme: -1%

Field Germination



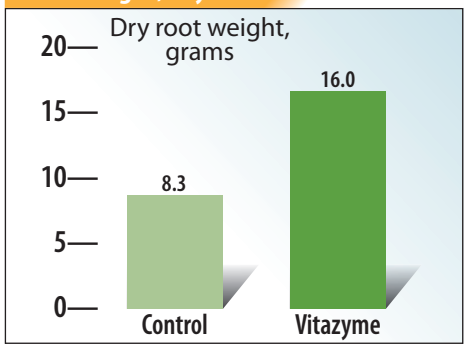
Field seed germination increase with Vitazyme: 7%

Root Weight, fresh



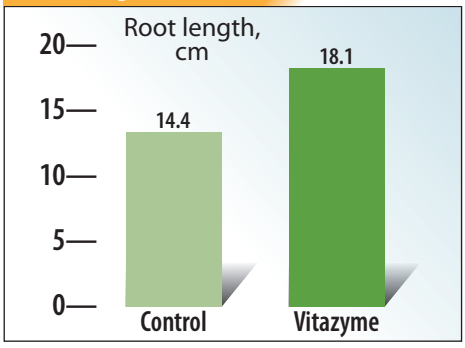
Fresh root weight increase with Vitazyme: 6%

Root Weight, dry



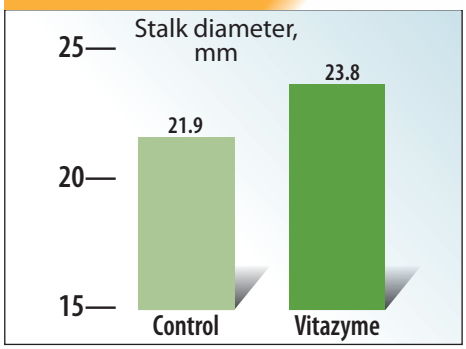
Dry root weight increase with Vitazyme: 93%

Root Length



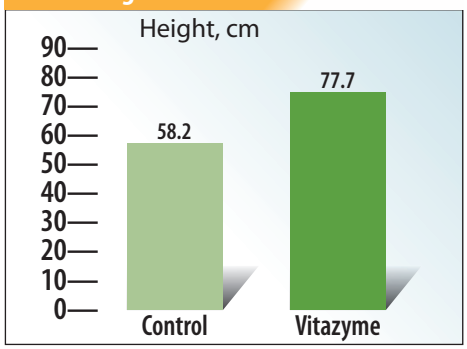
Root length increase with Vitazyme: 26%

Stalk Diameter



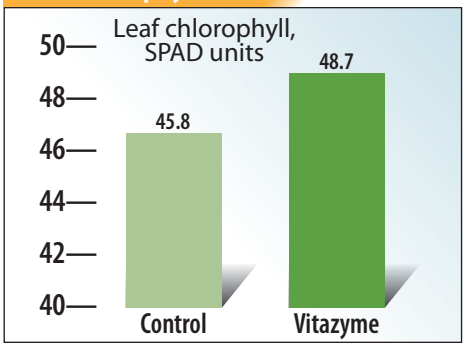
Stalk diameter increase with Vitazyme: 9%

Plant Height



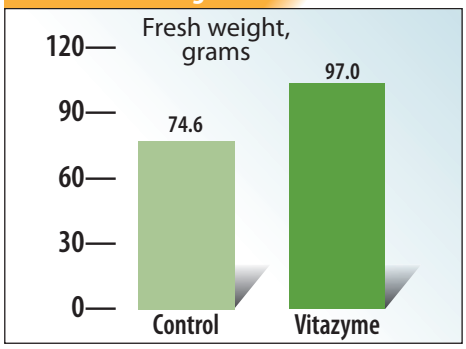
Plant height increase with Vitazyme: 34%

Leaf Chlorophyll



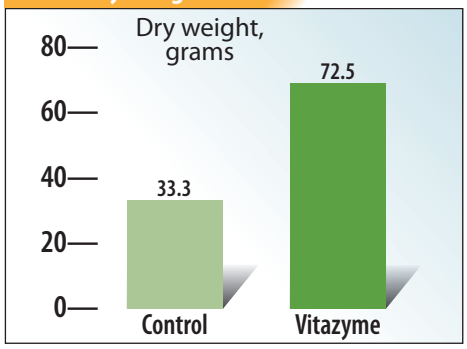
Leaf chlorophyll increase with Vitazyme: 6%

Plant Fresh Weight



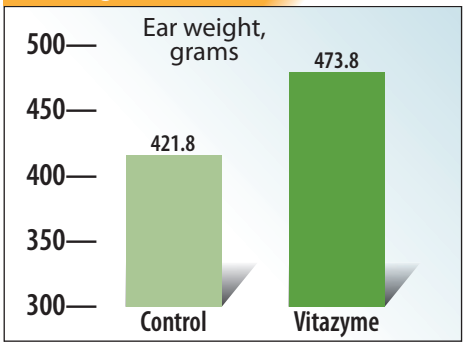
Plant fresh weight increase with Vitazyme: 30%

Plant Dry Weight



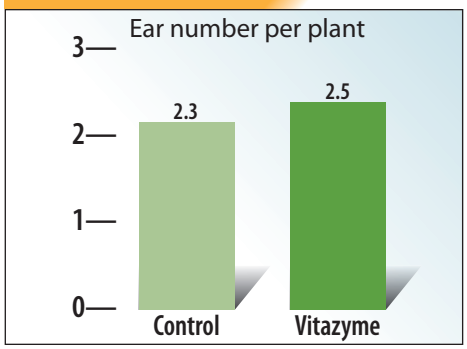
Plant dry weight increase with Vitazyme: 118%

Ear Weight



Ear weight increase with Vitazyme: 12%

Ears Per Plant



Increase in average ear number per plant with Vitazyme: 9%

Conclusions: A small-plot replicated study on corn in Sinaloa State, Mexico, comparing Vitazyme applied as a seed treatment (0.25 liter/ha, or 4 oz/acre), along with a 1 liter/ha (13 oz/acre) foliar spray 30 days later, revealed that all growth and yield parameters responded positively to the program. Grain yield increased by a considerable 23%, reflecting improvements in germination (+7%), root weight (6%) fresh and 93% dry), root length (+26%), stalk diameter (+9%), plant height (+34%), leaf chlorophyll (+6%), plant weight (+30% fresh and +118% dry), ear weight (+12%), and ears per plant (+9%). The brassinosteroids and other growth promoters in Vitazyme clearly triggered a wide array of beneficial growth responses, which illustrates it efficacy in corn production in Sinaloa State, Mexico.

Corn *with Vitazyme application*

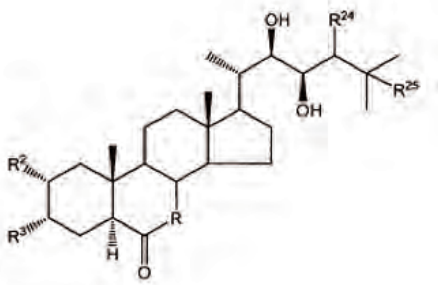
Researchers: Robert J. Kremer, Timothy M. Reinbott, Paul W. Syltie, Manjuala V. Nathan, and C. LeRoy Deichman
Research organization: School of Natural Resources and Division of Plant Science and Technology, University of Missouri, Columbia, Missouri ***Location:*** Bradford Research Farm, Columbia, Missouri

A Research Paper Presented At the International Biostimulant Congress in Miami, Florida, November 2021

Title: A Brassinosteroid- based Biostimulant Integrated With An Innovative Crop System Improves Maize Productivity
Justification: (1) Farmers need alternatives to current industrial agriculture production models.
(2) Alternatives include innovative management systems that enhance crop productivity on the same land area, improve soil health and environmental quality, and assure food security. (3) Biostimulants are vital components of innovative management.

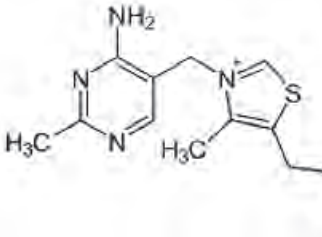
Vitazyme biostimulant components:

Brassinosteroids—plant hormones with multiple plant growth effects
- Enhance root development
- Improve nutrient uptake efficiency
- Suppress diseases
- Improve stress tolerance



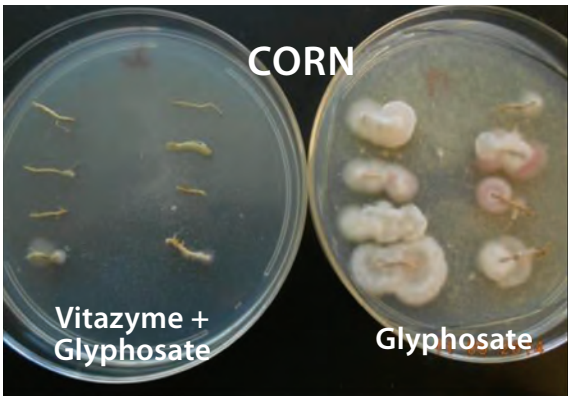
1-Tricontanol—long chain fatty alcohol from plant waxes with plant growth-regulating properties
- Increase cell division
- Increase photosynthesis
- Increase chloroplast number
- Increase chlorophyll

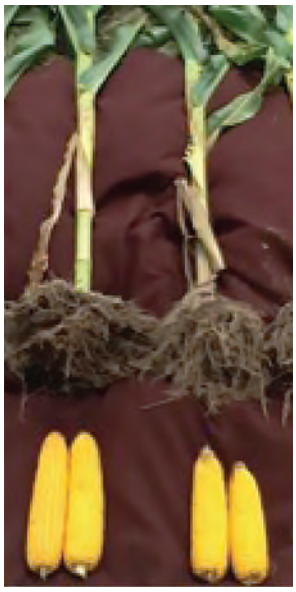
B-Vitamins
- Mediate energy metabolism in both plants and soil microbiome
- Stimulate root growth and resistance against phytopathogens
- Promote root colonization by plant growth promoting bacteria



B_1 (thiamine)

Previous Vitazyme results on maize
- Increased leaf chlorophyll / photosynthetic activity (SPAD)
- Increased root biomass
- Increased grain yield ≈ 5%
- Increased rhizosphere microbiome diversity and abundance
- Increased beneficial plant growth-promoting rhizobacteria
- Increased rhizosphere microbiological activity (glucosidase enzyme activity)
- Decreased root colonization by potential pathogenic Fusarium species
- Decreased stress due to effects of herbicide glyphosate released into rhizosphere of transgenic hybrids



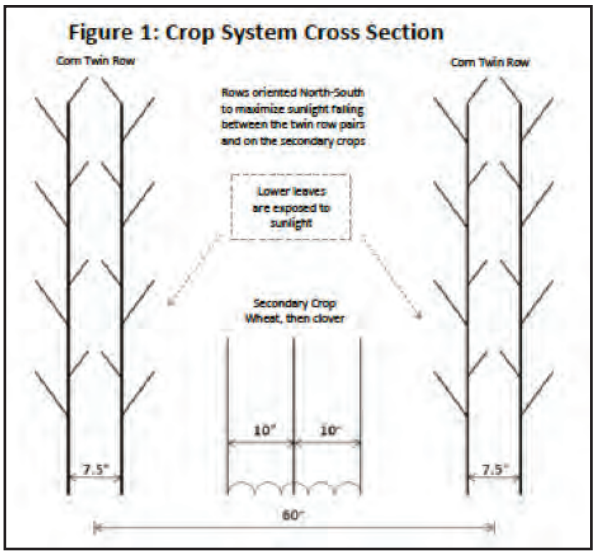


+ Vitazyme **Control**

Kremer, R.J. et al. 2017. Abstr. 3rd World Congress on the use of Biostimulants in Agriculture
Nathan, M. et al. 2019. Abstr. 4th World Congress on the use of Biostimulants in Agriculture

The Solar Corridor production system:
Depiction of maize planted in a solar corridor system for increased light capture

Maize twin rows (15-cm) planted with 152-cm alley or 'solar corridor'. Knox County, MO - 2011



Source: Deichman, C.L. 2009. Farming Systems Design Symposium Proceedings, pp. 87-88

Deichman, C.L., Kremer, R.J. (eds.). 2019. ***The Solar Corridor Crop System***, Elsevier Academic Press, San Diego

Benefits of the system:

- Greater access to photosynthetically active radiation
- Increased CO_2 uptake by lower leaf canopy
- Increased photosynthate production
- Similar or increased grain yields with no land area expansion
- Enhanced root biomass
- Increased root exudation of C substrates and rhizosphere microbial growth and diversity

Solar corridor planting of corn with cowpea as inter-crop

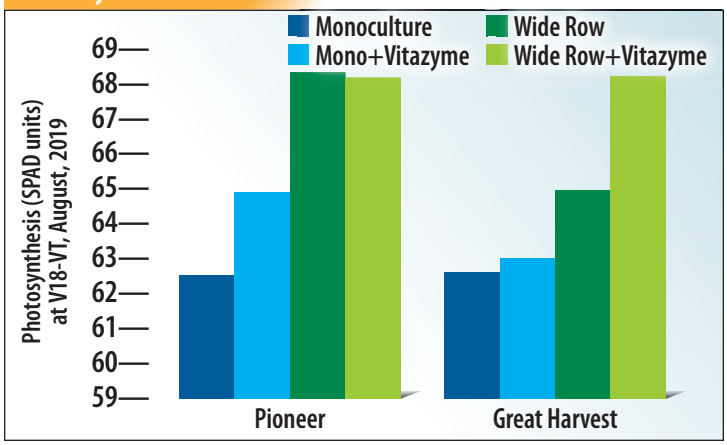
Study objective: Determine the effects of multi-functional Vitazyme on maize growth in the solar corridor crop production system, doing "proof of concept" studies in 2018 and 2019

Experimental design:

- Conduct field trials conducted at Columbia, Missouri USA on Mexico silt soil (fine, smectitic, mesic vertic epiaqualfs) in 2018 and 2019 using randomized complete block designs with four replicates
- Plant maize conventionally using minimum tillage as "monoculture" in 76-cm rows and also as "solar corridor" in 152-cm rows. Use two maize cultivars, one better adapted to the solar corridor system than the other.
- Apply Vitazyme as (1) a seed coating at planting, and (2) a foliar spray using (950 mL/ ha) at vegetative stage V6 (Abendroth et al. 2011)
- Evaluate leaf chlorophyll with a Minolta SPAD meter (Naus et al. 2010) and sample ear leaves for nutrient analysis at growth stage V18-VT
- Root sampling at stage R4
- Harvest with plot combine

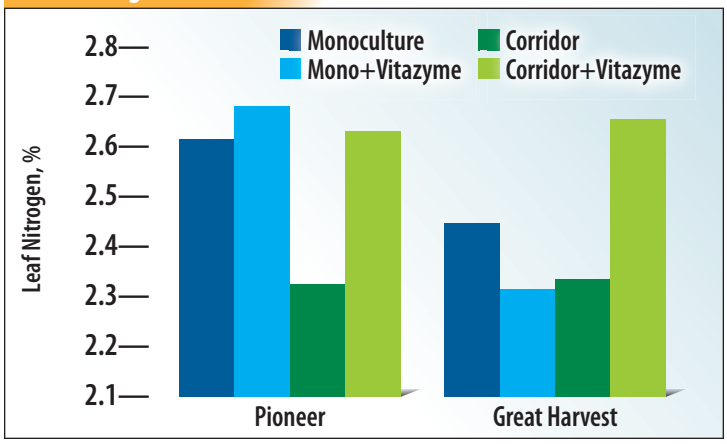
Photosynthesis results: Chlorophyll levels were considerably higher for maize grown in wide rows (152 cm) than in conventional rows (76 cm), and Vitazyme provided additional increase in activity in wide-row planted Great Harvest hybrid in 2019.

Photosynthesis Results

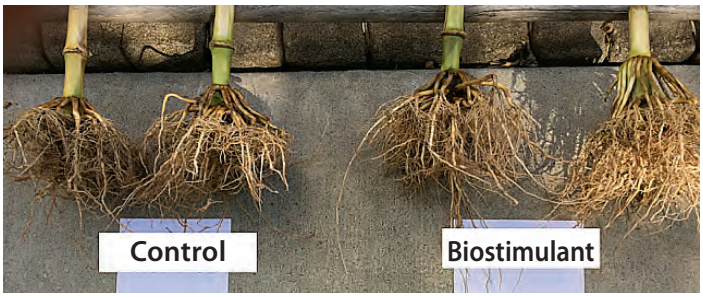


Leaf nitrogen results: Leaf nitrogen in August of 2019 was reduced somewhat in the corridor system for the Pioneer hybrid, but Vitazmye boosted the leaf N for both hybrids, especially in the solar corridor system. With the Great Harvest hybrid, the monoculture system resulted in lower leaf N than for the Pioneer hybrid in the conventional system, and Vitazyme did not elevate the N level. However, Vitazyme greatly enhanced leaf N in the solar corridor row spacing.

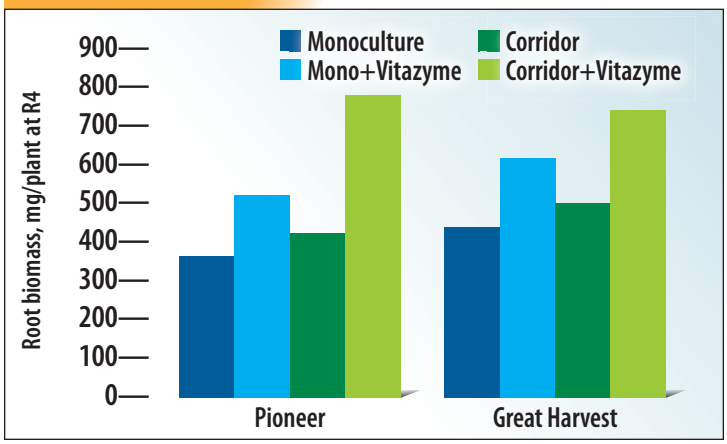
Leaf Nitrogen Results



Root biomass results: At the R4 stage in September, 2019, the maize root mass was greatly increased for both cultivars for both the conventional and solar corridor systems.



Root Biomass Results

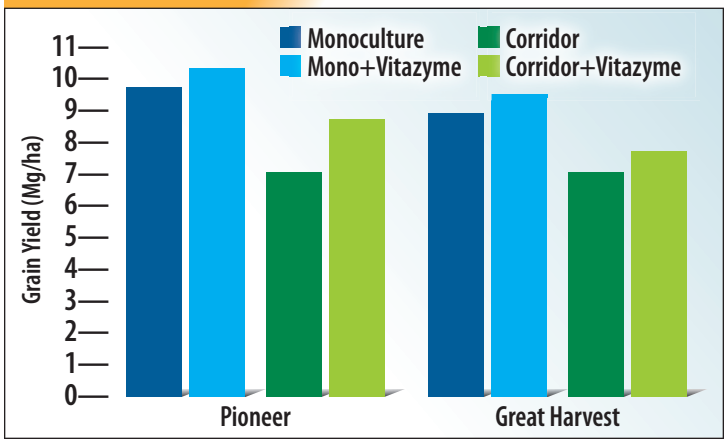


Grain yield results: While the Pioneer hybrid yielded a bit more than the Great Harvest cultivar in both systems, Vitazyme increased the yield in every case.

Control

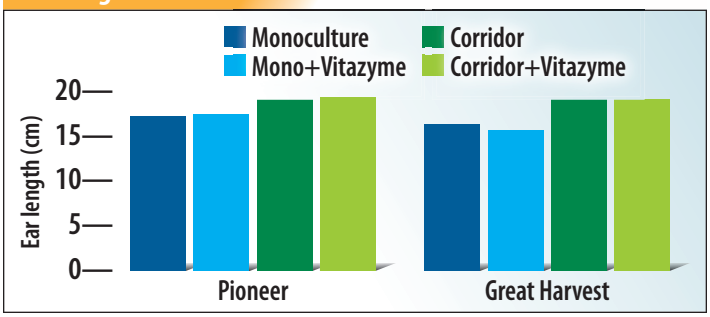
Biostimulant

Grain Yield Results

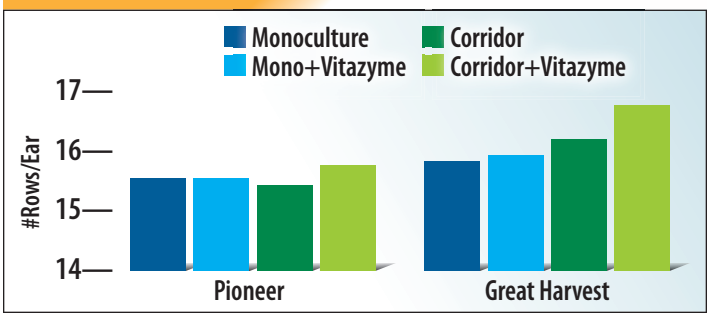


Corn ear results: Ear length varied slightly in favor of a longer length of the Great Harvest hybrid. Rows per ear were greater with the Great Harvest hybrid in both the monoculture and solar corridor systems, and in all but the monoculture with the Pioneer hybrid Vitazyme increased rows per ear. Kernels per ear were markedly greater in the solar corridor system for both hybrids, and Vitazyme increased the kernels in all but the monoculture comparison for the Great Harvest cultivar.

Ear Length Results



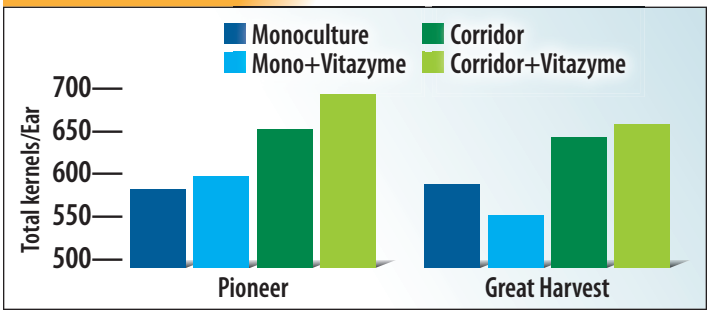
Kernels Rows/Ear Results



Monoculture typical ear: 34,000 seeds/acre

Solar corridor typical ear: 34,000 seeds/acre

Kernels/Ear Results



Unique aspects of Vitazyme in the Solar Corridor cropping system:

Solar Corridor

- Increased light exposure
- Increased CO_2 uptake
- Increased photosynthesis
- Increased nutrient uptake
- Maintained or increased maize grain yields
- Increased root biomass
- Increased soil microbe diversity
- Increased production of labile soil carbon
- Increased soil microbial activity
- Provides crop diversity and conserves soil

Vitazyme

- Increased photosynthesis
- Increased nutrient uptake
- Increased root biomass
- Maintained or increased maize grain yields and yield components (ear row number, ear kernel number)
- Increased soil microbe diversity

Conclusions:

1. Biostimulants containing brassinosteroids, triacontanol, and B vitamins supplement several facets of plant growth and soil health functions. (Hayat and Ahmad, 2011). In these studies, Vitazyme, containing these components, performed these functions.
2. Vitazyme, as a multifunctional biostimulant evaluated in the studies, improved these benefits when integrated in management for an intercropping practice—the solar corridor crop production system—by increasing root biomass, improving potential photosynthesis and carbon capture, and increasing economic yield.
3. Integration of biostimulants such as Vitazyme can be accomplished with all crop management models, and appear well-suited as a practice benefiting alternative management in the transition from industrial crop production to more sustainable and diverse production systems.

Corn *with Vitazyme application—A Study With Bio Seed Crop Inoculant*

Note the far superior root development, more aggressive brace roots, and greater stalk width for the Vitazyme treated corn plants on the left

The corn plants treated with Vitazyme show considerably better root development, which has led to greater nutrient uptake and superior ear development.

Researcher: Bruce Kirksey, Ph.D.
Research organization: Agricenter International, Memphis, Tennessee ***Location:*** Memphis, Tennessee
Variety: DK64-89 ***Planting date:*** May 18, 2021 ***Planting depth:*** 1.5 inches
Row spacing: 30 inches ***Tillage:*** conventional
Soil type: Falaya and Waverly silt loam, 1.8% organic matter, pH 6.5, cation exchange capacity 7.8 meq/100 g of soil, excellent fertility, good drainage
Experimental design: A small-plot research trial was designed in a randomized complete block design, using four replications with five treatments, on plots that were 10 x 30 feet (four rows per plot). The objective of the trial was to evaluate the effects of Vitazyme and Bio Seed, alone and in combination, on the yield of corn.

Treatment	Vitazyme[1]		Bio Seed,
	In-furrow	Foliar	In-furrow
	oz/acre	oz/acre	grams/acre
1. Control	0	0	0
2. Vitazyme	13	0	0
3. Bio Seed	0	0	50
4. Vitazyme + Bio Seed	13	0	50
5. Vitazyme + Bio Seed	0	13	50

[1]13 oz/acre = 1 liter/ha. The foliar Vitazyme application was made on June 21.

Fertilization: unknown, uniform over the entire area
Vitazyme application: 13 oz/acre in-furrow at planting for Treatments 2 and 4, and foliar by sprayer on June 21 at 34 days after emergence for Treatment 5
Bio Seed application: 50 grams/acre as an in-furrow treatment for Treatments 3, 4, and 5. Bio Seed is a mixture of bacteria and fungi that are beneficial to seed germination and plant development.
Growing season weather: favorable
Harvest date: October 12, 2021
Grain moisture results: There were no significant grain moisture differences among the five treatments, which ranged from 16.4 to 16.6%.
Grain test weight results: Test weight (density) varied nonsignificantly from 54.1 to 56.1 lb/bu among the five treatments.

Yield results: An area of 5 x 25 feet was harvested by an Almaco plot combine for each plot.

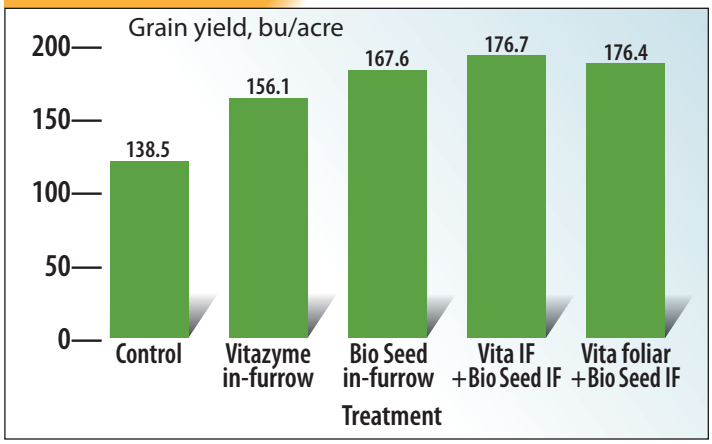
Treatment	Yield[1]	Yield change
	bu/acre	bu/acre
1. Control	138.5 c	—
2. Vitazyme in-furrow	156.1 b	17.6 (+13%)
3. Bio Seed in-furrow	167.6 ab	29.1 (+21%)
4. Vita in furrow + Bio Seed in-furrow	176.7 a	38.2 (+28%)
5. Vita - foliar + Bio Seed in-furrow	176.4 a	37.9 (27%)
LSD (P=0.05)	12.0	
CV	4.77	
Replicate F	0.408	
Treatment F	0.0001	

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

Increase in Grain Yield

Vitazyme alone..... +13%
Bio Seed alone..... +21%
Vitazyme in-furrow
+ Bio Seed in-furrow ..... +28%
Vitazyme foliar
+ Bio Seed in-furrow ..... +27%

Corn Grain Yield



Conclusions: A small plot replicated study on corn in western Tennessee, using Vitazyme and Bio Seed alone and in combination, revealed that all treatment yields significantly exceeded the control treatment yield by from 13 to 27%. Vitazyme and Bio Seed alone were statistically equal and a bit less in yield than the combined products. It is clear that the combined Vitazyme + Bio Seed treatments, whether Vitazyme was applied in-furrow or foliar, greatly surpassed the product applied alone. The 27 and 28% yield increases with the products applied together show the great potential for this combination to enhance corn yields in the mid-Mississippi River Valley. There were no significant effects on grain moisture at harvest or grain test-weight.

Corn *with Vitazyme application*

Researcher: Jonathan Jaschen
Research organization: ACRES Research, Cedar Falls, Iowa
Location: Cedar Falls, Iowa ***Variety:*** P0589AMXT
Planting date: May 31, 2020
Plant population: 34,000 plants/acre
Row spacing: 30 inches ***Previous crop:*** corn
Soil type: unknown
Tillage method: conventional

Experimental design: A small plot experiment, using five replications, was initiated using plots that were 15 x 30 ft (450 ft^2), to determine the effects of Vitazyme and PurYield—urea that is encapsulated in a polymer—in different formulations for rate of release, with and without Vitazyme incorporation, to determine the yield enhancement with these formulations versus appropriate untreated controls. The experimental design was a Randomized Complete Block.

Treatment	Normal urea		PurYield[1]		PurYield + Vitazyme[2]		Vitazyme in-furrow	Vitazyme foliar (V6)
	120 lb/acre	180 lb/acre	120 lb/acre	180 lb/acre	120 lb/acre	180 lb/acre		
1	x	o	o	o	o	o	o	o
2	o	x	o	o	o	o	o	o
3	o	o	x	o	o	o	o	o
4	o	o	o	x	o	o	o	o
5	o	o	o	o	x	o	o	o
6	o	o	o	o	o	x	o	o
7	o	o	x	o	o	o	o	x
8	o	o	o	x	o	o	o	x
9	o	o	x	o	o	o	x	o
10	o	o	o	x	o	o	x	o
11	x	o	o	o	o	o	x	o
12	x	o	o	o	o	o	x	x
13	o	x	o	o	o	o	o	x
14	o	o	o	o	o	o	o	o

[1]PurYield was applied as a combination of 10-day release, 30-day release, and 45-day release polymer coated urea in the following fashion: 120 lb/acre N, 425, 425, and 430 g/plot for the three types; 180 lb/acre N, 636, 636, and 643 g/plot for the three types.
[2]PurYield + Vitazyme was a formulation as in footnote 1 above, plus Vitazyme incorporated into the granules at manufacture to give a 13 oz/acre rate.

Fertilization: PurYield was applied by broadcasting at the rates given in the table on May 30, 2020. Urea was likewise broadcast at the rates given in the table on May 30, at 1,220 g/plot for the 120 lb/acre N rate, and at 1,830 g/plot for the 180 lb/acre N rate. PurYield is a polymer-coated urea formulated by Pursell Agri-Tech, Sylacauga, Alabama. Treatment 13 had a side-dress application of urea at V6 (July 1).

Vitazyme application: Vitazyme was applied directly to the urea during the encapsulation process, to give about 13 oz/acre when the granules are applied at normal rates. The in-furrow treatment was at 13 oz/acre applied in the seed row at planting (May 31), and the foliar application was sprayed on at 13 oz/acre at the V6 stage, on July 1, 2020.

Growth results: Excavation of roots on August 28 from Vitazyme treated plants and untreated plants revealed considerably better rooting for the treated plants.

This comparison of corn treated with Vitazyme has the same levels of PurYield nitrogen on both sides. The root growth and ear fill are markedly better with Vitazyme.

Another PurYield nitrogen rate shows the same advantage of ear fill and root enhancement for Vitazyme as with the other nitrogen rate in the other photo.

The Vitazyme treated corn roots on the right show a remarkable enhancement of development compared to the untreated plant on the left.

Ear development is markedly improved in terms of fill and kernel size with the ear from the Vitazyme treated plant on the right.

Yield results: The plots were harvested on October 25, 2020, using a plot combine to harvest the inner two rows of each plot, or an area of 60 in x 30 ft per plot.

Treatment	Yield[1]	Yield change at the same N level					
	bu/acre	Comparison	bu/acre	Comparison	bu/acre	Comparison	bu/acre
1. Urea 120	195.6 a	1 vs. 3	+1.4	1 vs. 5	+4.4	1 vs. 9	+6.8
2. Urea 180	208.4 a	2 vs. 4	+9.9	2 vs. 5	-8.4	2 vs.10	+7.3
3. PurYield 120	197.0 a	3 vs. 5	+3.0	3 vs. 7	-4.1	3 vs.9	+5.4
4. PurYield 180	218.3 a	4 vs. 6	-8.2	4 vs. 8	-5.2	4 vs.10	-2.6
5. PurYield 120 + Vita	200.0 a	5 vs. 7	-6.9	5 vs. 9	+2.4	5 vs.11	-0.4
6. PurYield 180 + Vita	210.1 a	6 vs. 8	+3.0	6 vs.10	+5.6	6 vs.13	+11.6
7. PurYield 120, Vita V6	192.9 a	7 vs. 9	+9.5	7 vs.11	+6.7	7 vs.12	+1.5
8. PurYield 180, Vita V6	213.1 a	8 vs.10	+2.6	8 vs.13	+8.6		
9. PurYield 120, Vita IF	202.4 a	9 vs.11	-2.8	9 vs.12	-8.0		
10. PurYield 180, Vita IF	215.7 a	10 vs.13	+6.0				
11. Urea 120, Vita IF	199.6 a	11 vs.12	-5.2				
12. Urea 120, Vita IF + Vita V6	194.4 a						
13. Urea 180, Vita V6	221.7 a						
14. None	107.0 b						
LSD (P=0.05)	16.9 bu/acre						
CV	6.73						
Replicate F	2.73						
Treatment F	21.84						

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

Conclusions: This small-plot corn study in east-central Iowa, comparing corn yields treated with conventional urea, polymer-coated slow-release urea of 10, 30, and 45 days, these fertilizers incorporated with Vitazyme within the granule, and also with Vitazyme applied in-furrow or foliar at V6, showed a considerable amount of variation among the treatments. As a result, there were no significant differences among the treatment means, except that all of the fertilizer treatments were about double that of the unfertilized control (Treatment 14).

Some increases in yield did appear for the same level of nitrogen when Vitazyme was either added within the polymer granules, or applied in-furrow or foliar.

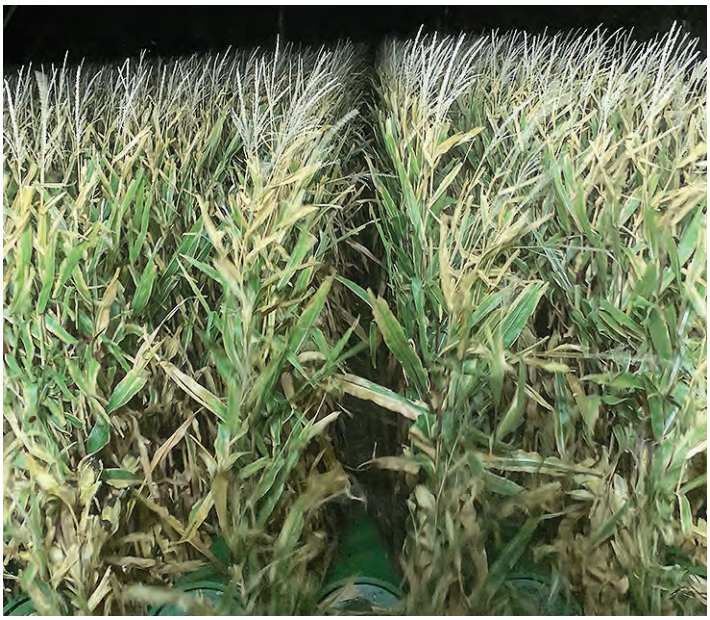
Urea 120 vs. PurYield 120 + Vitazyme .....+4.4 bu/acre
Urea 120 vs. PurYield 120 + Vitazyme in-furrow.....+6.8 bu/acre
Urea 180 vs. PurYield 180, Vitazyme in-furrow.....+7.3 bu/acre
PurYield 120 vs. PurYield 120, Vitazyme in-furrow.....+5.4 bu/acre
PurYield 180 + Vitazyme vs. PurYield 180, Vitazyme in-furrow.....+5.6 bu/acre
PurYield 180 + Vitazyme vs. Urea, Vitazyme V6 .....+11.6 bu/acre
PurYield 120, Vitazyme V6 vs. PurYield 120, Viazyme in-furrow ....+9.5 bu/acre
PurYield 120, Vitazyme V6 vs. Urea 120, Vitazyme in-furrow .....+6.7 bu/acre
PurYield 180, Vitazyme V6 vs. Urea 180, Vitazyme V6 .....+8.6 bu/acre
PurYield 180, Vitazyme in-furrow vs. Urea 180, Vitazyme V6 .....+6.0 bu/acre

Because of the high variability of individual plot data, not a lot of confidence can be placed in these data. Of particular note is that the highest yielding treatment was urea applied at 180 lb/acre of N plus Vitazyme sprayed at 13 oz/acre on the leaves at the V6 stage.

There was a significant boost to rooting with Vitazyme treatments that was noted in sampled plots before senescence, which normally would translate to higher yields at harvest.

Corn *with Vitazyme*

Researcher: Mike Williams
Location: Pocahontas County, Iowa
Farmer: Mike Williams
Variety: unknown
Planting date: spring of 2019
Experimental design: A corn field in eastern Iowa was divided into an untreated control area, and an area treated with four products: Vitazyme, Syntose FA (a sugar), Environoc 401 (a microbial array), and WakeUp Spring (a surfactant). These products were applied in-furrow at planting, to determine their combined effect on the yield and maturity of the corn crop.



The Vitazyme treated corn on the Williams farm produced 10 bu/acre more when combined with WakeUp Spring, Environoc 401, and Syntose FA.

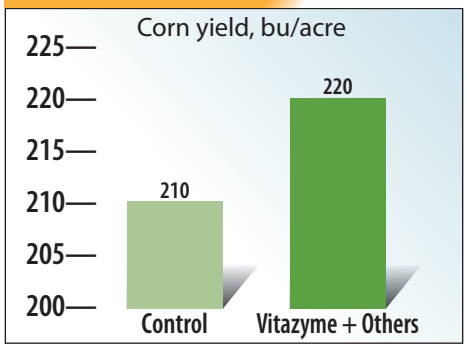
1 ***Control*** **2** ***Vitazyme + Other products***

Fertilization: unknown, the same for both treatments
Syntose FA: a blend of sugars, molasses, and fulvic acid that is recommended for use with starter fertilizers, to enhance soil microorganism activity, made by Conklin Company Inc, Kansas City, Missouri; applied at 1 point/acre (1 lb of sugar)
Environoc 401: an array of beneficial microorganisms that promote rhizosphere function to benefit plant growth, made by Biodyne-USA, Fort Wayne, Indiana; applied at 16 oz/acre in-furrow.
WakeUp Spring: an array of colloidal micelles derived from plant-sourced oils and alcohols, plus chelating agents derived from sugars, designed to enhance the absorption and translocation of plant nutrients, made by Renewable Farming LLC, Cedar Falls, Iowa; applied in-furrow at 3 oz/acre.
Vitazyme application: 13 oz/acre in-furrow at planting
Yield results: At harvest, five 8-row strips each about 0.5 acre, were combined, one strip through the control area and four strips nearby in the treated area. All yields were measured with a combine yield monitor. Grain moisture averaged 16.7%.

Treatment	Yield	Yield change
	bu/acre	bu/acre
Control	210	—
Vitazyme + Others	220[1]	10 (+5%)

[1]Average of strips yielding 215, 221, 221, and 223 bu/acre

Corn Yield



Vitazyme + WakeUP *Spring*

Note the excellent stimulation of germination of corn seedlings on the Williams farm, using Vitazyme and three other products in-furrow at planting.

Increase in corn yield with Vitazyme plus other inputs: 5%

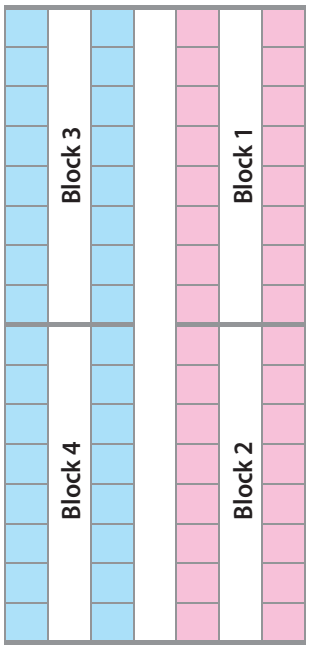
Income results: The price for corn was $3.70/bu. After subtracting product costs, the net return was increased by $30.00/acre
Conclusions: An in-field corn trial in eastern Iowa in 2019, using Vitazyme in-furrow together with a sugar/molasses/fulvic acid product, a microbial array, and a surfactant produced a yield increase of 5%. This increase resulted in a $30.00/acre grain in net income in spite of the very low corn price.

Corn *with Vitazyme application—A Study At South Dakota State University*

Researcher: Graig Reicks and David Clay, PhD.
Research organization: South Dakota State University, Department of Plant Sciences, Brookings, South Dakota
Location: South Dakota State University Experimental Farm, Aurora, South Dakota
Variety: unknown ***Planting date:*** May 2, 2020
Planting rate: 34,750 seeds/acre ***Soil type:*** Brandt silty clay loam
Row spacing: 30 inches ***Planting depth:*** 2 inches
Experimental design: A small-plot corn trial, using four replications with plots that were six rows wide (15 feet) and 20 feet long, was arranged in a randomized complete block design. During harvest a 20-foot x two row section of each plot was hand harvested. Four nitrogen rates were applied to four Vitazyme methods of treatment to determine the effects of these treatments on the yield of corn.

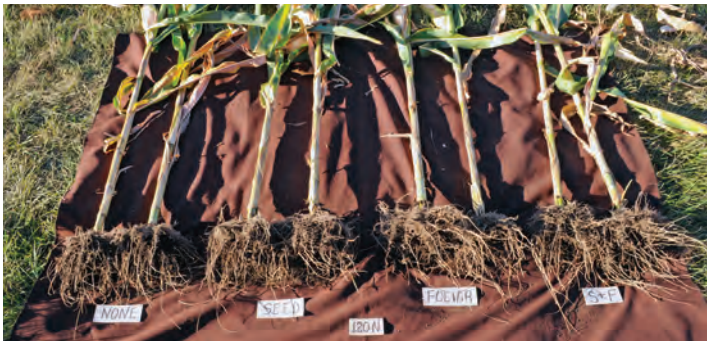
Treatment	Nitrogen rate lb/acre	Vitazyme Treatment	
		Seed	Foliar
1	0	0	0
2	0	X	0
3	0	0	X
4	0	X	X
5	40	0	0
6	40	X	0
7	40	0	X
8	40	X	X
9	80	0	0
10	80	X	0
11	80	0	X
12	80	X	X
13	120	0	0
14	120	X	0
15	120	0	X
16	120	X	0

Fertilization: **Blocks 1 and 2:** appropriate plots received urea coated with N-Fixx urease inhibitor, at 2.11 quarts/ton of urea. **Blocks 3 and 4:** appropriate plots received urea coated with N-Fixx urease inhibitor, at 4.0 quarts/ton of urea.



Note regarding the statistical analysis of this trial: Because there was an error in application of the N-Fixx rates for the plots (half received the high rate and half received the low rate), the arrangement of the replicates was changed, and several plots had to be generated and data values had to be estimated.

Each one of the 16 treatments has been sampled in this South Dakota State University trial, and the plants are laid out for closer inspection.



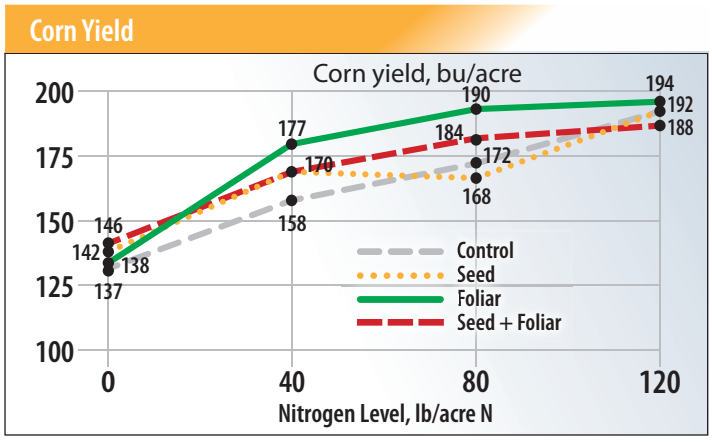
The plants with the various Vitazyme regimes have been laid out to compare the root and plant masses. Note that the Vitazyme treatments give greater and more aggressive root masses than the untreated control roots on the far left.

Vitazyme application: (1) On seeds: the equivalent of 8 oz/acre of Vitazyme was pre-treated on the seeds before planting, using undiluted product. (2) On leaves and soil: 13 oz/acre were applied using a backpack sprayer equipped with 8003 nozzles, at 32 psi; Chemsurf 90 non-ionic surfactant was added at o.25% to maximize droplet adherence to leaves. Application was made at V6 on June 24, 2020.
Harvest date: several days in early November by hand picking of the inner two rows of each plot
Yield results:

Treatment	Vitazyme	Nitrogen	Yield	P-value[1]	Yield change[2]
		lb/acre	bu/acre		bu/acre
1	0	0	137	<0.01	—
2	seed	0	142	<0.01	5 (+4%)
3	foliar	0	138	<0.01	1 (+1%)
4	seed + foliar	0	146	<0.01	9 (+7%)
5	0	40	158	<0.01	—
6	seed	40	170	0.27	12 (+8%)
7	foliar	40	177	0.53	19 (+12%)
8	seed + foliar	40	170	0.18	12 (+8%)
9	0	80	172	0.25	—
10	seed	80	168	0.11	(-) 4 (-2%)
11	foliar	80	190	1.00	18 (+10%)
12	seed + foliar	80	184	0.97	12 (+7%)
13	0	120	192	—	—
14	seed	120	192	1.00	0 (+0%)
15	foliar	120	194	1.00	2 (+1%)
16	seed + foliar	120	188	1.00	(-) 4 (-2%)

[1]Using the two-tailed Dunnett's Test. where the control is 120 lb/acre N with no Vitazyme applied.
[2]Yield changes are computed using the no-Vitazyme treatment as the control for each nitrogen level.

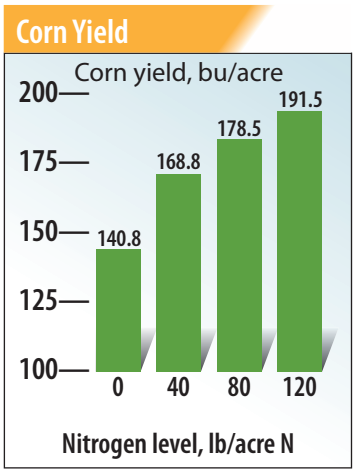
Vitazyme Effects At Each Nitrogen Level



The ears from each of the 16 treatments have been laid out in a grid pattern to reveal how the Vitazyme treatments have improved ear size and fill for all four nitrogen levels.

The ears for the 80 lb/acre nitrogen treatment show how the Vitazyme treatments, in particular the foliar and seed + foliar treatments, have improved ear size and fill, a response to greater root development and plant leaf biomass.

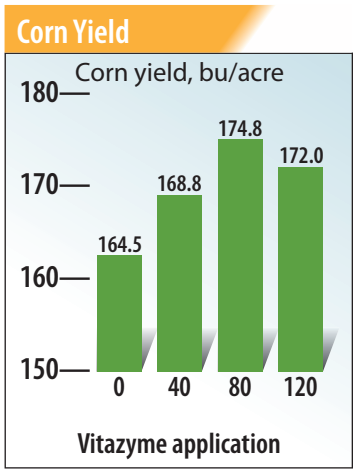
Nitrogen Effects for All Vitazyme Treatments



Increase in corn yield at N levels

40 lb N/acre.... +20%
80 lb N/acre.... +27%
120 lb N/acre.. +36%

Vitazyme Effects for All Nitrogen Levels



Increase in corn yield with Vitazyme applications

Seed..... +2%
Foliar ..... +6%
Seed + Foliar.... +5%

Conclusions: A small-plot corn study at South Dakota State University, using four replications with four equal increments of nitrogen (urea) and variations of Vitazyme application, revealed that the Vitazyme foliar treatment at 13 oz/acre, applied at the V6 stage, significantly boosted yield by 14 bu/acre (8%) above the untreated control. Moreover, all Vitazyme treatments boosted corn yield above the untreated controls by an average of 2, 6, and 5% for the seed, foliar, and seed + foliar treatments respectively. Nitrogen levels boosted yield by 20% to 36% over the no nitrogen treatments. This study was affected by a mistake in applying an N- Fixx coating to the plots at two different rates, but changes in the replication arrangement and estimates for plots made possible a statistical analysis. As stated by Graig Reicks, "Even at the 40 lb N/acre rate, a Vitazyme treatment (either seed or foliar) increased yields to as high as corn grown with 120 lb N/acre." These results show the good efficacy of Vitazyme us to enhance corn yields and improve nitrogen efficiency.

Vitazyme Foliar Pooled Treatment Effect At All Nitrogen Levels

Vitazyme treatment	Nitrogen level	Yield	P-value
	lb/acre	lb/acre	
Foliar	120	195	0.6355
None	120	189	—
Foliar	80	187	0.9937
None	**80**	**173**	**0.0209**
Foliar	40	177	0.1539
None	40	158	<0.0001
Foliar	0	138	<0.0001
None	0	137	<0.0001
Mean, foliar		174.3 (+ 6%)	
Mean, none		164.3	

Using the pooled data, it is apparent that at 80 lb/acre of nitrogen, the Vitazyme foliar treatment produced a significant increase in yield compared to the untreated control, at P = 0.02. The mean of all foliar treatments produced 10.0 bu/acre more (6%) yield than the untreated controls.

Increase in corn yield with the Vitazyme foliar treatment at four nitrogen rates

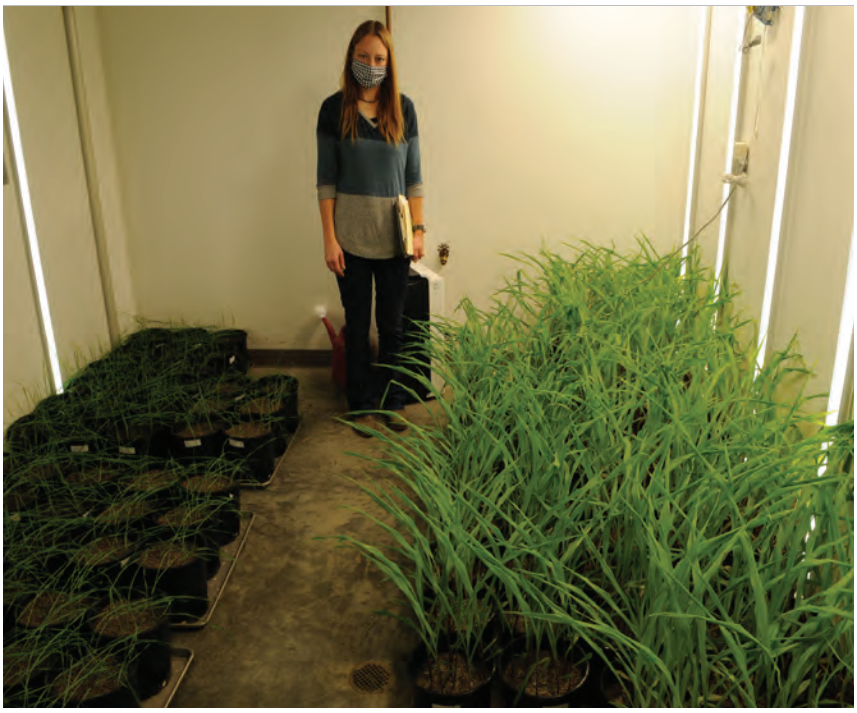
0 N..... 1 bu/acre
40 lb/acre N ..... 19 bu/acre
80 lb/acre N ..... 14 bu/acre
120 lb/acre N ..... 6 bu/acre

Corn *with Vitazyme—A Synergism Study with Flobond SC-100 Polymer*

Researcher: Amanda Ver Helst
Research organization: SGS North America, Inc., Brookings South Dakota
Location: Brookings, South Dakota
Variety: TG249, Roundup Ready 2
Planting date: September 3, 2020
Soil: Sungro Propagation Mix
Planting rate: 10 seeds per pot

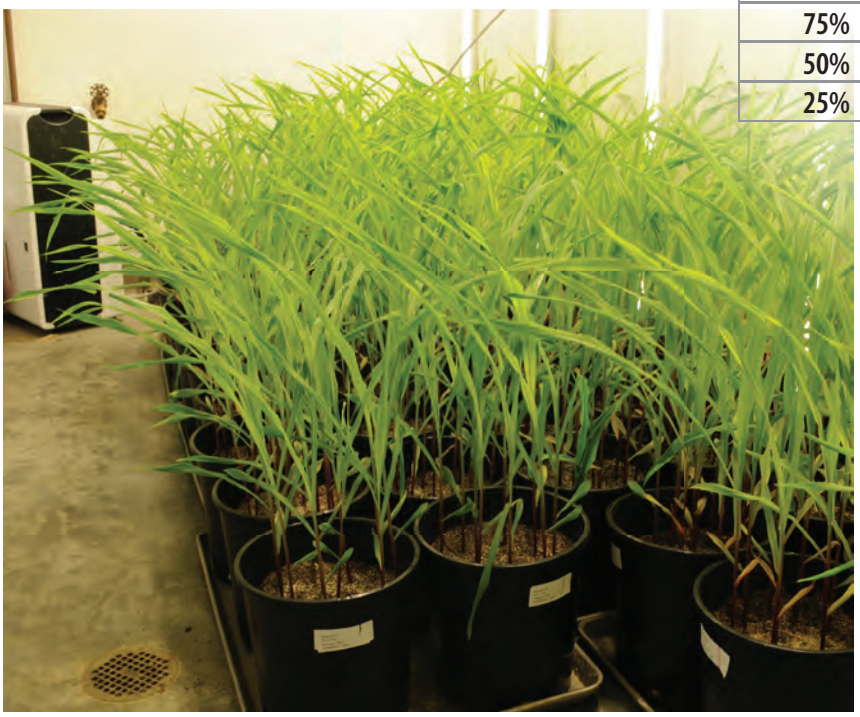
Experimental design: A growth chamber experiment, using six replications, was designed to evaluate the effect of Vitazyme alone, and Vitazyme plus Flobond SC-100 polymer, as a pretreated seed coating on the germination and early growth, leaf and root growth, and shoot and root mass of hard red spring wheat under varying degrees of water stress.

Treatment	Amount of water			
	100%	75%	50%	25%
1. Vitazyme	x	x	x	x
2. Vitazyme + SC-100	x	x	x	x
3. Control	x	x	x	x



The growth chamber used for the SGS early growout study is shown here, with internal temperature and humity control, and delivery of predetermined levels of water to each pot.

Fertilization: potting mix pre-formulation
Vitazyme application: Seeds for Treatment 1 and 2 were treated with a seed treater at 415 ml/100g of seed, which is the equivalent of about 6 oz/acre as applied by the seeds.
SC-100 application: After the seeds were treated with Vitazyme for Treatment 2, the seeds were coated with 1% Flobond SC-100 polymer.



The corn planted in these pots had pre-treated seeds, first with Vitazyme and then with Flobond SC-100 for one of the treatments.

Watering regions: The following watering schedule was followed.

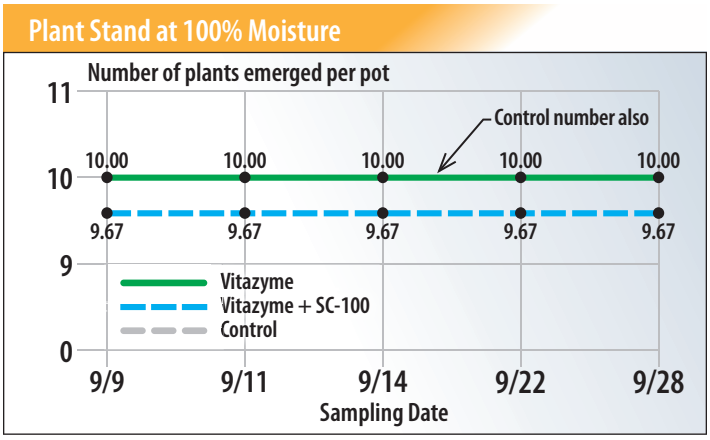
Watering rate	Soil amount	Initial water added	Weekly water added
	g/pot	g/pot	ml/pot
100%	2032	3736	467
75%	2032	2802	350
50%	2032	1868	234
25%	2032	934	117

Harvest date: October 5, 2020
Plant stand results: Counts for plants were made on September 14, 15, 16, 18, 22, and 28, and October 24.

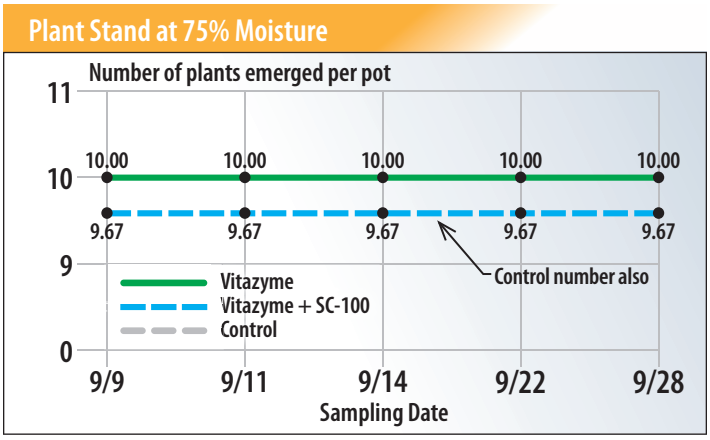
Plant stand results:

PLANT STAND OVER TIME

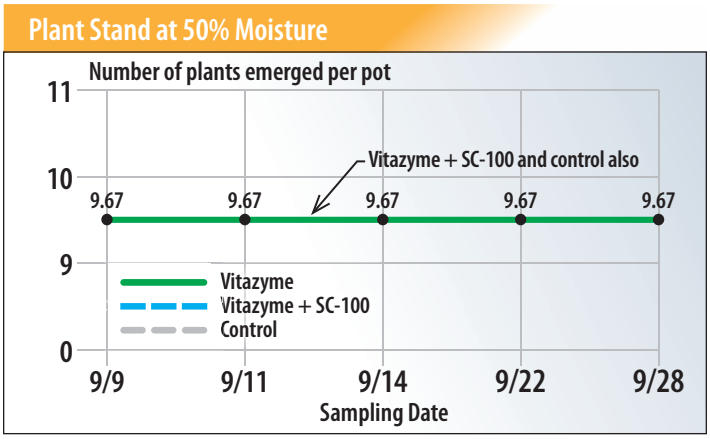
Plant Stand at 100% Moisture



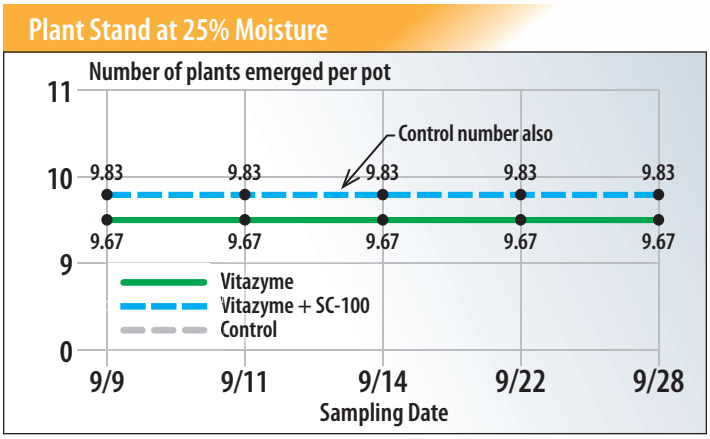
Plant Stand at 75% Moisture:



Plant Stand at 50% Moisture:



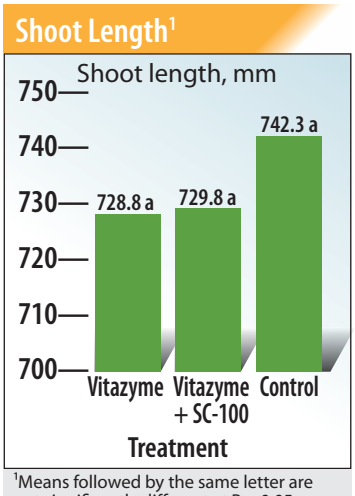
Plant Stand at 25% Moisture:



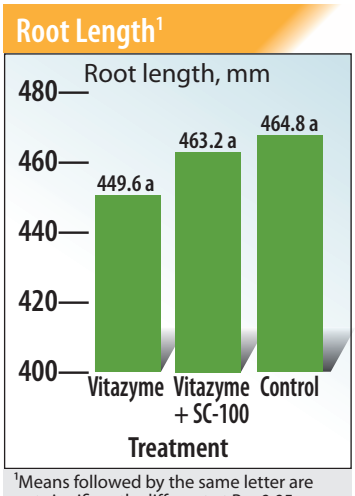
Stem and root length results:

SHOOT AND ROOT LENGTH

Results for Three Treatments Over All Moisture Levels

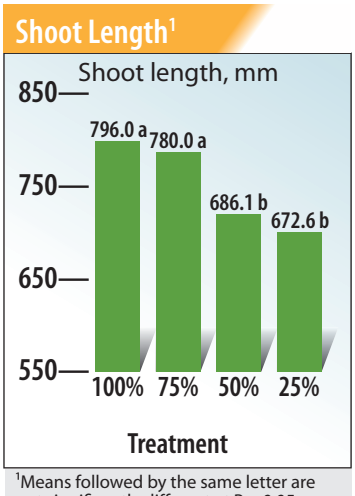


[1]Means followed by the same letter are not significantly different at P = 0.05.



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

Results for Moisture Levels Over All Three Treatments



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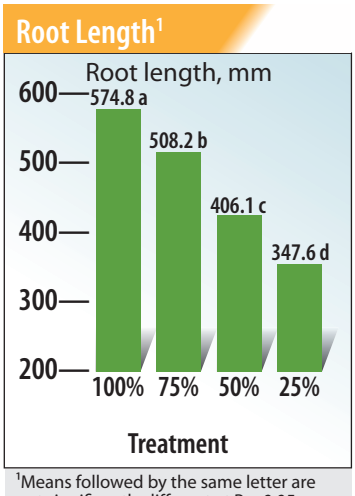
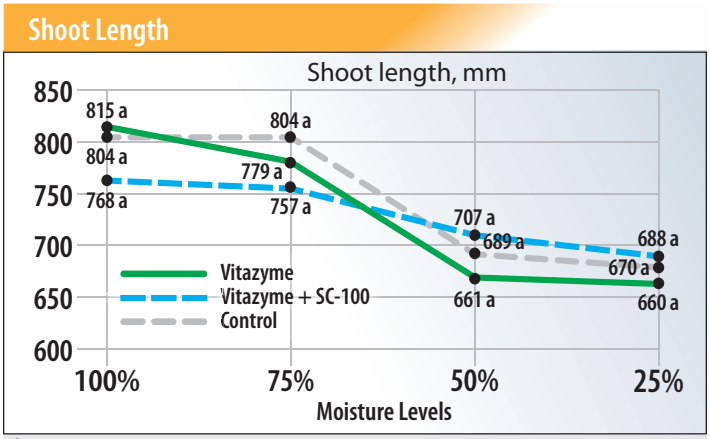


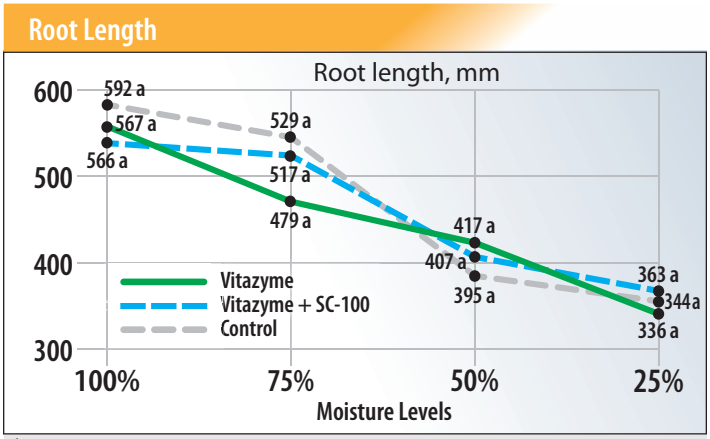
[1]Means followed by the same letter are not significantly different at P = 0.05.

Shoot Length for Three Treatments at All Four Moisture Levels[1]



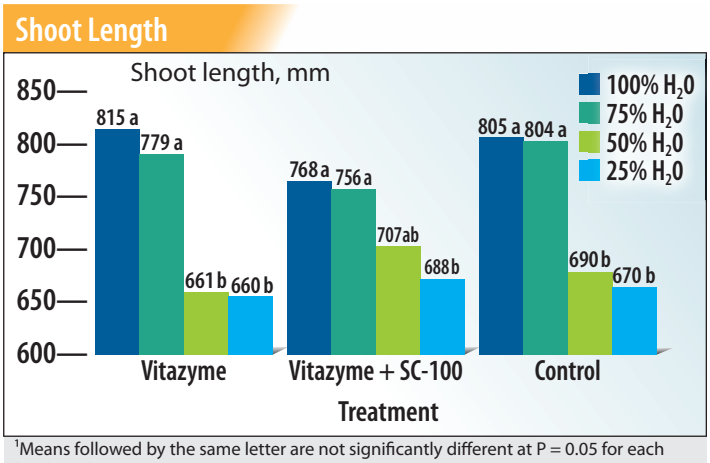
[1]Means followed by the same letter are not significantly different at P = 0.05 at each moisture level.

Root Length for Three Treatments at All Four Moisture Levels[1]



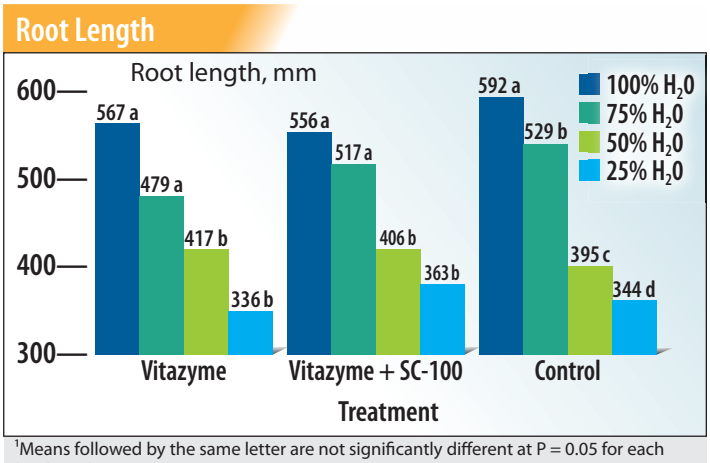
[1]Means followed by the same letter are not significantly different at P = 0.05 at each moisture level.

Shoot Length for All Four Moisture Levels for Three Treatments[1]



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

Root Length for All Four Moisture Levels for Three Treatments[1]

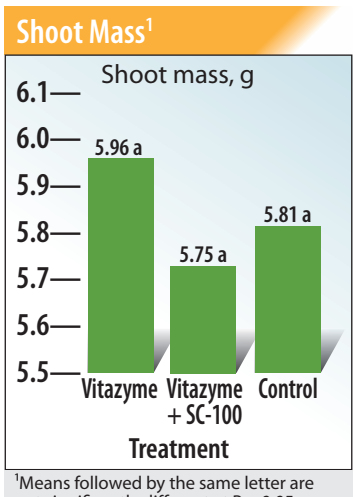


[1]Means followed by the same letter are not significantly different at P = 0.05 for each treatment.

Shoot and root mass results:

SHOOT AND ROOT MASS

Results for Three Treatments Over All Moisture Levels



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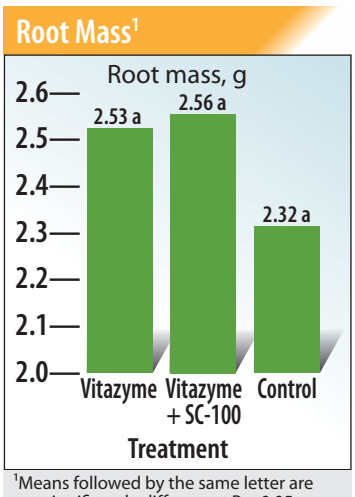
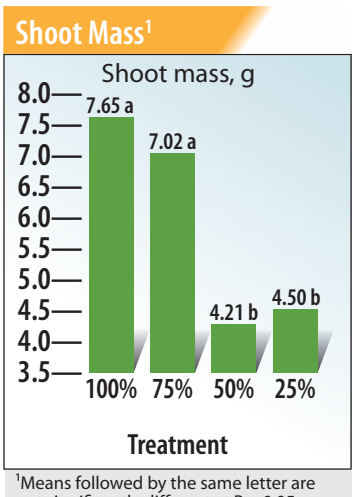


[1]Means followed by the same letter are not significantly different at P = 0.05.

Results for Moisture Levels Over All Three Treatments



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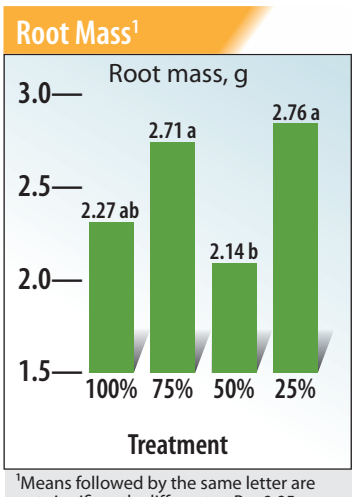
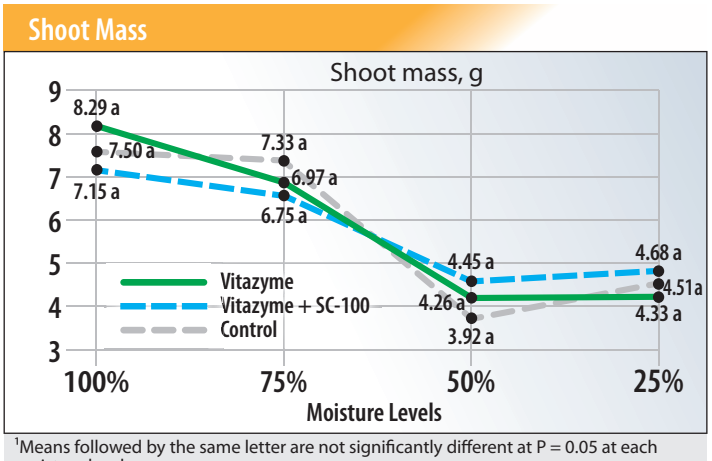


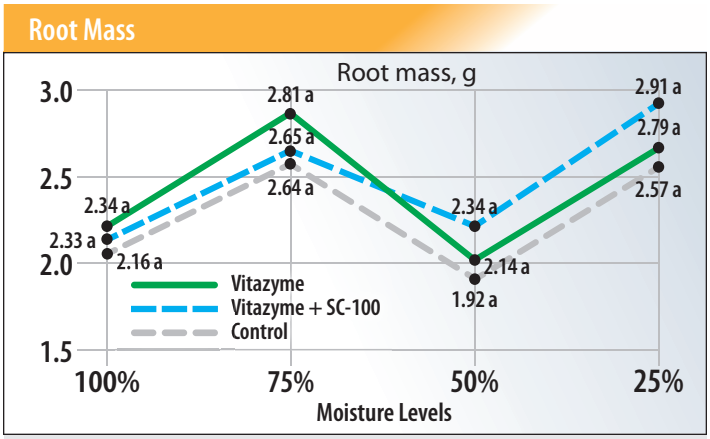
[1]Means followed by the same letter are not significantly different at P = 0.05.

Shoot Mass for Three Treatments at All Four Moisture Levels[1]



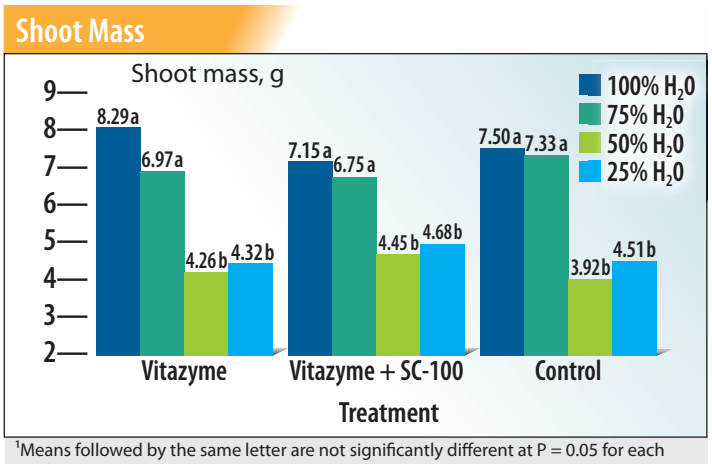
[1]Means followed by the same letter are not significantly different at P = 0.05 at each moisture level.

Root Mass for Three Treatments at All Four Moisture Levels[1]



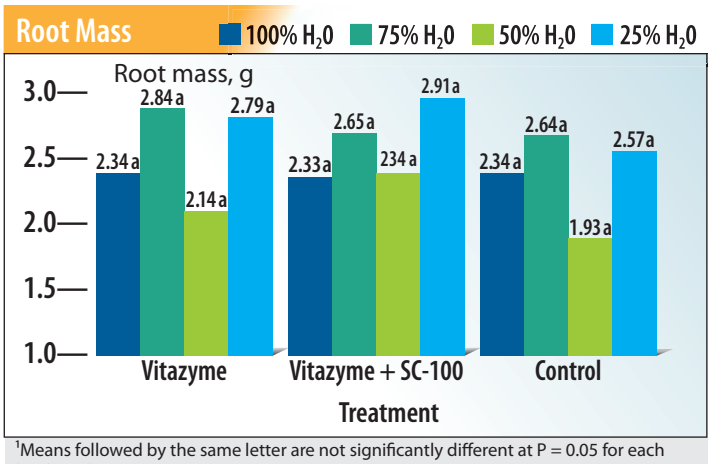
[1]Means followed by the same letter are not significantly different at P = 0.05 at each moisture level.

Shoot Mass for All Four Moisture Levels for Three Treatments[1]



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

Root Mass for All Four Moisture Levels for Three Treatments[1]



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

Conclusions:

Seedling emergence: At all four moisture levels the seedling emergence was maximal for all three treatments, the emergence differing only most likely because of a few seeds not being viable. To detect differences in emergence the observations should have begun sooner than six days after planting.

Shoots and root length: Both shoot and root length responded to moisture levels significantly, the 100% level giving the greatest lengths which decreased as water was reduced. Vitazyme and Vitazyme + SC-100 did not increase root or shoot length across all water levels. However, Vitazyme produced the tallest plants of the entire experiment, at 100% moisture. Root length did not show a consistent pattern for the three treatments at the four moisture levels.

Shoot and root mass. Over all moisture levels, Vitazyme produced the greatest shoot mass, but both Vitazyme and Vitazyme + SC-100 produced higher root masses than the untreated control. Shoot mass was highest for the Vitazyme + SC-100 treatment at the 50% and 25% moisture levels, and this combination also improved root mass above the control at 50% and 25% moisture. The increases were not significant at P=0.05. Vitazyme alone caused the greatest shoot mass at 100% moisture, while the root mass was boosted the most by Vitazyme + SC-100 at 25% moisture. Results were mixed for these responses, and not significant.

It is suggested that the potting mix and initial watering, even at the low moisture levels of 25% and 50%, may have reduced potential responses of the corn for both Vitazyme and Vitazyme + SC-100 due to possible excessive moisture in the mix at the beginning of the study, thus reducing the ability of the SC-100 to fully express its hygroscopic properties.

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.

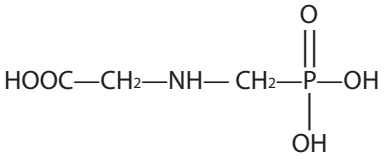
EXPERIMENTAL DESIGN

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

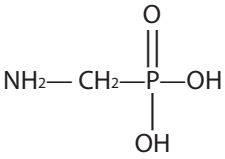
Delaware County, IA-2014-2019
Soils: Bassett-Olin Variant-Bertram-Lilah association- sandy loams
Crops: Maize, soybean
Minimum tillage: fertilizer based on soil test
Fields continuously cropped to GE varieties with annual applications of glyphosate-based herbicides for 19 years prior to transition to 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

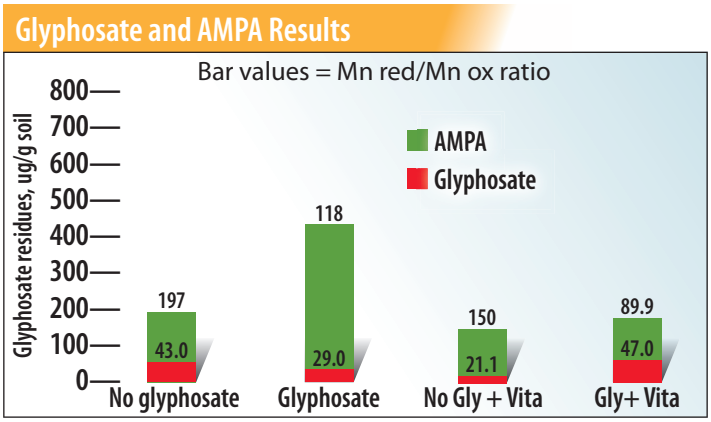


AMPA

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

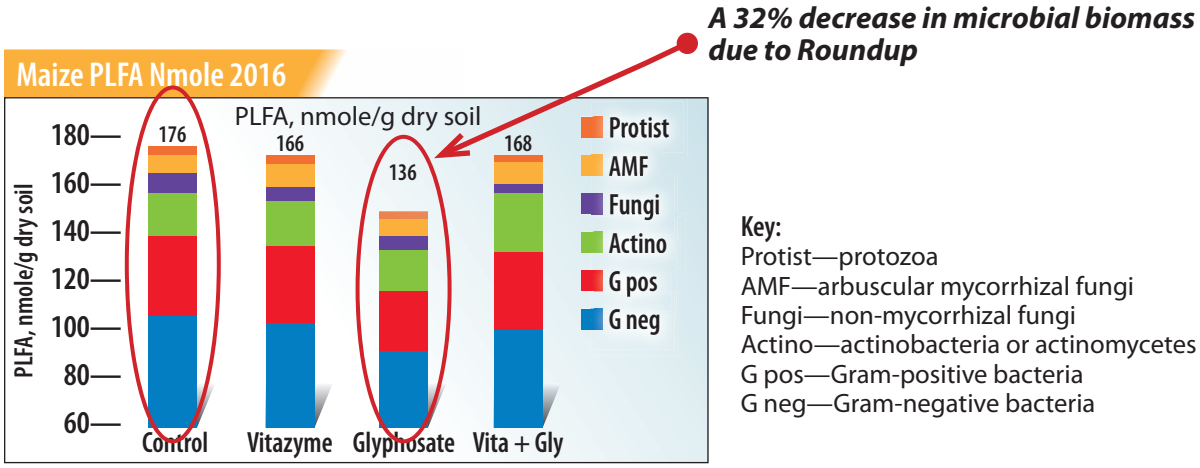


The mean soil glyphosate and AMPA concentrations for each treatment were associated with very high standard deviations, indicating considerable variable distribution within the experimental area regardless of application dosages or times of application.

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)

Corn *with Vitazyme application*

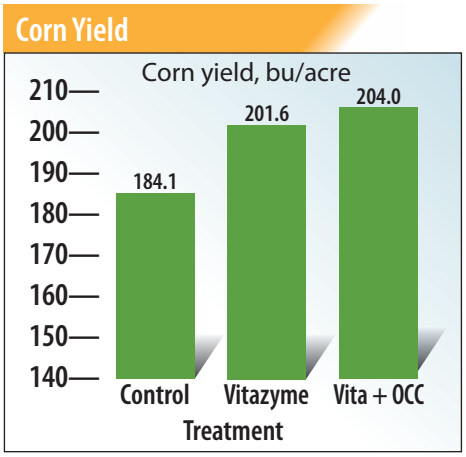
Researcher: K. Bruce Kirksey, PhD. ***Research organization:*** Agricenter International, Memphis, Tennessee
Location: Memphis, Tennessee ***Variety:*** P7111VT2P (yellow dent corn) ***Planting date:*** May 4, 2020
Planting depth: 1.5 inches ***Plant populations:*** 32, 000 seeds/acre ***Row width:*** 30 inches
Soil: Falaya and Waverly soil types; organic matter = 1.8%, pH = 6.5, cation exchange capacity = 7.8 meq/100 grams of soil
Soil moisture at planting: excellent
Experimental design: A replicated small-plot design (four replications, plots 10 x 30 feet, or four rows per plot; 300 ft^2/plot) was used to evaluate the effect of Vitazyme, alone and in combination with OCC, a plant-based emulsion, to improve the yield of corn grain. Plots were arranged according to a randomized complete block design (RCBD).

❶ *Control* ❷ *Vitazyme* ❸ *Vitazyme =+ OCC*

Fertilization: unknown, but somewhat less than optimum levels for maximum yields
Vitazyme application: (1) 13 oz/acre in-furrow at planting on May 4; (2) 13 oz/acre sprayed on the plants and soil at V6 on June 15
OCC application: 0.0125% v/v of the sprayer capacity sprayed at V6 to the plants and soil on June 15. OCC is a plant-based concentrated 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 applications.
Growing season conditions: good
Harvest date: October 16, 2020. An Almaco plot combine was used to harvest a 5 x 30 foot section of each plot, or two of the four rows.
Grain moisture results: Grain moisture varied from 15.58 to 15.65%, and there were no significant differences among the three treatments.
Grain weight results: The pounds/bushel weights varied from 55.61 to 56.18, and were not significantly different among the three treatments.
Grain yield results:

Treatment	Yield[1]	Yield change
	bu/acre	bu/acre
1. Control	184.1 b	—
2. Vitazyme	201.6 a	17.5 (+10%)
3. Vitazyme + OCC	204.0 a	19.9 (+11%)
LSD (P = 0.05)	8.2	
CV	2.41	
Replicate F	0.616	
Treatment F	0.002	

[1]Means followed by the same letter are not significantly different at P = 0.05 according to Levene's test.



Increase in corn yield

Vitazyme only..... 10%
Vitazyme + OCC..... 11%

Conclusions: A randomized complete block design study of corn in Memphis, Tennessee, in 2020, comparing Vitazyme alone at 13 oz/acre applied in-furrow and at V6, with an untreated control and the two Vitazyme treatments plus OCC emulsion, produced no differences in grain moisture or grain density at harvest. However, the yield was markedly increased by the two Vitazyme treatments alone (17.5 bu/acre, or 10%), and the two applications plus OCC (19.9 bu/acre, or 11%). These increases were significantly greater than the untreated control at P = 0.002, and reveal the great value of Vitazyme to increase corn yield under somewhat suboptimal fertility conditions. It also appears that OCC emulsion may benefit the activity of Vitazyme.

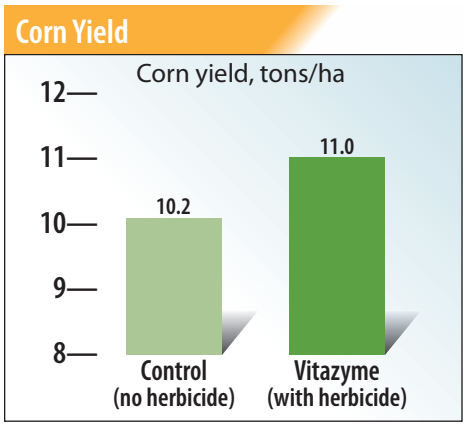
Corn *with Vitazyme—Recovery from Herbicide Damage*

Researcher: V. V. Plotnikov
Research organization: Plant Designs International, Rochester, New York, and Agro Expert International, Kaharlyk, Ukraine
Location: LLC "Odemo", Zhmerynka District, Vinnytsya Region, Ryzhivka Village, Ukraine; northern Ukraine (440 to 590 mm of rain per year)
Variety: P9241, FAO 360 ***Planting date:*** April 18, 2020 ***Planting rate:*** 70,000 seeds/ha ***Previous crop:*** winter wheat
Tillage: disking to 6-8 cm, plowing to 22-24 cm, cultivating to 5-6 cm ***Soil type:*** gray podzolic (1.8% organic matter)
Experimental design: A corn field area of 24 ha was mistakenly treated with an anti-slag herbicide at V5, causing severe damage to the plants within two days. To alleviate the damage, Vitazyme was applied as soon as possible (the day after herbicide application) to see if the plant damage could be reversed and corn yields maintained.

1 ***Control (no herbicide)*** **2** ***Vitazyme (with herbicide damage)***

Fertilization: 205 kg/ha of nitrogen and 24 kg/ha of sulfur applied before plowing, and 8-24-24 kg of N-P_2O_5-K_2O applied in-furrow at planting
Vitazyme application: 1 liter/ha sprayed on the leaves and soil at V5 on May 20, the day after herbicide application
Herbicide application: Clomazone 480 applied at 100 g/ha at V5 on May 19, causing severe plant damage within hours
Plant observation: The damage caused the inappropriate herbicide application was quickly reversed, and the plants made a complete recovery over the following weeks.
Yield results: Yield measurements were made on the 24-acre herbicide and Vitazyme treated area, as well as an adjoining area that received neither material.

Treatment	Yield	Yield change
	tons/ha	tons/ha
1. Control	10.2	—
2. Vitazyme	11.0	0.8 (+8%)



Increase in corn yield with Vitazyme after herbicide application and damage, versus plants receiving no Vitazyme and herbicide: 8%

Conclusions: A study on herbicide damage of corn in Ukraine, where an untreated control area received neither Vitazyme nor Chomazone 480 herbicide compared to an adjoining area receiving the herbicide, followed by 1 liter/ha of Vitazyme a day later at V5, revealed that the severe damage caused by the herbicide was reversed over the course of several weeks, to produce a crop yield that exceeded the untreated control area by 8% (0.8 ton/ha). This remarkable recovery of the crop following severe herbicide damage reveals the ability of Vitazyme to reactivate the metabolic systems within plants after being severely disrupted by a herbicide.

Corn *with Vitazyme application*

Researchers: Leonel Yaeggy and Luis Pedro Barneond
Research company: Duwest Guatemala
Grower: Agronomist Manolo Tuna
Location: Valle Oro (Golden Valley) Farm, Taxisco, Santa Rosa, Guatemala
Variety: Pioneer Biogene
Planting date: December 10, 2018
Experimental design: A seven-hectare corn field was divided into treated and untreated areas to evaluate the effect of Vitazyme on the yield of leaves and ears.

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

Fertilization: All fertilizers were water soluble, applied through the irrigation system.

Days after planting	Fertilizer
10 (December 20)	Nutrex (20-20-20 % N-P_2O_5-K_2O) at 17.9 kg/ha
20 (December 30)	Nitro-Xtend (46-0-0 % N-P_2O_5-K_2O) at 77.8 kg/ha
30 (January 9)	Hidrosol N-Calcio (calcium nitrate: 25.5% Ca + 14% nitric N + 1.5% NH_4-N) at 17.9 kg/ha
40 (January 19)	Hidrosol K-NO (K-nitrate; 46-0-46% N- P_2O_5-K_2O at 17.9 kg/ha + 77.8 kg/ha later

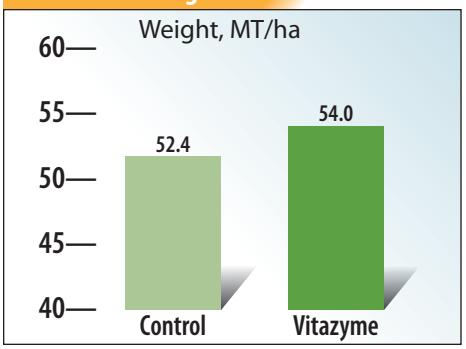
Vitazyme application: (1) Seed treatment with 125 ml on 18 kg of seeds; (2) 1.4 liters/ha foliar spray 24 days after planting on January 3, 2019
Harvest dates: March 4 to 15, 2019
Yield results: Values given are the average of the plots harvested.

Treatment	Green leaves	Green leaf change	Corn ears	Ear change
	MT/ha	MT/ha	MT/ha	MT/ha
1. Control	52.4	—	10.22	—
2. Vitazyme	54.0	1.6 (+3%)	11.00	0.78 (+8%)

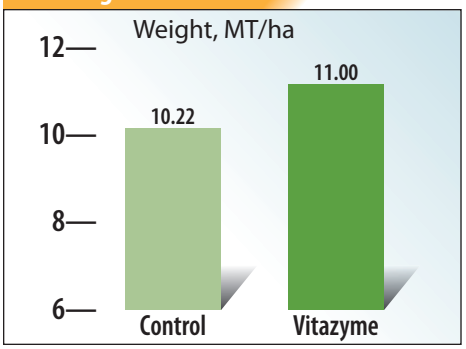
Increase in green leaf yield with Vitazyme: 3%

Increase in ear yield with Vitazyme: 8%

Green Leaf Weight



Ear Weight



Conclusions: This Guatemala corn trial, using two Vitazyme applications (seed and foliar), showed that small but significant increases in leaf and ear yields were obtained. Largest increases were in ear weight so that the ear/forage ratio was increased from 19.5% (Control) to 20.4% (Vitazyme). This program thus is shown to provide valuable increases in corn production in Guatemala.

Corn *with Vitazyme application—A Study on Synergism with Bio Seed & Environoc 401*

Researchers: Steve Schmidt and Bert Schou, Ph.D.
Research organization: ACRES Research, Cedar Falls, Iowa ***Location of trial:*** Denver, Iowa
Variety: P0574AM Roundup Ready ***Planting date:*** May 13, 2019 ***Planting depth:*** 2 inches ***Row spacing:*** 30 inches
Soil type: Floyd loam and Clyde silty clay loam; pH=5.7, organic matter = 2.2%, cation exchange capacity = 12.7 meq/100g of soil; N = 64 lb/acre, S = 13 ppm, $P_2 0_5$ = 139 lb/acre, Ca = 2,672 lb/ha, Mg = 450 lb/ha, K = 175 lb/acre, Na = 10 lb/acre, B = 1.6 ppm, Fe = 320 ppm, Mn = 26 ppm, Cu = 1.4 ppm, Zn = 5.8 ppm, Percent base saturations: Ca = 53%, Mg = 15%, K = 1.8%, Na = 0.2%, H = 25%.
Planting rate: 35,600 seeds/acre ***Tillage:*** strip-tillage
Experimental design: A small-plot corn trial, using plots that were 15 x 30 feet (five replications), was established in a randomized complete block design, using seven treatments with different methods and rates of Vitazyme application, plus the addition of two microbial products for two treatments, to evaluate their effects on corn grain yield.

Treatment
1. Control
2. Vitazyme in-furrow at 13 oz/acre (1 liter/ha)
3. Vitazyme in-furrow at 26 oz/acre (2 liters/ha)
4. Vitazyme in-furrow at 13 oz/acre (1 liter/ha) + Bio Seed in-furrow at 50g/acre
5. Vitazyme in-furrow at 13 oz/acre (1 liter/ha) + Environoc 401 in-furrow at 16 oz/acre (1.3) liters/ha)
6. Vitazyme sprayed on the leaves and soil at V8, at 13 oz/acre (1 liter/ha)
7. Vitazyme pre-treated on the seeds at 5 oz/acre (0.4 liter/ha)

In this trial there is a noted progression in ear development from seed, to foliar, to seed plus foliar treatment.

The corn treated with Vitazyme on both the seeds and the leaves displays much greater vigor in the root systems than the control.


This replicated trial with ACRES Research proved the value of Vitazyme as a yield promoter, during a wet year.

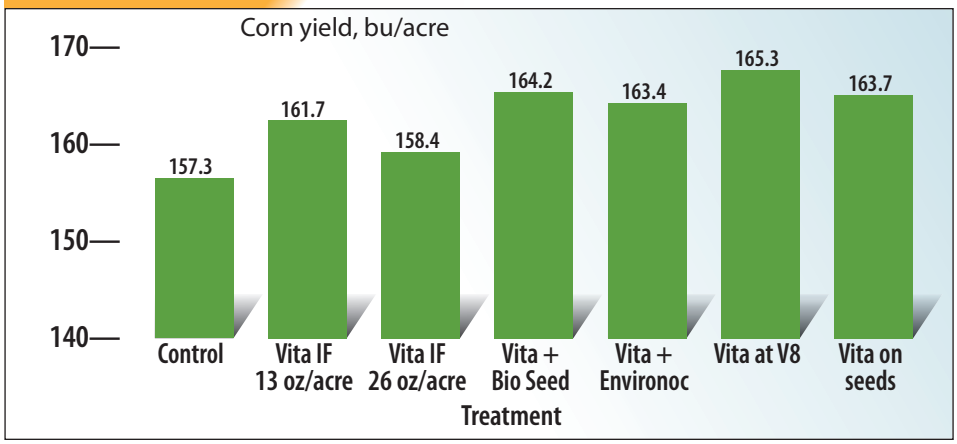
Fertilization: At planting, 11 gal/acre of 28% UAN; side-dressed on June 11, 11.5 gal/acre of 32% UAN. Total application of N was about 70 lb/acre for all areas.
Vitazyme application: All in-furrow treatments occurred on May 13, and foliar/soil treatments at V8 were made on July 2.
Bio Seed application: Bio Seed is an array of beneficial bacteria and fungi that populate the root zone. It was applied in-furrow along with Vitazyme for Treatment 4.
Environoc 401 application: Environoc 401 is a selection of beneficial microbes that populate the root zone. It was applied in-furrow along with Vitazyme for Treatment 5.
Herbicide treatments: Pre-emergent on May 18: Corvus (5.6 oz/acre), Roundup (1 quart/acre), and Atrazine (1 lb/acre). Post-emergent on June 17: Callisto (3 oz/acre), Atrazine (0.5 lb/acre), and Spray-Tec Fulltec (1.6 oz/acre).

Harvest date: November 4, 2019, using an MF 8 plot combine, harvesting the inner two rows of each plot
Yield results: There were no significant differences among all treatments for plant population and grain moisture content.

Treatment	Grain yield[1]	Yield change
	bu/acre	bu/acre
1. Control	157.3	—
2. Vitazyme in-furrow, 13 oz/acre	161.7	4.4 (+3%)
3. Vitazyme in-furrow, 26 oz/acre	158.4	1.1 (+1%)
4. Vita + Bio Seed in-furrow	164.2	6.9 (+4%)
5. Vita + Environoc 401 in-furrow	163.4	6.1 (+4%)
6. Vitazyme at V8, at 13oz/acre	165.3	8.0 (+5%)
7. Vitazyme on seeds, 5 oz/acre	163.7	6.4 (+4%)

[1]Adjusted to 15.5% moisture. LSD = 10.1 bu/acre.

Corn Yield



Weather for the growing season: wetter than normal in the early and latter part of the growing season
Conclusions: A small-plot replicated corn trial in eastern Iowa in 2019 revealed that small but consistent increases in yield were realized for all six Vitazyme treatments. The largest increase was 8 bu/acre (5%) with the 13 oz/acre (1 liter/ha) foliar spray at V8. All other responses were 3 to 4%, including the Bio Seed and Environoc 401 treatments, except for Vitazyme in-furrow at 26 oz/acre (2 liters/ha). This cooler and wetter year produced a slightly greater response from a foliar spray than for seed and in-furrow applications.

Corn *with Vitazyme application*

Researchers: Luciano Frias (Quimica Lucava), Guillermo Cisneros (Magussa), and Dr. Juan Carlos Diaz (Ag Biotech)
Growers: Gustavo Figueroa Ramirez and Gustavo Figueroa Reulas
Location: El Fresno Farm, Cofradia de Lepe, Jalisco, Mexico
Variety: Asgrow ***Planting date:*** June 28, 2018
Experimental design: A 4-hectare portion of a corn field was treated with Vitazyme to evaluate the effect of the product on corn growth and yield in a field setting.

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

Fertilization: unknown
Vitazyme application: (1) Seed treatment on June 28 of 0.25 liter of Vitazyme in 0.25 liter of water (50% solution) to coat seeds for 1 hectare;
(2) 1 liter/ha sprayed by backpack sprayer at the 6-leaf stage;
(3) 1 liter/ha sprayed by backpack sprayer at the 9-leaf stage.
Six days after planting (July 4): Vitazyme treated seeds had much better root development, 6 roots vs. 3.5 roots.
Thirteen days after planting (July 1): Again Vitazyme showed much better root and leaf development.
Twenty-eight days after planting (July 26): Treated plants were larger and darker green, having more chlorophyll.
Sixty-two days after planting (August 29): Vitazyme treated plants were observed to have greater stalk diameters and taller plants. Part of the control area was drought-affected, but no such stress was noted in the treated area.
111 days after planting (October 17): Vitazyme treated plants had.
- Taller plants
- Greater leaf area
- Better root development
- Improved ear fill

Yield and income results: The plots were harvested on January 10,2019.

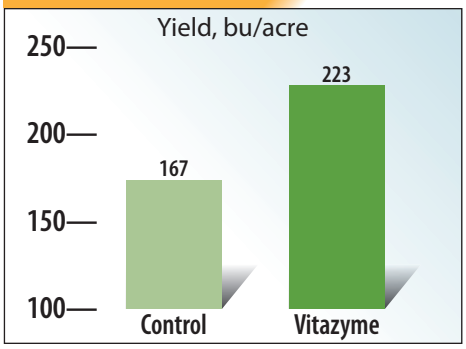
Parameter	Control	Vitazyme	
Plant fresh weight, grams	1,020	2,720	(+167%)
Ear fresh weight, with husk, grams	340	530	(+56%)
Ear fresh weight no husks, grams	250	350	(+40%)
Shelled corn yield, tonnes/ha	10.5	14.0	(+33%)
Shelled corn yield, bu/acre	167	223	(+33%)
Total income, U.S. $/acre	839	1,118	(+33%)
Cost of Vitazyme, U.S. $/acre	—	25.41	
Net, U.S. $/acre	839	1,093	(+30%)
Cost: Benefit Ratio		10:1	

The Vitazyme treated corn (above) displays excellent ear development, with filling to the tip and large kernels,giving a 35% greater yield than the control.

Growth was enhanced greatly in this Mexican corn trial.

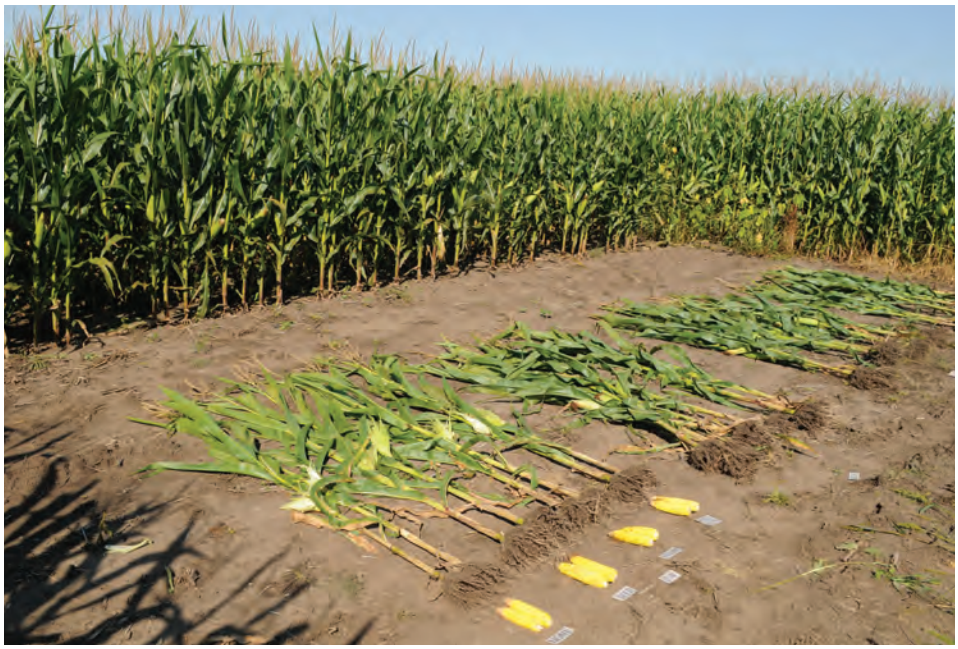
A seed treatment (right) on corn in Mexico caused considerably better rooting, right from the beginning of the growth cycle, as is evidenced only days after planting. The yield increase was 33%, and the net return was 30% higher with Vitazyme.

Corn Yield



Conclusion: This Mexican corn trial revealed that Vitazmye, applied to the seeds, and then 1.0 liter/ha to the leaves at both the 6 and 9-leaf stages, produced an excellent 33% yield increase. Signs of this improvement were evident throughout the growing season, since root development, plant height, and leaf mass were all improved with these three applications. These results show the great value of the Vitazyme program for corn production in Mexico, as evidenced by a 33% yield increase and a cost: benefit of 10:1.

Corn *with Vitazyme application*



The experimental corn plots at South Dakota State University reveal good growth, but with excessive rains the fertilizer nitrogen was leached or denitrified to a large degree, giving mixed results for the lower application rates.

Sample corn ears from all 16 treatments reveal a progressive improvement in ear development moving towards the lower right corner, which has the seed plus foliar Vitazyme treatment and a 43% yield increase.

Researcher: David Clay Ph. D., and Graig Reicks
Research institution: Department of Plant Sciences, South Dakota State University, Brookings, South Dakota
Location: South Dakota State University, Field Research Facility, Aurora, South Dakota
Variety: ***Planting date:*** May 17, 2019
Planting rate: 33,500 seeds/acre ***Planting depth:*** 2 inches
Row spacing: 30 inches ***Soil type:*** Brandt silty clay loam
Experimental design: A small plot corn study, with plots six rows wide (15 feet) and 20 feet long using four replications, was arranged in a randomized complete block design. At harvest a 20-foot section of each plot, using the two middle rows, was harvested by hand. Four nitrogen rates and three Vitazyme application variations were used to determine the effects of nitrogen and Vitazyme regimes on the yield of corn grain. Nitrogen and water use efficiency will be evaluated during the coming months once ^{15}N and ^{13}C analyses are completed.

	Nitrogen rate	Vitazyme treatment	
	lb/acre	Seeds	Foliar
1.	120	x	x
2.	120	o	x
3.	120	x	o
4.	120	o	o
5.	80	x	x
6.	80	o	x
7.	80	x	o
8.	80	o	o
9.	40	x	x
10.	40	o	x
11.	40	x	o
12.	40	o	o
13.	0	x	x
14.	0	o	x
15.	0	x	o
16.	0	o	o

Note the excellent responses to all Vitazyme applications at the 120 lb/acre nitrogen rate, with yield increases of 22 to 43%. The combined seed plus foliar application did the best.

Fertilization: Nitrogen fertilizer was applied by hand to the soil surface as urea (46% N) to appropriate plots on June 19, 2019. The corn was at the V3 growth stage. The urea was coated with Factor urease inhibitor, at 3.25 quarts/ton of urea.
Vitazyme application: (1) ***Seed treatment:*** 8 oz/acre of Vitazyme equivalent applied to the seeds of appropriate plots just before planting. (2) ***Foliar treatment:*** 13 oz/acre sprayed on appropriate plots on July 2, with 22.4 gal/ha using TTI ll003 nozzles at 30 PSI. Interlock drift retardant was added at 0.75%. The corn was at VG growth stage.
Growing season weather: The year was very cold and wet in the spring, with record rainfall for the season. Nutrient leaching and denitrification were active.

Yield results: An Analysis of Variance was performed on the data from all 64 plots

Vitazyme Effects at Nitrogen Levels			
N rate	Vitazyme treatment	Yield[1]	Yield change[2]
lb/acre	lb/acre	bu/acre	bu/acre
120	Seed + Foliar	203 a	+ 43
	Foliar	182 b	+ 22
	Seed	183 b	+ 23
	None	160 c	—
	Mean	185	
80	Seed + Foliar	163 a	-11
	Foliar	165 a	-9
	Seed	164 a	-10
	None	174 a	—
	Mean	167	
40	Seed + Foliar	165 a	-2
	Foliar	149 a	-18
	Seed	157 a	-10
	None	167 a	—
	Mean	160	
0	Seed + Foliar	124 b	-24
	Foliar	142 ab	-6
	Seed	158 a	+ 10
	None	148 a	—
	Mean	143	

[1]Means followed by the same letter are not significantly different at P=0.10.
[2]Comparisons are made within the same N level.

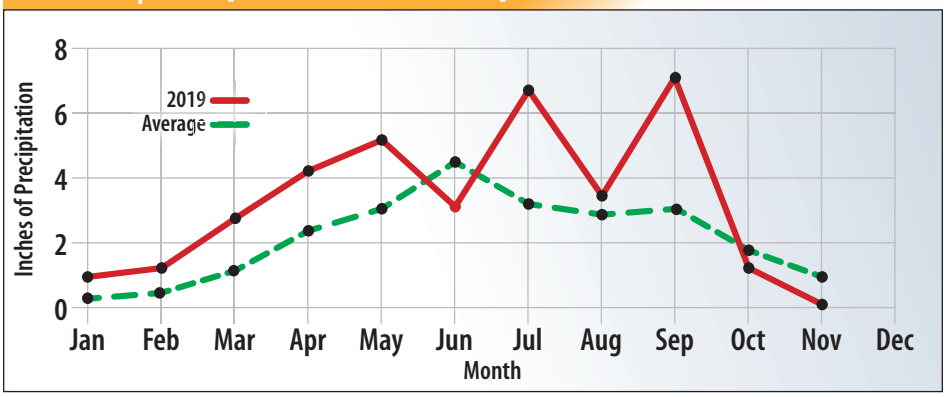
Nitrogen Effects at Vitazyme Levels			
Vitazyme treatment	N rate	Yield[1]	Yield change[2]
lb/acre	lb/acre	bu/acre	bu/acre
None	120	180 ab	+32
	80	174 a	+26
	40	167 ab	+19
	0	148 b	—
	Mean	167	
Seed	120	183 a	+25
	80	164 a	+6
	40	157 a	-1
	0	158 a	—
	Mean	166	
Foliar	120	182 a	+40
	80	165 b	+23
	40	149 bc	+7
	0	142 c	—
	Mean	160	
Seed & Foliar	120	203 a	+79
	80	163 b	+39
	40	165 b	+41
	0	124 b	—
	Mean	164	

[1]Means followed by the same letter are not significantly different at P=0.10.
[2]Comparisons are made within the same Vitazyme application regime.

Conclusions: The results of this Vitazyme study on corn at South Dakota State University were quite different than with previous years' studies, when the yields were promoted by Vitazyme applications at all nitrogen levels. It is apparent that severe leaching and/or denitrification of nitrogen occurred during this extremely wet year, in fact the wettest on record. The rainfall amounts are given in the accompanying table.

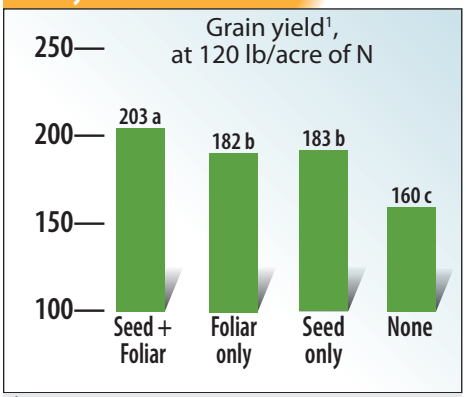
Note that the growing season rainfall was 30.43 inches, far above the average rainfall for that period by 61%. This excessive rainfall surely caused significant nitrate leaching and denitrification, which is strongly indicated by the Vitazyme Effects table: the average yields for 40 and 80 lb/acre N were 160 and 167 bu/acre, respectively, not a great deal more than the 143 bu/acre average for the 0 N rate. There was apparently not enough N for Vitazyme to work with at these two N rates after excessive leaching and denitrification had occurred. On the other hand, at the highest N rate of 120 lb/acre there was enough N remaining after losses to allow Vitazyme to improve N efficiency, as has been observed with ^{15}N studies at South Dakota State University during previous studies. The excellent responses at this N rate are shown in the graph.

2019 Precipitation [National Weather Service]



Total precipitation for 2019 (minus December): 36.96 in.
Average precipitation (minus December): 23.77 in.
Total growing season precipitation (April to September): 30.43 in.
Average growing season precipitation (April to September): 18.90 in.
Excess growing season precipitation above average: 11.53 in. (+61%)

Vitazyme Effects on Corn



[1]Means followed by the same letter are not significantly different at P=0.10.

Vitazyme Corn Grain Yield Increases with 120 lb/acre of N

Seed + Foliar treatment.....43%
Foliar treatment.....22%
Seed treatment.....23%

These results illustrate the unpredictability of the weather to influence corn productivity, in South Dakota or anywhere. Nitrogen losses caused lower than average corn yields throughout the Brookings area in 2019, as well as in many areas of the Corn Belt affected by heavy precipitation. Nitrogen leaching and denitrification, as well as late planting from the excessive rains, contributed greatly to yield declines in 2019, and for many acres the inability to plant a crop.

The results also demonstrate Vitazyme's ability to assist the crop in making better use of nitrogen that yet remains in the root zone due to high rainfall.

Corn *with Vitazyme application*

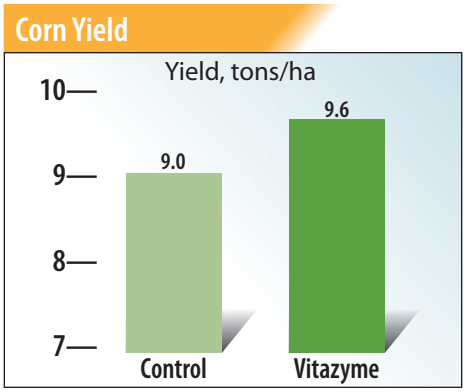
Researcher: V. V. Plotnikov
Research organizations:
Plant Designs International, Rochester, New York, and Agro Expert International, Kaharlyk, Ukraine
Location: ALLC "Lan", Smila District, Cherkasy Region, Plosky Village, Ukraine; Central Ukraine (440-590 mm of precipitation per year)
Variety: DKS 5141, FAO 430 ***Planting date:*** April 22, 2019
Planting rate: 70,000 seeds/ha
Previous crop: winter wheat
Soil type: typical Chernozem (humus = 4.0 %)
Field preparation: disking to 6-8 cm, plowing to 22-24 cm, harrowing to 5-6 cm
Experimental design: A corn field was divided into conventionally treated and Vitazyme treated portions to evaluate the effects of Vitazyme on the yield of the corn grain.

As for other corn trials in Ukraine in 2019, root and ear development were noticably enhanced when Vitazyme was applied, even at less than optimal rates.

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

Fertilization: 123 kg/ha of N applied before planting; 8-24-24 kg/ha of N-P_2O_5-K_2O applied at planting
Vitazyme application: 0.5 liter/ha sprayed on the leaves and soil at the 5 to 6-leaf stage on May 22.
Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
Control	9.0	—
Vitazyme	9.6	0.6 (+7%)



Income results: The extra 0.6 tons/ha gave $81/ha more income.
Conclusion: A corn trial using Vitazyme in Central Ukraine, the product applied once at 0.5 liter/ha at the 5 to 6-leaf stage, revealed that this reduced application rate nevertheless produced a highly profitable $81/ha income increase from a 7% yield increase. This program is shown to be a valuable adjunct to corn growing programs in Ukraine.

Increase in grain yield with Vitazyme: 7%

Corn *with Vitazyme application*

Improved leaf and chlorophyll development is an expected response to the Vitazyme program in Ukraine, as for all countries under a diversity of climatic and soil conditions.

Corn grown with Vitazyme in Ukraine displays considerably better ear development than the untreated control. The yield with Vitazyme was 11% greater.

Researcher: V. V. Plotnikov
Research organizations: Plant Designs International, Rochester, New York, and Agro Expert International, Kaharlyk, Ukraine
Location: Drabiv District, Cherkasy Region, Novomykolaivka Village, Ukraine; Central Ukraine (440-590 mm of precipitation per year)
Variety: ES Method, FAO 380
Planting date: April 26, 2019
Planting rate: 70,000 seeds/ha
Previous crop: winter wheat
Soil type: typical Chernozem (humus = 4.1%)
Field preparation: disking to 6-8 cm, harrowing to 22-24 cm, cultivation to 5-6 cm
Experimental design: A corn field was divided into conventionally treated and Vitazyme treated portions to evaluate the effects of Vitazyme on the yield of the grain.

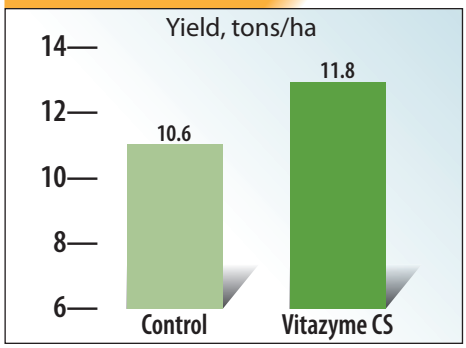
❶ ***Control*** ❷ ***Vitazyme***

Fertilization: 123 kg/ha of N applied before planting and cultivated in; 8-24-24 kg/ha of N-P_2O_5-K_2O at planting
Vitazyme application: Seeds were treated with Vitazyme on April 23 to give an equivalent of 0.5 liter/ha as planted; then 1 liter/ha was sprayed on the leaves and soil at the 7 to 8-leaf stage on May 29.

Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
Control	10.6	—
Vitazyme	11.8	1.2 (+11%)

Corn Yield



Increase in grain yield with Vitazyme: 11%

Income results: The additional 1.2 tons/ha of corn grain with Vitazyme created $175/ha more income.
Conclusion: A corn trial in Ukraine utilizing Vitazyme on both the seeds and leaves produced an excellent gain in yield of 11%, showing the efficacy of this program for improving corn production. Income increased by $175/ha.

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:

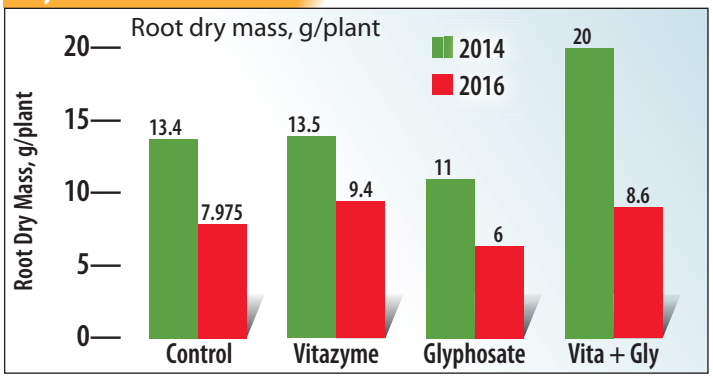
- Field trials conducted at Columbia (2014) and Novelty (2016-17) Missouri on Mexico silt soil (fine, smectitic, mesic Vertic Epiaqualfs)
- Maize and soybean planted conventionally using minimum tillage; plants and soils collected at R2 soybean & V10 maize growth stage
- Root-colonizing *Fusarium* assessed 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

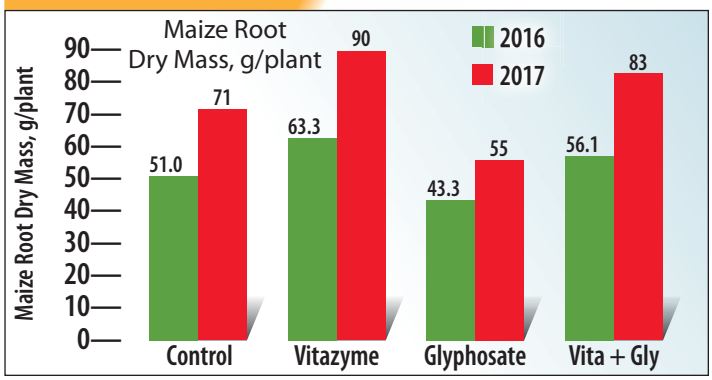
Soybean root biomass enhanced by Vitazyme

Maize root biomass enhanced by Vitazyme

Soybean Root Biomass



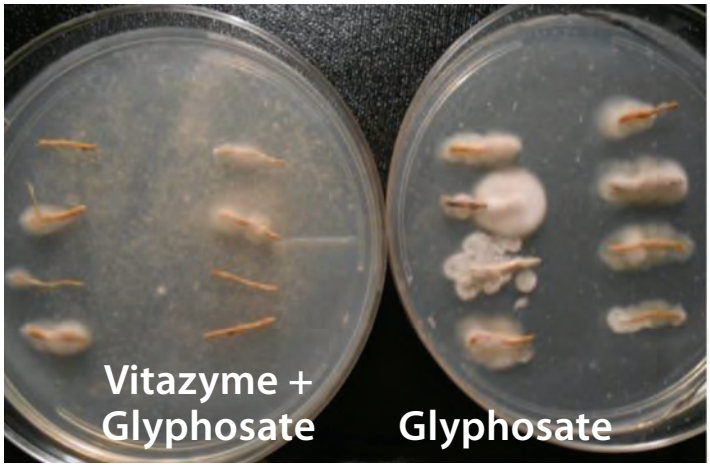
Maize Root Biomass



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.

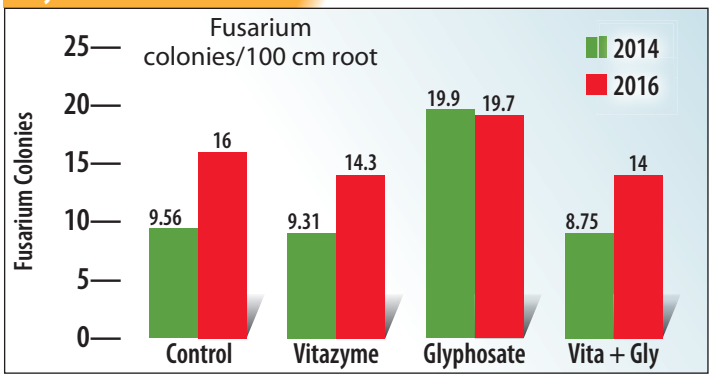
Soybean root colonization by Fusarium spp.



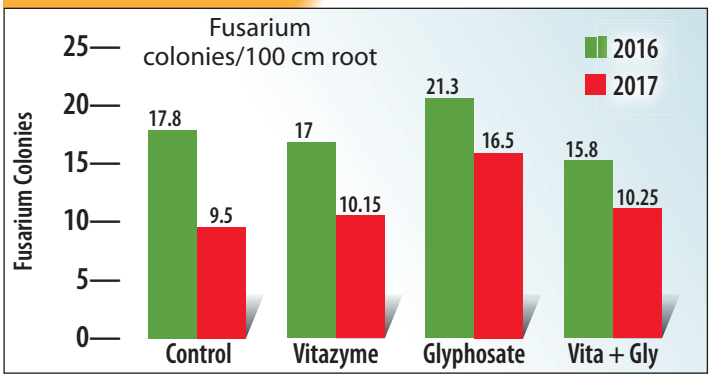
Maize root colonization by Fusarium spp.

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



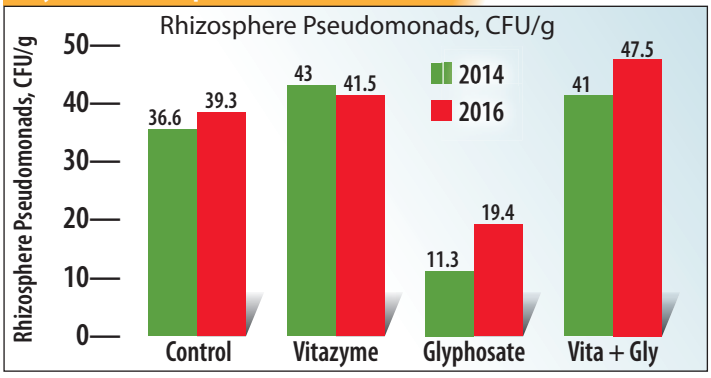
Maize Fusarium



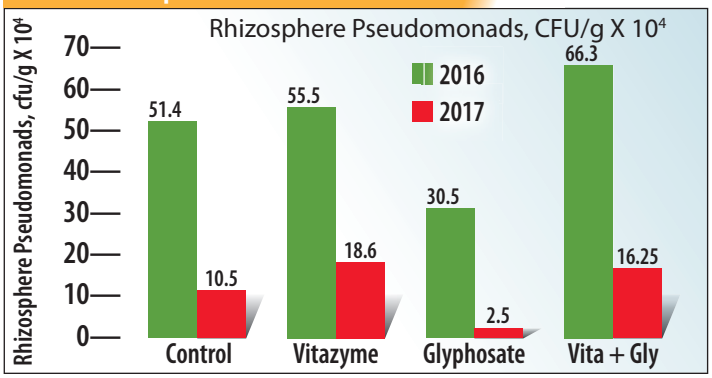
Vitazyme reduced *Fusarium* colonization of roots on both soybean and maize each year relative to no treatment. Vitazyme overcame detrimental effects of glyphosate in reducing root *Fusarium* in both crops. Values above bars are colonization density per 100 cm root or % colonization.

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

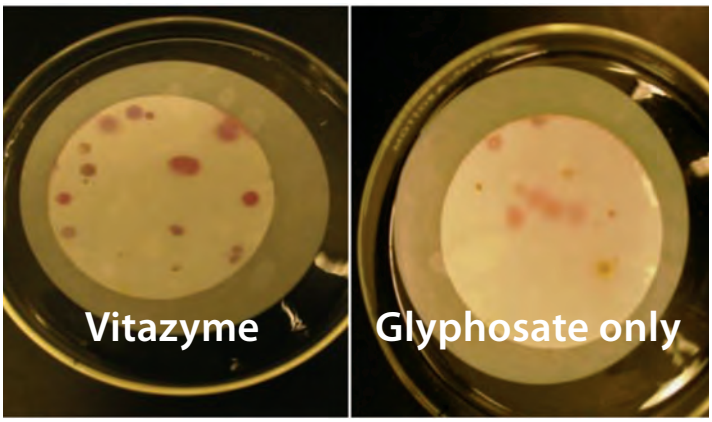


Maize Rhizosphere Pseudomonads



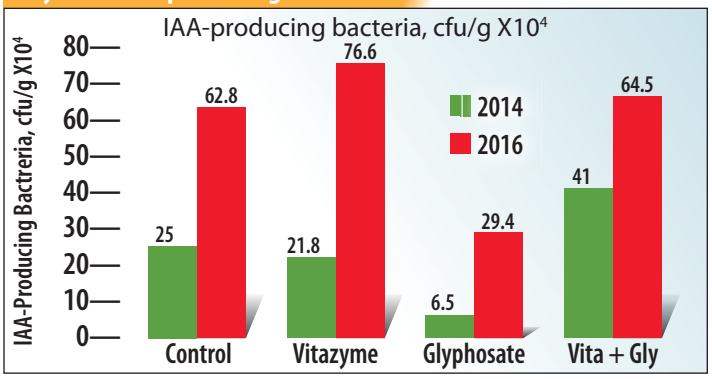
Vitazyme improved rhizosphere pseudomonads. Vitazyme was very effective in overcoming detrimental effects of glyphosate on pseudomonad abundance.

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.

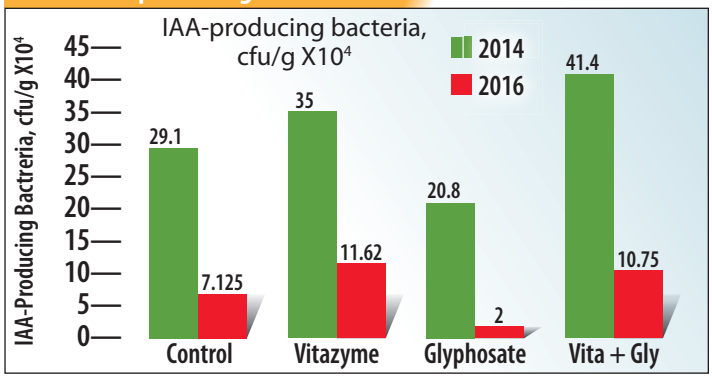


Bacterial colonies attached to membrane show IAA production detected via pink color reaction with Salkowski reagent saturated in the membrane. Instensity of color also indicates IAA concentration.

Soybean IAA-producing Bacteria



Maize IAA-producing Bacteria

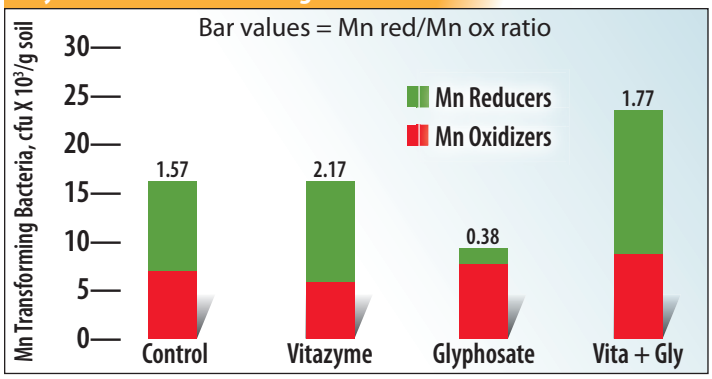


Vitazyme enhanced rhizosphere IAA bacteria abundance on both soybean and maize. Vitazyme was very effective in overcoming detrimental effects of glyphosate on IAA-producing rhizobacteria.

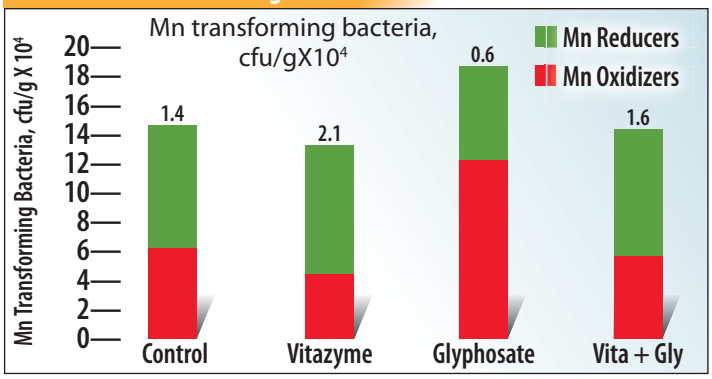
Rhizosphere Mn-transforming bacteria results: Mn-reducing microorganisms provide available Mn (reduced) for plant and microbial uptake. Glyphosate increases Mn-oxidizing microorganisms and limits Mn availability in the rhizosphere.

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

Soybean Mn Transforming Bacteria



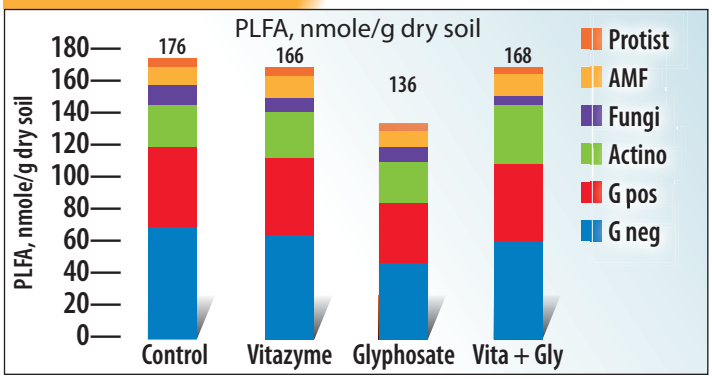
Maize Mn Transforming Bacteria



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

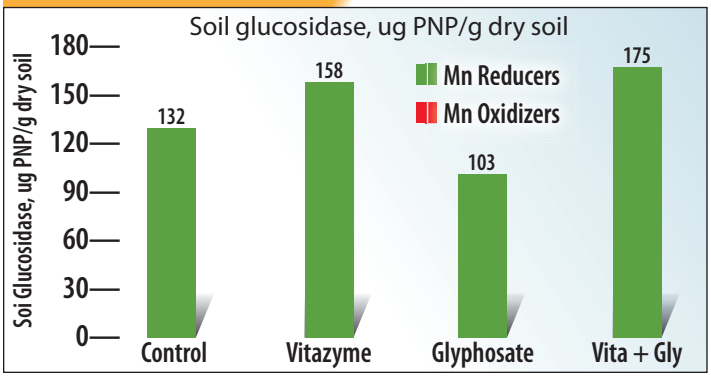


Key:
Protist—protozoa
AMF—arbiscular mycorrhizal fungi
Fungi—non-mycorrhizal fungi
Actino—actinobacterial or actinomycetes
G pos—Gram-positive bacteria
G neg—Gram-negative bacteria

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.

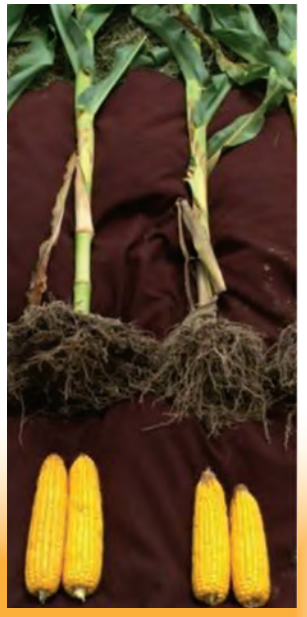
Maize Soil Glucosidase 2016



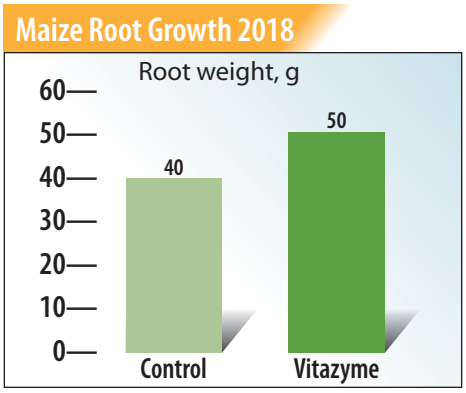
Soybean rhizosphere soil microbial activity indicated by soil glucosidase, a carbon -cycling enzyme.

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.

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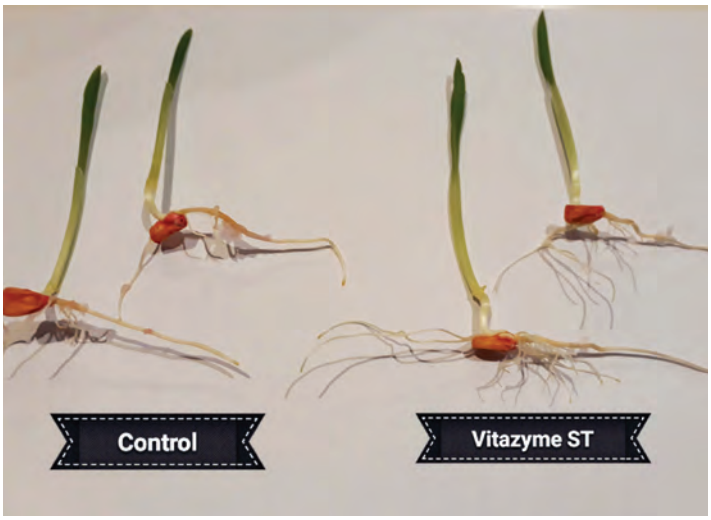
Corn *with Vitazyme application—A Germination Study*

Researcher: Steven David
Research organization: Sustainable Farming Solutions, Perth, Western Australia
Location: Western Australia
Variety: Unknown
Experimental design: Corn seeds were treated with Vitazyme and compared with an untreated control treatment to determine the effect of this product on germination.

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

Vitazyme application: The treated seeds were treated on blotter paper with a 5% Vitazyme solution.
Growth results: Root and shoot growth were not measured, but can be clearly seen to be superior with the Vitazyme treatment. Note the accompanying photograph.
Conclusions: A corn seed treatment study with Vitazyme revealed that a 5% solution will dramatically enhance the development of roots and shoots.



Corn seeds treated with a 5% Vitazyme solution show much greater vitality on emergence than the untreated control. Note especially the improved rooting.

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

Researchers: Steve Schmidt and Bert Schou, Ph.D.
Research organization: ACRES Research, Cedar Falls, Iowa
Location: Denver, Iowa
Variety: P0 589 AM
Planting date: May 18, 2018
Planting rate: 34,600 seeds/acre
Planting depth: 2 inches
Row spacing: 30 inches
Plot size(harvested area): 5x60 feet
Soil type: Dickinson fine sandy loam (2% organic matter, 6.3 pH, 9.1 meq/100 grams cation exchange capacity.
Experimental design: A small-plot corn trial, with four replications and six treatments, was prepared in east-central Iowa to evaluate the effect of Vitazyme, applied at different times, on corn yield. An additional treatment was added to evaluate the effect of WakeUp adjuvant as a synergist with Vitazyme.

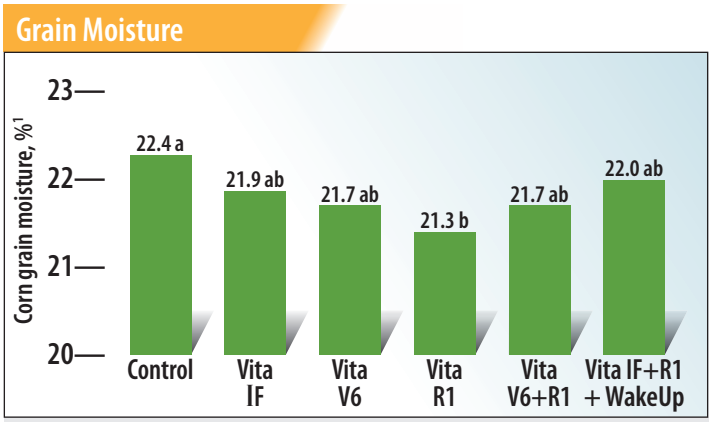
A much more massive root system with the Vitazyme seed treatment produced an 8.0 bu/acre yield increase compared to the untreated control.

Treatment	Vitazmye			WakeUp	
	In-furrow	V6	R1	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 R1	0	0	13	0	0
5. Vitazyme foliar/soil V6 + R1	0	13	13	0	0
6. Vitazyme + WakeUp Spring in-furrow + Vitazyme + Wake Up Summer R1	13	0	13	4	4

Ear filling was enhanced considerably by a Vitazyme seed treatment at Denver, Iowa.

Fertilization: 90 lb/acre of N
Vitazyme application: (1) 13 oz/acre in-furrow (treatments 2 and 6); (2) 13 oz/acre to the leaves and soil at V6 on June 13 (Treatments 3 and 5); (3) 13 oz/acre to the leaves at R1 (silking; Treatments 4, 5, and 6).
WakeUp Spring application: 4 oz/acre in-furrow (Treatment 6).
WakeUp Summer application: 4 oz/acre at R1 (silking; Treatment 6)
Harvest date: October 17, 2018, using a MF 8 plot combine
Plant population results: The treatments ranged in population from 32,210 to 33,165 plants/acre, and did not differ significantly at P=0.05 (F-value = 0.8866 for replicates, and 0.6809 for treatments).

Grain moisture results:



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

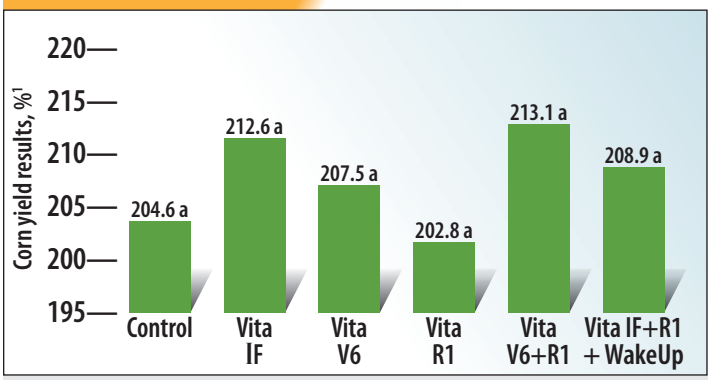
Decrease in grain moisture at harvest with Vitazyme: 0.5 to 1.3 percentage points

Statistics

LSD (P=0.05)	1.12%
Standard deviation	0.021%
CV	1.19
Replicate F	0.946
Treatment F	0.542

Grain yield results:

Grain Yield



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

Yield change with Vitazyme and WakeUp

Vitazmye in-furrow ..... + 8.0 bu/acre (+4%)
Vitazyme at V6 ..... + 2.9 bu/acre (+1%)
Vitazyme at R1 ..... – 1.8 bu/acre (-1%)
Vitazyme at V6 + R1 ..... + 8.5 bu/acre (+4%)
Vitazyme at IF + R1 ..... + 4.3 bu/acre (+2%) +WakeUp IF + R1

Statistics

LSD (P=0.05) ..... 14.1 bu/acre
Standard deviation ... 10.7 bu/acre
CV 5.12
Replicate F 0.350
Treatment F 0.590

Conclusions: A small-plot research trial in eastern Iowa, using Vitazyme at different times, and together with WakeUp application in one treatment, revealed that corn yield responded to Vitazyme applied in-furrow (+ 4%), and also when applied at V6 and R1 (silking) at 13 oz/acre each time. The WakeUp applications with Vitazyme gave only a 2% yield increase, implying that there was little apparent synergism between the two products, though none of the yield values were significantly different. The R1 application alone gave a slightly negative, insignificant response. This treatment however, gave a slight reduction in grain moisture. These results corroborate the consistent effect of Vitazyme to increase corn grain yields in the United States Corn Belt.

Corn *Vitazyme on Corn—A Synergism Study with WakeUp and Environoc 40IC*

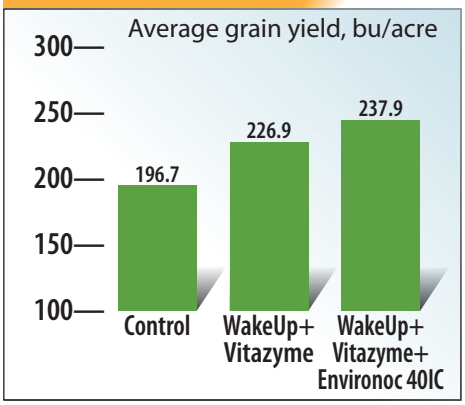
Researcher: Gilman Farley and Jerry Carlson
Research organization: Biodyne Midwest, Fort Wayne, Indiana, and Renewable Farming, LLC, Cedar Falls, Iowa
Location: eastern Iowa
Variety: unknown
Planting dates: unknown (2017 cropping year)
Experimental design: Eight field areas were treated in 2017 with different treatments, using WakeUp Spring, Vitazyme, and Environoc 40IC in combinations, to determine the yield of corn on an eastern Iowa farm. Two of the field areas were untreated controls. Samples of two to 10 acres were harvested from each of the eight areas and analyzed for yield using a combine monitor.

Product	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8
	application in-furrow per acre							
1. WakeUp Spring	0	3 oz	3 oz	3 oz	3 oz	3 oz	0	3 oz
2. Vitazyme	0	8 oz	8 oz	8 oz	8 oz	8 oz	0	8 oz
3. Environoc 40IC	0	1 pint	0	1 pint	1 pint	0	0	0

Fertilization: according to soil test results, including chicken litter and gypsum
Vitazyme application: 8 oz/acre in-furrow to Plots 2, 3, 4, 5, 6, and 8.
WakeUp Spring application: This Renewable Farming product, a vegetable oil-based adjuvant, was applied at 3 oz/acre in-furrow to Plots 2, 3, 4, 5, 6, and 8.
Environoc 40IC application: This Biodyne product, containing various bacteria, nitrogen-fixing organisms, and mycorrhizal fungi, was applied at 1 pint/acre in-furrow to Plots 2, 4, and 5.
Harvest date: unknown
Yield results: An 8-row combine with a calibrated yield monitor harvested areas of two to 10 acres of each treated field. The combine yield monitor maps were analyzed by Larry Eekhoff, a professional agronomist, and yield data was extracted from rows near each other to minimize soil effects. Plots having the same treatment are averaged in the table.

Treatment	Plot 1	2	3	4	5	6	7	8	Mean	Yield Change
	bu/acre									
1. Control	201.3	—	—	—	—	—	192.0	—	**196.7**	—
2. WakeUp Spring + Vitazyme	—	—	228.5	—	—	224.4	—	227.9	**226.9**	**30.2(+15%)**
3. WakeUp Spring + Vitazyme +Environoc 40IC	—	229.5	—	253.8	228.2	—	—	—	**237.2**	**40.5(+21%)**

Grain Yield



The plot yields for the control and WakeUp Spring + Vitazyme were very consistent, varying only 9.3 bu/acre and 4.1 bu/acre, respectively. Plot 4 of the three products combined yielded 25.6 bu/acre more than the lowest yield plot with that treatment, giving that treatment a 21% increase over the control and 6% more yield than the WakeUp + Vitazyme treatment.

Conclusions: This in-field study in eastern Iowa, comparing in-furrow applications at recommended rates of WakeUp Spring + Vitazyme and WakeUp Spring + Vitazyme + Environoc 40IC with the untreated control, revealed that these two combinations of products provided excellent synergisms for yield increases. These increases were 30.2 (15%) and 40.5 (21%) bu/acre for the respective treatments, revealing that an adjuvant, together with a biostimulant and appropriate microorganisms that fix nitrogen and help make nutrients available to plant roots, worked very well together. The surface tension reducing properties of WakeUp Spring to enhance cell membrane nutrient passage, plus the Enironoc 40IC organisms which are triggered by the active agent of the Vitazyme, produced strong evidence of an excellent mutualism in this study. These yield increases were extremely profitable considering the low cost of the inputs, even for a year when grain prices were very low.

Corn *with Vitazyme application—Mutualistic Effects with Environoc 401*

Researcher: Gilman Farley
Research organization: Biodyne USA, Ft. Wayne, Indiana
Location: eastern Iowa
Variety: Unknown
Experimental design: A corn field was selected to evaluate the effectiveness of Vitazyme, together with Environoc 401, to improve grain yield as compared to an untreated area.

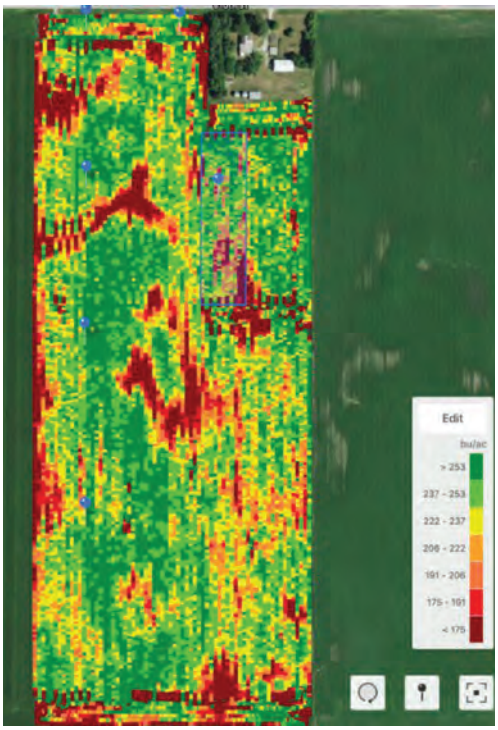
1 *Control* 2 *Vitazyme + Environoc 401*

Fertilization: 4 gal/acre of 6-24-6% N-$P_2 0_5$-$K_2 0$
Vitazyme application: 4 oz/acre (0.3 liter/ha)
Environoc 401 application: 16 oz/acre in-furrow. Environoc 401 is a selection of beneficial microbes that populate the rhizosphere for increased growth.
Yield results: A combine monitor was used for yield determinations. The moisture content of the corn grain varied within a narrow range; 16.4% to 17.1%. Two side-by-side comparisons were made in the field.

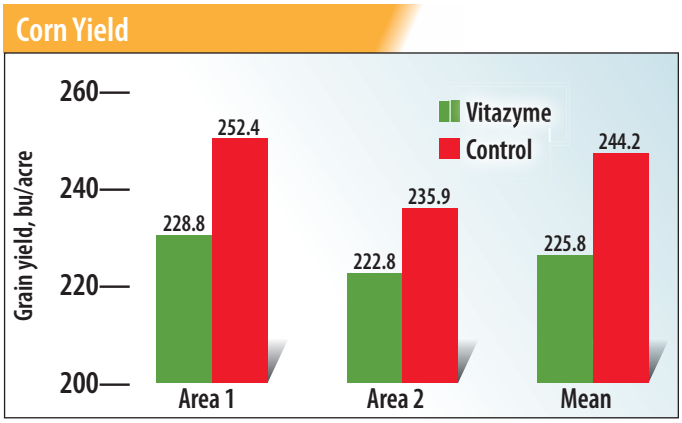
Treatment	Yield	Yield change
	bu/acre	bu/acre
Comparison 1:		
Control	228.8	—
Vitazyme + E 401	252.4	23.6 (+10%)
Comparison 2:		
Control	222.8	—
Vitazyme + E 401	235.9	13.1 (+6%)
Average:		
Control	225.8	—
Vitazyme + E 401	244.2	18.4 (+8%)

Overall increase in corn yield with Vitazyme: 8%

Conclusions: This on-farm corn yield study in north-central Iowa, using Vitazyme together with Environoc 401 in-furrow at planting, revealed that the yield was markedly improved, by 13.1 to 23.6 bu/acre, averaging 18.4 bu/acre (+8%). This result shows the excellent effectiveness of this program for corn farmers in Iowa.



The Vitazyme + Environoc 401 effects on corn yield can be clearly noted on this combine monitor printout; see the darker green strip on the left half of the field.



Corn *with Vitazyme application—An Evaluation on Effects with Mexican Corn Rootworm*

Researcher: Frias, Eng.
Research organization: Quimica Lucava, S. A., Guanajuato, Mexico
Farmer: Octavio Solorzano
Location: Estipac, Jalisco, Mexico
Variety: Pioneer
Planting date: June 15, 2018

Experimental design: A 1 hectare area of a corn field was treated with Vitazyme, and compared with the adjoining untreated control area to evaluate the effect of this product on the damage caused by the Mexican corn rootworm (*Diabrotica* virgifera *zeae*) on plant growth and yield.

❶ ***Control*** ❷ ***Vitazyme***

Fertilization: unknown
Vitazyme application: 1 liter/ha sprayed on the leaves and soil at the 6-leaf stage, 25 days after planting (July 10, 2018)

Growth and yield results:

Nine Days After Application (July 19)

Note more abundant healthier roots with Vitazyme.

The roots of the Vitazyme treated corn on the right reveal superior growth compared to the untreated control on the left.

Twenty Days After Application (July 30)

The stem diameter is greater, the height is greater, and the plants are more vigorous with Vitazyme.

Notice how much more growthy is the treated corn on the right, which displays more leaves, thicker stalks, and a darker green color due to more chlorophyll.

Fifty-Seven Days After Application (September 5)

There was damage present by Mexican corn rootworm (*Diabotica* virgifera *zeae*), which was causing much plant lodging. However, plants treated with Vitazyme, because of their greater root development, recovered better.

Rootworm-damaged corn treated with Vitazyme has more aggressively turned upwards to regain its stature , compared to the untreated control.

Eighty-Five Days After Application (October 3)

It was observed that, even with the Diabrotica (Mexican corn rootworm) and lodging issues, plants and ears from the Vitazyme-treated area had better filling, better size and better weight, than the untreated control.

The Day Before Harvest

At this time, three samples of representative ears were collected from each treatment and weighed as-is.

Vitazyme

Weight: 392 grams

401 grams

371 grams

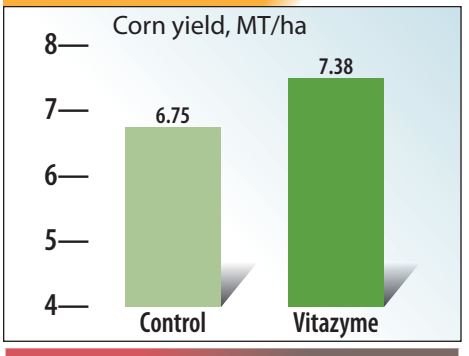
Untreated Control

Weight: 268 grams

321 grams

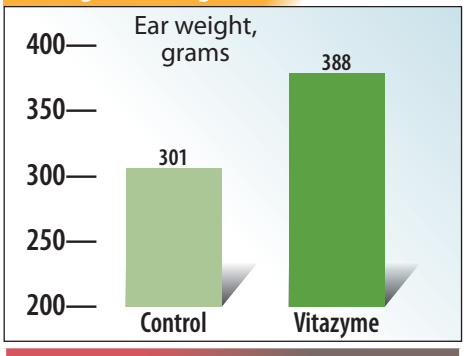
314 grams

Corn Yield



Increase in yield with Vitazyme: 9%

Average Ear Weight



Increase in ear weight with Vitazyme: 29%

Income Results: At $0.20/kg of grain, Vitazyme produced $123/ha greater income.

Conclusions:

- Vitazyme treated plants showed healthier and more abundant roots, thicker stems, and taller and more vigorous plants than the untreated control.
- Vitazyme treated plants rebounded stronger from lodging caused by the attack of Mexican corn rootworm (*Diabrotica* virgifera *zeae*), in comparison with the untreated control.
- Plants and ears from the area treated with Vitazyme had better filling, better size, and 29% greater ear weight than those of the untreated control.
- Vitazyme caused a 9% yield increase (0.63 MT/ha) with only a single 1 liter/ha foliar spray.

Corn *with Vitazyme application*

Researchers: Luciano Frias (Quimica Lucava), Guillermo Cisneros (Magussa), and Dr. Juan Carlos Diaz (Ag Biotech)
Growers: Gustavo Figueroa Ramirez and Gustavo Figueroa
Location: El Fresno Farm, Cofradia de Lepe, Jalisco, Mexico
Variety: Asgrow ***Planting date:*** June 28, 1018
Experimental design: A 4-hectare portion of a corn field was treated with Vitazyme to evaluate the effect of the product on corn growth and yield in a field setting.

1 *Control* 2 *Vitazyme*

Fertilization: unknown
Vitazyme application: (1) Seed treatment on June 28 of 0.25 liter of Vitazyme in 0.25 liter of water (50% solution) to coat seeds for 1 hectare;
(2) 1 liter/ha sprayed by backpack sprayer at the 6-leaf stage;
(3) 1 liter/ha sprayed by backpack sprayer at the 9-leaf stage.
Six days after planting (July 4): Vitazyme treated seeds had much better root development, 6 roots vs. 3.5 roots.
Thirteen days after planting (July 1): Again Vitazyme showed much better root and leaf development.
Twenty-eight days after planting (July 26): Treated plants were larger and darker green, having more chlorophyll.
Sixty-two days after planting (August 29): Vitazyme treated plants were observed to have greater stalk diameters and taller plants. Part of the control area was drought-affected, but no such stress was noted in the treated area.
111 days after planting (October 17): Vitazyme treated plants had...
- Taller plants
- Greater leaf area
- Better root development
- Improved ear fill

Yield and income results: The plots were harvested on January 10,2019.

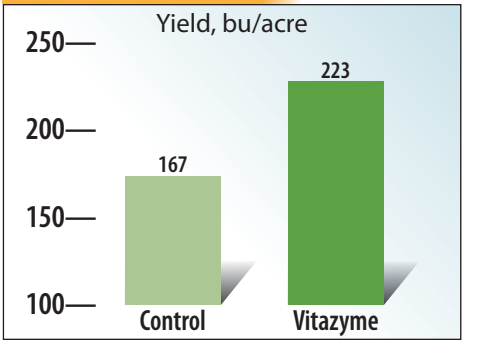
The Vitazyme treated corn (above) displays excellent ear development, with filling to the tip and large kernels,giving a 35% greater yield than the control.

Growth was enhanced greatly in this Mexican corn trial.

A seed treatment (right) on corn in Mexico caused considerably better rooting, right from the beginning of the growth cycle, as is evidenced only days after planting. The yield increase was 33%, and the net return was 30% higher with Vitazyme.

Parameter	Control	Vitazyme	
Plant fresh weight, grams	1,020	2,720	(+167%)
Ear fresh weight, with husk, grams	340	530	(+56%)
Ear fresh weight no husks, grams	250	350	(+40%)
Shelled corn yield, tonnes/ha	10.5	14.0	(+33%)
Shelled corn yield, bu/acre	167	223	(+33%)
Total income, U.S. $/acre	839	1,118	(+33%)
Cost of Vitazyme, U.S. $/acre	—	25.41	
Net, U.S. $/acre	839	1,093	(+30%)
Cost: Benefit Ratio		10:1	

Corn Yield



Conclusion: This Mexican corn trial revealed that Vitazmye, applied to the seeds, and then 1.0 liter/ha to the leaves at both the 6 and 9-leaf stages, produced an excellent 33% yield increase. Signs of this improvement were evident throughout the growing season, since root development, plant height, and leaf mass were all improved with these three applications. These results show the great value of the Vitazyme program for corn production in Mexico, as evidenced by a 30% increase and a cost: benefit of 10:1

Corn *with Vitazyme application*

Researcher: James Anderson
Research organization: J & H Distributing, Belgrade, Minnesota
Location: Pederson Farms, Spicer, Minnesota
Variety: P9929AMXT and DCK 45-65
Planting date: unknown
Soil type: silty clay loam
Experimental design: A corn field of 132.2 acres was treated in part (89.3 acres) with Vitazyme in-furrow, to determine the effect of the product on corn yield.
Fertilization: unknown

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

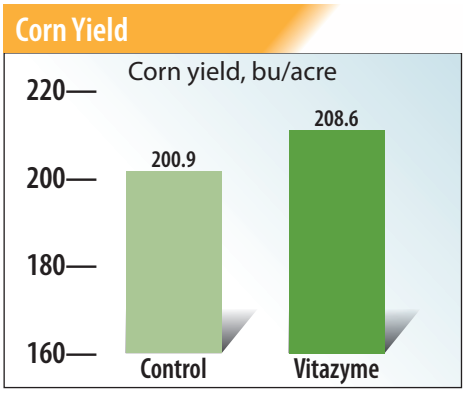
Vitazyme application: 13 oz/acre (1 liter/ha) in-furrow at planting
Crop season weather: a cold and late spring, with a summer of average temperatures and above-average rainfall

Treatment	Yield	Yield change
	bu/acre	bu/acre
1. Control	200.9	—
2. Vitazyme	208.6	7.7 (+4%)

The Vitazyme seed treated plants are larger with considerably better developed root systems.

More full kernel development of the Vitazyme treated plants resulted in a higher yield of 8 bu/acre, a highly profitable application despite low corn prices.

Yield results: Both the control and treated grain were harvested at 22% moisture. A combine monitor was used to record yields.



Conclusions: An on-farm corn trial in central Minnesota proved that Vitazyme, applied in-furrow at 13 oz/acre (1 liter/ha) increased the grain yield by 7.7 bu/acre (4%), showing the high profitability of this amendment for corn farmers in the northern Corn Belt.

Increase in corn yield with Vitazyme: 4%

Corn *with Vitazyme application*

Researcher: David Clay Ph. D., and Graig Reicks
Research institution: Department of Plant Sciences, South Dakota State University, Brookings, South Dakota
Location: South Dakota State University, Field Research Facility, Aurora, South Dakota
Variety: DKC 47-47
Planting date: May 15, 2018
Planting rate: 30,750 seeds/acre
Planting depth: 2 inches
Row spacing: 30 inches
Soil type: Brandt silty clay loam
Experimental design: A replicated, randomized complete block design, with four replications, was set up in a small-plot corn trial, plots being six rows wide (15 feet) and 20 feet long. At harvest, 20 feet of the two middle rows were machine-harvested with a plot combine. Three nitrogen rates and three different times of application were utilized. Grain yield was measured, and nitrogen efficiency and water efficiency were to be determined through ^{15}N and ^{13}C analyses.

Vitazyme application	Nitrogen rate,lb/acre		
	0	75	125
	Treatment number		
Control	1	2	3
Seed only	4	5	6
Foliar V6 only	7	8	9
Seed + Foliar V6	10	11	12
Seed + Foliar R1	13	14	15

Fertilization: Nitrogen fertilizer was applied by hand as urea (46%N) to appropriate plots on June 1, when the corn was in the V1/V2 (one to two-leaf) stage.
Vitazyme application: Seed treatment (at planting on May 15): 156 ml of Vitazyme per 12.3 lb of seed, or 8 oz/acre sprayed on the seeds and mixed by hand in totes. ***Foliar treatment*** (on June 22 at V 6, and on July 27 at R1): 13 oz/acre using a 15 gal/acre spray soulution with a non-ionic surfactant (0.25%) and a backpack sprayer.
Harvest date: unknown

Vitazyme on the seeds, as well as on the leaves, produced better filled ears with larger kernels, as can be seen in this 2018 nitrogen efficiency study.

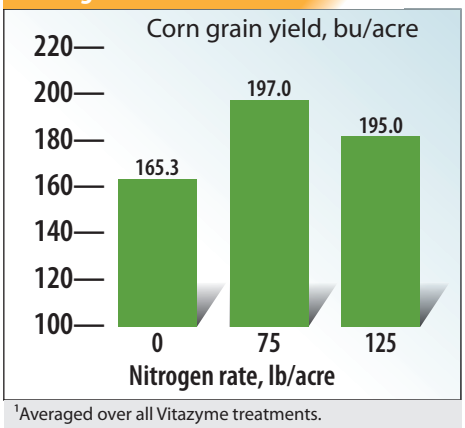
Notice the excellent root development with Vitazyme application at 75 lb/acre of nitrogen. This has led to better ear filling, as seen in the other photo.

Yield results:

Nitrogen Fertilizer Effect			
Vitazyme	N rate	Grain yield[1]	Yield change[2]
	lb/acre	bu/acre	bu/acre
1. None	0	153 e	—
2. None	75	197 a	+ 44 (+29%)
3. None	125	195 ab	+ 42 (+27%)
4. Seed	0	170 cde	—
5. Seed	75	194 ab	+ 24 (+14%)
6. Seed	125	200 a	+ 30 (+18%)
7. Foliar V6	0	171 bcde	—
8. Foliar V6	75	197 a	+ 26 (+15%)
9. Foliar V6	125	190 abcd	+ 19 (+11%)
10. Seed + Foliar V6	0	167 de	—
11. Seed + Foliar V6	75	199 a	+ 32 (+19%)
12. Seed + Foliar V6	125	197 a	+ 30 (+18%)
13. Seed + Foliar R1	0	—	—
14. Seed + Foliar R1	75	198 a	n.a.[3]
15. Seed + Foliar R1	125	193 abc	n.a.[3]

[1]Means followed by the same letter are not significantly different at P=0.05. [2]Change vs. the O-N rate for that Vitazyme treatment. [3]Data is not available.

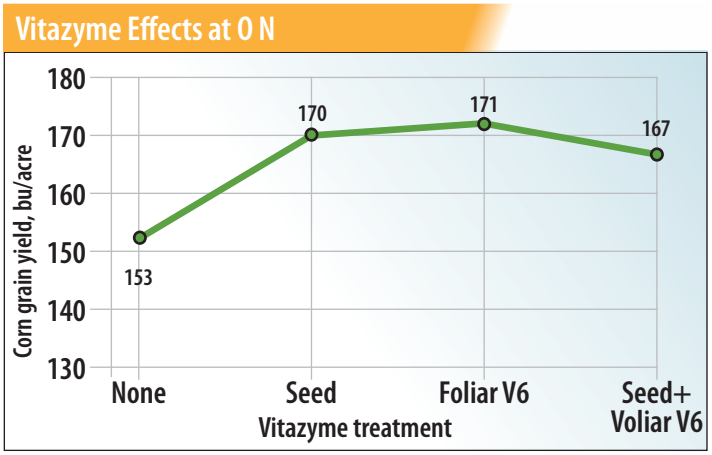
Average Fertilizer Effect[1]



[1]Averaged over all Vitazyme treatments.

Increase in yield with 75 lb/acre N: 31.7 bu/acre (+19%)

Increase in yield with 125 lb/acre N: 29.7 bu/acre (+18%)



Vitazyme Treatment	Grain yield	Yield change
	bu/acre	bu/acre
None	153	—
Seed	170	17 (+11%)
Foliar V6	171	18 (+12%)
Seed + Foliar V6	167	14 (+9%)

Increase in yield with seed treatment: 11%

Increase in yield with foliar treatment at V6: 12%

Increase in yield with seed + foliar treatment at V6: 9%

Vitazyme effects at the 75 and 125 lb/acre N rates were not significant, likely because the corn crop had reached its maximum yield potential at about 195 to 200 bu/acre.

Conclusions: This South Dakota State University corn study, using three nitrogen fertilizer rates, plus four Vitazyme application regimes, revealed that, with no added nitrogen, Vitazyme elevated the grain yield by 9 to 12% above the untreated control, by amounts of 14 to 18 bu/acre. At nitrogen rates of 75 and 125 lb/acre, however, the yields of all treatments were similar, varying from 190 to 200 bu/acre, so Vitazyme effects were not detected because the maximum yield potential had been reached even at 75 lb of N/acre. This medium application rate outyielded the high nitrogen rate by 2 bu/acre. It would have been proper during this trial to have utilized lower fertilizer nitrogen rates, such as 25 and 50 lb/acre, to evaluate fertilizer efficiency effects of Vitazyme at these lower rates.

Evaluations of nitrogen and water efficiency will be conducted on these 15 treatments during the coming months, and will be reported in upcoming data summaries.

Corn *with Vitazyme application*

Researcher: E. Bruce Kirksey, Ph. D.
Research organization: Agricenter International, Memphis, Tennessee
Location: Memphis, Tennessee
Variety: DK 65-19
Soil type: Falaya clay loam; good fertility and drainage; pH=6.4
Row spacing: 30 in
Plant population: 32,000 seeds/acre
Planting date: May 14, 2018
Experimental design: A small-plot replicated field corn trial was prepared using two Vitazyme applications, to determine the yield and profitability of this program compared to the untreated control. Four replications of plots 10 x 30 ft were used.

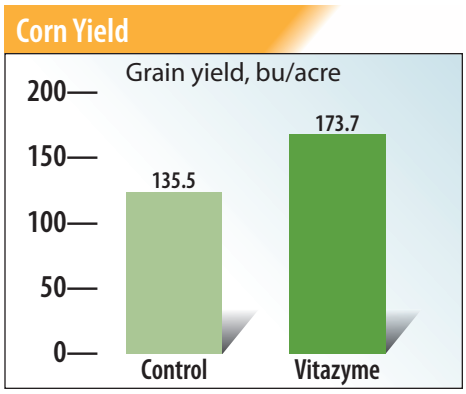
1 ***Control*** **2** ***Vitazyme***

Fertilization: unknown
Vitazyme application: (1) 13 oz/acre (1 liter/ha) in-furrow at planting; (2) 13 oz/acre (1 liter/ha) sprayed on the leaves and soil at V6

Yield results: The corn grain from each plot was shelled and weighed on September 14, using an Almaco plot combine. Two rows 25 ft long were harvested.

Treatment	Yield[1]	Yield change
	bu/acre	bu/acre
Control	135.5 b	—
Vitazyme	173.7 a	38.2 (+28%)
Standard error	4.1	

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



Increase in corn grain with Vitazyme: 38.2 bu/acre (+28%)

Income results:

Income results	
Added income from the two applications	$143/acre
Added costs	$17/acre
Net profit	$126/acre
Return on investment	7.41:1

Conclusion: A small-plot replicated corn trial in Tennessee revealed a dramatic increase in shelled corn yield with in-furrow and foliar(V6) Vitazyme applications. The yield increase was 38.2 bu/acre above the untreated control treatment, or 28% more. This increase netted $128/acre more income, or a return on investment of 7.41:1. This increase, if extrapolated to a 1,000-acre corn farming operation, would give the farmer $126,000 more profit, from product costing him only about $17,000.

Corn *with Vitazyme application*

Researcher: V. V. Plotinikov
Research organization: Plant Designs, Inc., Rochester, New York, and Agro Expert International, Kaharlyk, Ukraine
Location: Drabiv District, Cherkasy Region, Novomykolaivka Village, Private Enterprise Opal, Ukraine
Variety: ES Sensor, FAO 370
Planting date: April 30, 2018
Previous crop: winter wheat
Soil type: typical chernozem (humus = 4.1%)
Planting rate: 70,000 seeds/ha
Field preparation: disking to 6-8 cm, plowing to 22-24 cm, cultivation to 5-6 cm
Experimental design: A corn field was treated in part with two applications of Vitazyme, and compared with the untreated portion of the field, to evaluate the effect of the product on the yield and profitability of corn grain.

Corn produced using Vitazyme shows better filling and ear size as a result of superior nutrient uptake by an enlarged root system and activated rhizosphere.

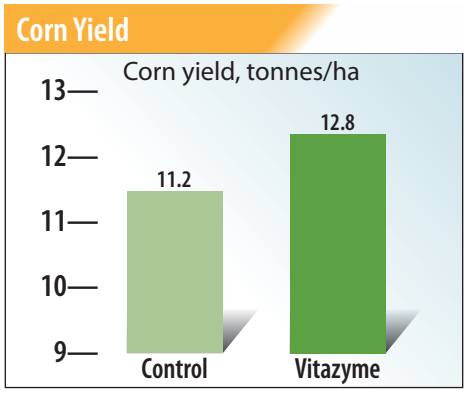
1 ***Control*** **2** ***Vitazyme***

Fertilization: 123-30 kg/ha of N-P_2O_5 at planting; 10-26-26 kg/ha of N-P_2O_5-K_2O at planting
Vitazyme application: (1) 1 liter/ha sprayed on the soil pre-plant on April 27; (2) 0.5 liter/ha sprayed on the leaves and soil at the 7 to 8-leaf stage on May 30
Yield results:

Treatment	Yield	Yield change
	tonnes/ha	tonnes/ha
Control	11.2	—
Vitazyme	12.8	1.6 (+14%)

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

Increase in grain yield with Vitazyme: 14%



Income results: An extra yield of 1.6 tonnes/ha produced an income increase of $281/ha.
Conclusion: This Ukrainian corn trial, using 1 liter/ha and 0.5 liter/ha sprays pre-plant and at the 7 to 8-leaf stage, respectively, resulted in an excellent 14% yield increase, which brought $281/ha more income. This program is highly effective for corn producers in Ukraine.

Corn *with Vitazyme application—A Study on Synergism with WakeUp Summer*

Researchers: Steve Schmidt and Bert Schou, Ph.D.
Research organization: ACRES Research, Cedar Falls, Iowa
Location: Denver, Iowa
Variety: Wyffels W5440
Planting date: May 16, 2017
Planting rate: 35,400 seeds/acre
Planting depth: 2.25 inches
Row spacing: 30 inches
Soil type: Organic matter, 3.0%; pH, 7.3; cation exchange capacity, 11.03 meg/100g.
Field preparation: strip tillage on April 24, 2017
Previous crop: soybeans
Experimental design: A medium-sized randomized complete block design with five replicates was established on a farmer's field, total plot size being 15 x 60 feet and the harvested area of each plot being 5 x 60 feet (0.00689 acre). Vitazyme and an adjuvant (WakeUp Summer) were appllied alone and together to determine the effect of each treatment on the grain yield.

1. ***Control***
2. ***Vitazyme***
3. ***WakeUp Summer***
4. ***Vitazyme + WakeUp Summer***

Fertilization: Starter mix (4-Star Mix) at planting: 5 gal/acre of MPK (0-52-34% N-$P_2 0_5$-$K_2 0$), 3 gal/acre of K-row (0-0-23-8 % N-$P_2 0_5$-$K_2 0$-S), 1 quart/acre of humate, and 4 oz/acre of Supertrace.
Vitazyme application: (1) 13 oz/acre (1 liter/ha) in-furrow at planting (May 16) and (2) 13 oz/acre (1 liter/ha) on the leaves and soil at R1 on June 26.
WakeUp Summer application: (1) 4 oz/acre in-furrow at planting (May 16) and (2) 4 oz/acre on the leaves and soil at R1, on June 26.
Herbicides: Pre-emergence (applied May 16), 5.6 oz/acre Corvus, 1 quart/acre Roundup, 1 lb/acre Atrazine, 1 pint/acre 2, 4-D, 1 lb/acre AMS, in 15 gal/acre of water. Post-cm organs (applied June 16), 1 oz/acre Impact, 0.25 lb/acre. Atrazine, 8 oz/acre MSO, and 2 lb/acre AMS.
WakeUp Summer: a vegetable-based adjuvant
Growing season weather: favorable throughout the growing season

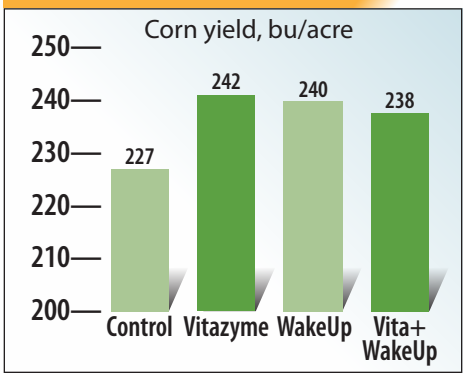
The Vitazyme treated corn showed the greatest rooting and overall growth in this Iowa study, from two applications, at planting and at V8.

Population results: Population counts were made on September 14. All treatments varied in population from 31,376 to 32,509 plants/acre, and were not significantly different.
Grain moisture results: Grain moisture varied from 19 to 20%, and were not significantly different.
Grain yield results: The plots were harvested on October 28, 2017 using a plot combine, during which grain weight and moisture content were recorded.

Treatment	Yield[1]	Yield change
	bu/acre	bu/acre
1. Control	227 b	—
2. Vitazyme	242 a	15 (+7%)
3. WakeUp Summer	240 a	13 (+6%)
4. Vita + WakeUp	238 ab	11 (+5%)

[1]Means followed by the same letter are not significantly different at P=0.05 according to the Student-Newman-Keuls Test. LSD 0.05=12.5 bu/acre.

Corn Yield



Note the larger, better filled ears from the Vitazyme treated corn in this study on the right, versus the contol corn on the left.

Conclusions: This small-plot study on corn near Denver Iowa, revealed that both Vitazyme and WakeUp Summer significantly improved corn grain yield, by 6% for WakeUp and 7% for Vitazyme. The combination of the two products also increased grain yield -by 5%- but this increase was slightly less than for each product by itself. Both Vitazyme and WakeUp Summer are shown to significantly improve corn yield when applied at 13 oz/acre (1 liter/ha) in furrow and at R1, and at these same growth stages for WakeUp, but at the 4 oz/acre rate.

Corn *with Vitazyme application—A Nitrogen Efficiency Study*

Researcher: Dr. David Clay and Graig Reicks
Research institution: Department of Plant Sciences, South Dakota State University, Brookings, South Dakota
Location: South Dakota State University, Field Research Facility, Aurora, South Dakota
Variety: DKC 49-72 (99-day hybrid)
Planting date: May 14, 2016
Planting rate: 32,000 seeds/acre
Planting depth: 2 inches
Row spacing: 30 inches
Soil type: Brandt silty clay loam
Experimental design: A replicated, randomized complete block design, with three replications, was established in a small-plot corn trial. Plots were six rows wide (15 feet) and 20 feet long, and at harvest 20 feet of the two middle rows were hand-harvested. Three nitrogen rates were utilized, along with Vitazyme applied on the seeds or foliar, to determine the effect of this product on corn yield, protein (nitrogen) levels, and nitrogen and water efficiency.

The research plots at South Dakota State University produced excellent yield and nitrogen efficiency data for 2016.

Notice the much improved root development when Vitazyme is applied to the seeds and leaves.

Nitrogen rate	Vitazyme application			
	None	Seeds	Leaves	Seeds + Leaves
lb/acre	(treatment number)			
0	1	4	7	10
75	2	5	8	11
125	3	6	9	12

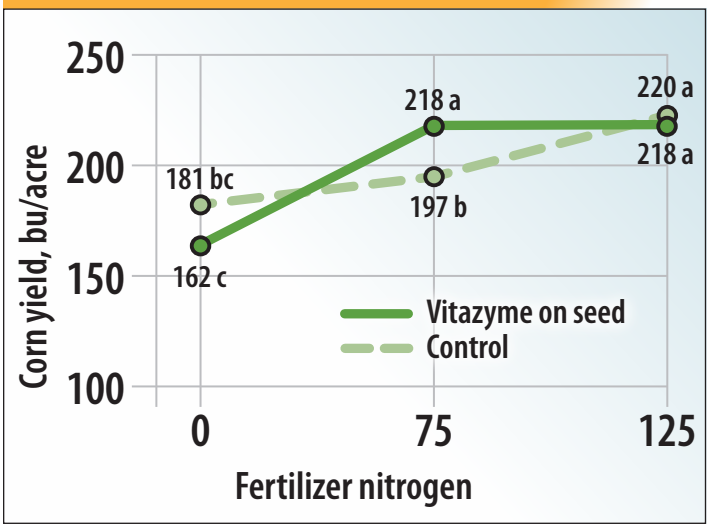
Fertilization: Nitrogen fertilizer was applied by hand as urea (46%) to appropriate plots on June 13, 2016, when the corn was at the V4 (four-leaf) stage.
Vitazyme application: Seed treatment (at planting on May 14): 112 ml of Vitazyme per 10 lb of seed, or 7.4 oz/acre sprayed on the seeds and mixed on a tarp; ***Foliar treatment*** (on June 29 at V 8-9) at 13 oz/acre, using a 15 gal/acre spray solution, with a non-ionic surfactant (0.25% v/v) and a backpack sprayer.
^{15}N and ^{13}C determinations: A mass spectrometer was used at the Department of Plant Science, South Dakota State University.
Harvest date: hand harvested on October 31, 2016
Yield, nitrogen efficiency, and water efficiency results: Ears were dried at 140° F and weighed daily until moisture loss ceased. Grain was then removed by a portable sheller and weighed. Yields were adjusted to 15% moisture. Yield loss due to water and nitrogen stress were then calculated using ^{14}N, and ^{15}N, and ^{13}C formulas.

Vitazyme Seed Treatment Effect on Corn Yield and Nitrogen Grain Use Efficiency

Treatment	Nitrogen fertilizer	Corn yield[1]	Corn grain use efficiency[2]
	bu/acre	bu/acre	%
1. None	125	220 a	43.3 b
	75	197 b	40.3 b
	0	181 bc	—
2. Vitazyme on seeds	125	218 a	42.6 b
	75	218 a	58.0 a
	0	162 c	

[1]Means followed by the same letter are not significantly at P=0.05. [2]Means followed by the same letter are not significantly different at P=0.10. The calculations used to determine this value are based upon 14N and 15N ratios in the grain, and will not be presented in this report.

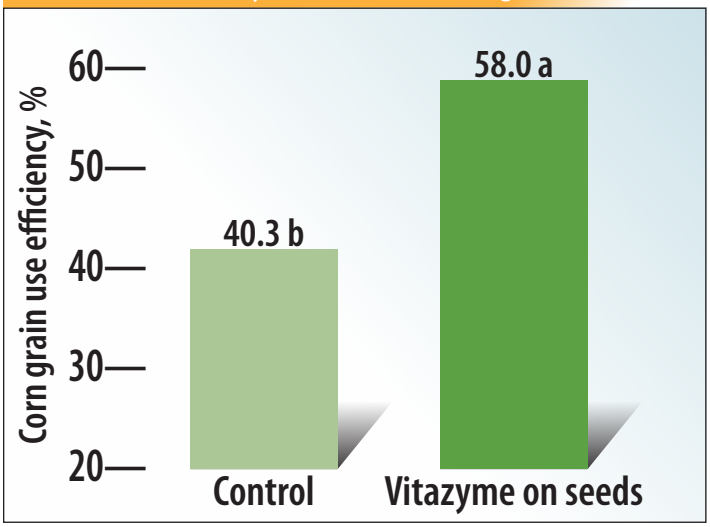
Vitazyme Seed Treatment Effect on Corn Yield



Yield increase with Vitazyme at 75lb/acre of nitrogen: 21 bu/acre

Corn yield with 75 lb/acre of N, using a 40% reduction in N, yielded the same as for the 100% (125 lb/acre) N rate.

Vitazyme Seed Treatment Effect on Corn Grain Use Efficiency at 75 lb/acre Nitrogen

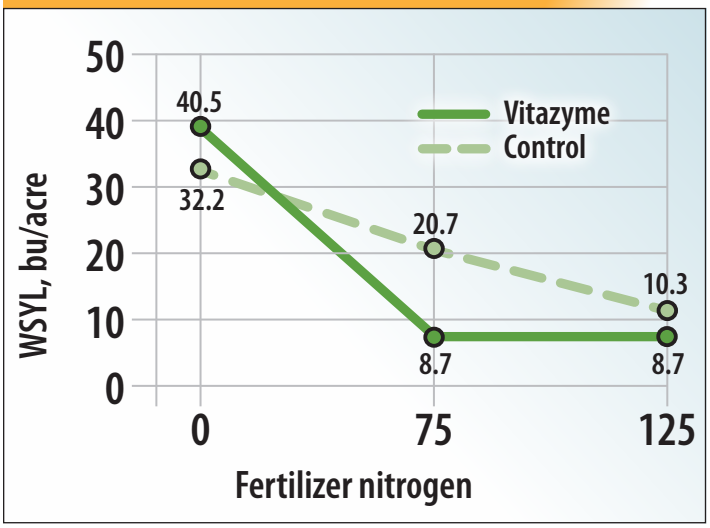


Vitazyme Seed Treatment Effect on Corn Yield and Water and Nitrogen Stress

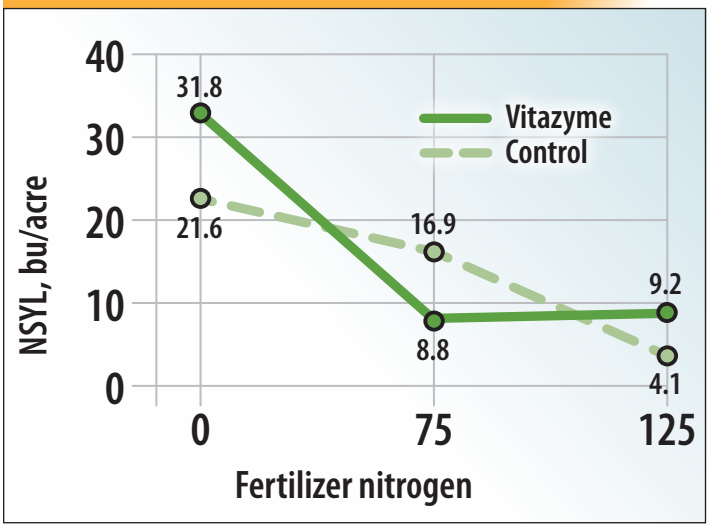
Vitazyme seed treatment	Nitrogen fertilizer rate	Grain yield	Yield loss water stress	Yield loss nitrogen stress	Grain nitrogen
	lb/acre	lb/acre	lb/acre	lb/acre	%
Yes	125	218 a*	8.7 b*	9.2 b*	1.31 a*
Yes	75	218 a	8.7 b	8.8 b	1.30 a
Yes	0	162 b	40.5 a	31.8 a	1.09 b
No	125	220 a*	10.3 c**	4.1 b **	1.47 a*
No	75	197 b	20.7 b	16.9 a	1.29 b
No	0	181 b	32.2 a	21.6 a	1.14 c

*Means followed by the same letter are not significantly different at P=0.05. **Means followed by the same letter are not significantly different at P=0.10.

Water Stress Yield Loss (WSYL)



Nitrogen Stress Yield Loss (NSYL)



Reduction in Water Stress Yield Loss		
	Vitazyme	No Vitazyme
At 75 lb/acre N	79%	26%
At 125 lb/acre N	79%	68%

Reduction in Nitrogen Stress Yield Loss		
	Vitazyme	No Vitazyme
At 75 lb/acre N	72%	22%
At 125 lb/acre N	71%	81%

Income results: At $4.00/bu of corn grain, the extra 23 bu/acre at 75 lb/acre of N is $92.00. A savings of 50 lb/acre N, at a cost of $0.27/lb of urea, is $13.50. That $105.50 greater income, less an approximate cost at $7.00/acre for Vitazyme, equals a Benefit: Cost of 15.1.

Benefit Cost of 15.1

Conclusions: A replicated small plot corn study conducted by South Dakota State University in 2016, near Aurora, South Dakota, using ^{15}N and ^{13}C analytical methods, revealed that Vitazyme on the seeds greatly improved the efficiency of both water and nitrogen use. This was shown in particular by the changes in efficiency at 75 lb/acre (40% N reduction) of nitrogen application: treated seeds reduced water stress yield loss by 79%, while nitrogen stress yield loss was reduced by 72%. Grain use efficiency (the percent of applied fertilizer actually going into the grain) at 75 lb/acre of N fertilizer for the Vitazyme treated seed was 58%, while the untreated seed efficiency was 40.3%. These effects of the Vitazyme seed treatment translated into virtually the same yield for Vitazyme on the seeds at 75 lb/acre of N (218 bu/acre) as for untreated seeds at 125 lb/acre of N (220 bu/acre). At 75 lb/acre of N, the treated seeds yielded 23 bu/acre more than the untreated seeds. Even with depressed corn prices of around $4.00/bu the benefit: cost ratio of the Vitazyme seed treatment with reduced N application would be 15.1:1. Grain nitrogen was also significantly increased by Vitazyme on the seeds.

The Vitazyme foliar treatment did not yield significantly positive results in this trial. Reasons for this lack of foliar response are not known, since a trial in 2014 did produce a significant yield increase of 9 bu/acre.

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:

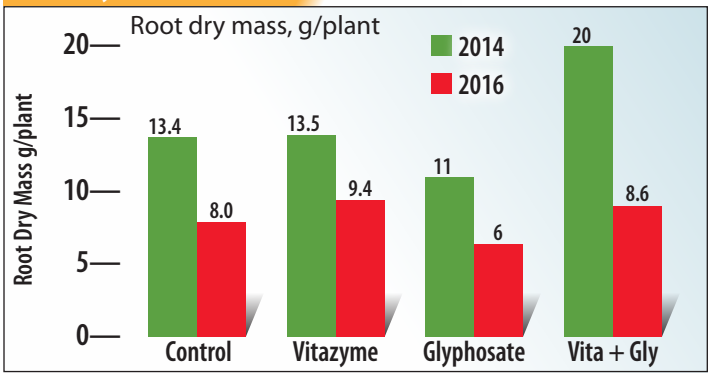
- Determine effects of Vitazyme on selected soil health indicators
- Determine effects of Vitazyme on rhizosphere biology in transgenic soybean and maize receiving glyphosate in field trials
- Determine potential effects of Vitazyme on crop growth in soils with residual glyphosate contents

Experimental design:

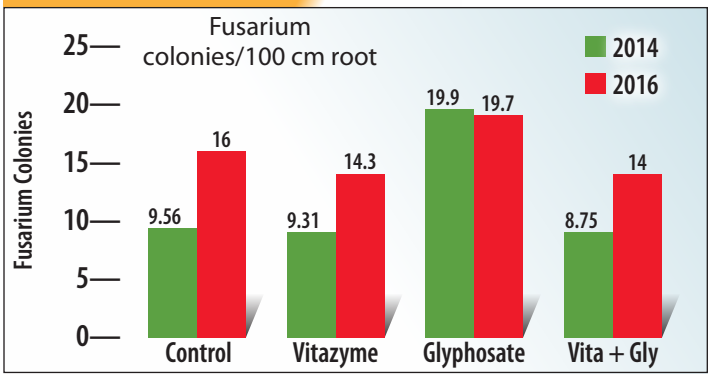
- Field trials conducted at Columbia (2014) and Novelty (2016-17), Missouri, on Mexico sil soil (fine, smectitic, sesic Vertic Epiaqualfs), maize and soybean planted conventionally using minimum tillage; plants and soils collected at R2 soybean and V10 maize growth stage
- Root-colonizing Fusarium assessed 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:

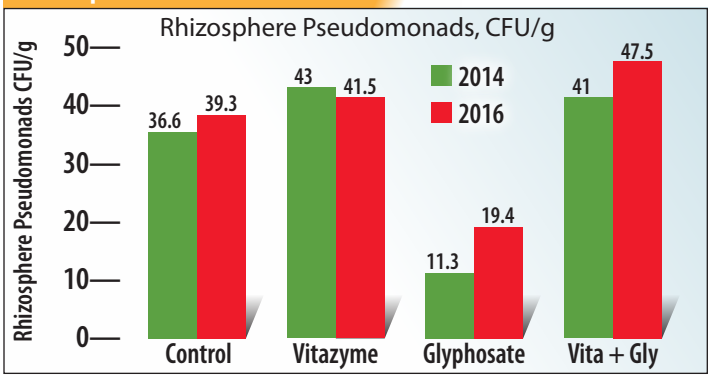
Root Dry Mass



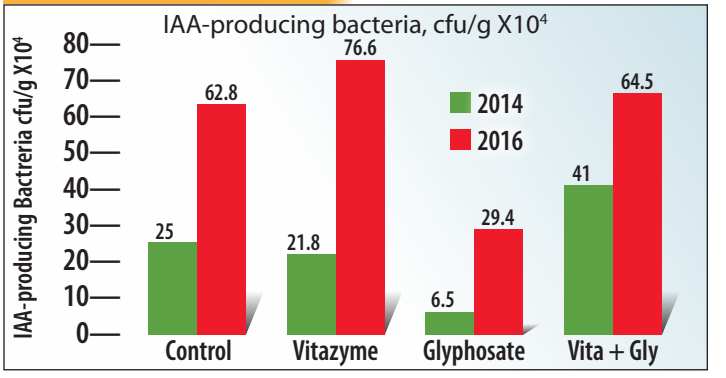
Fusarium

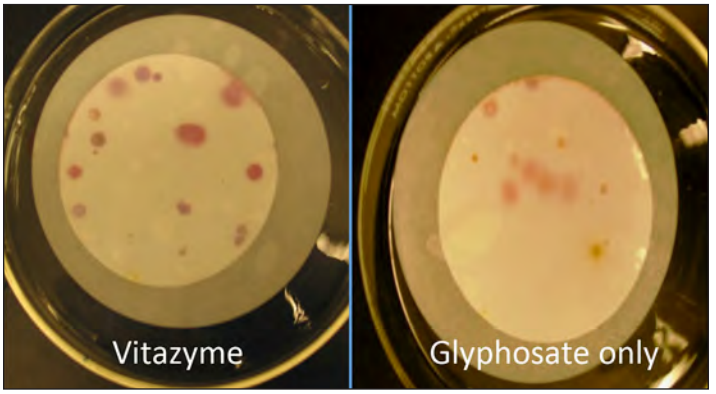


Rhizosphere Pseudomonads



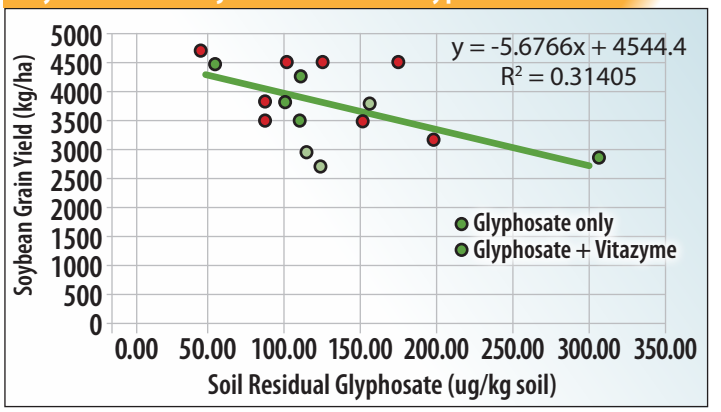
IAA-producing Bacteria





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.

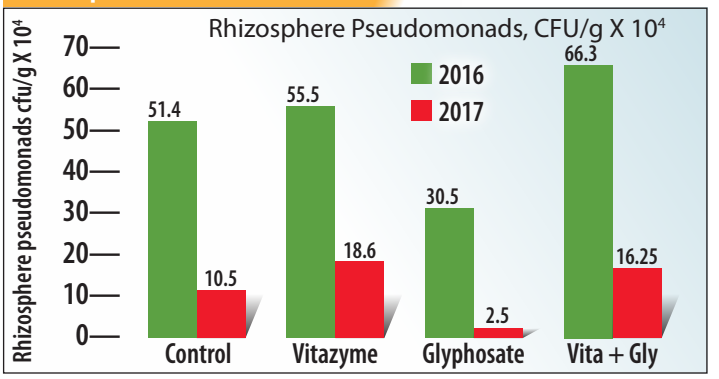
Soybean Yield Projection With Soil Glyphosate



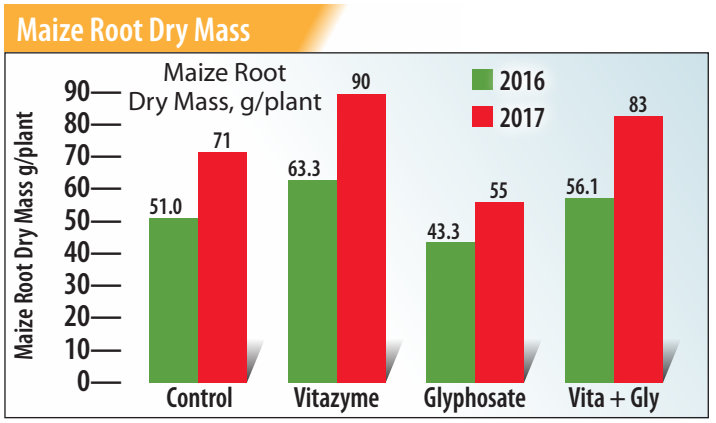
Corn Results:

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

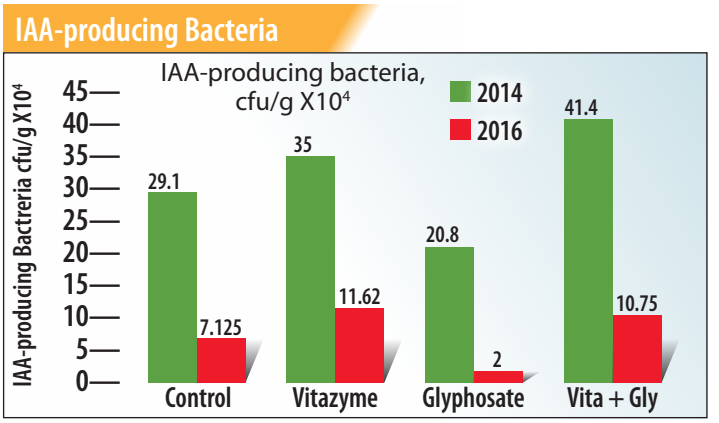
Rhizosphere Pseudomonads



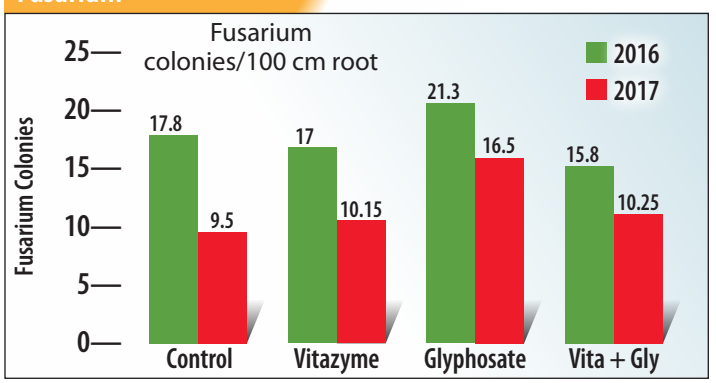
Maize Root Dry Mass



IAA-producing Bacteria

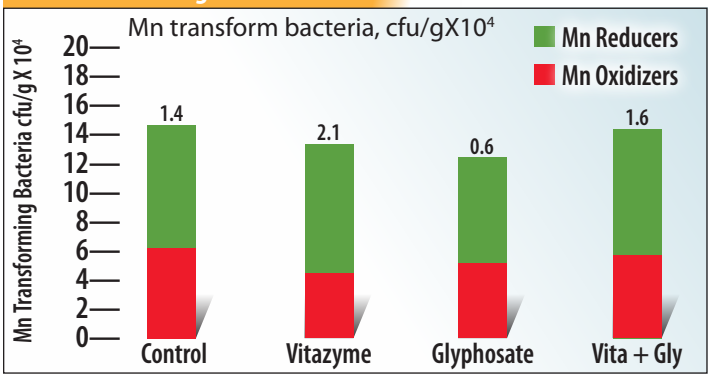


Fusarium

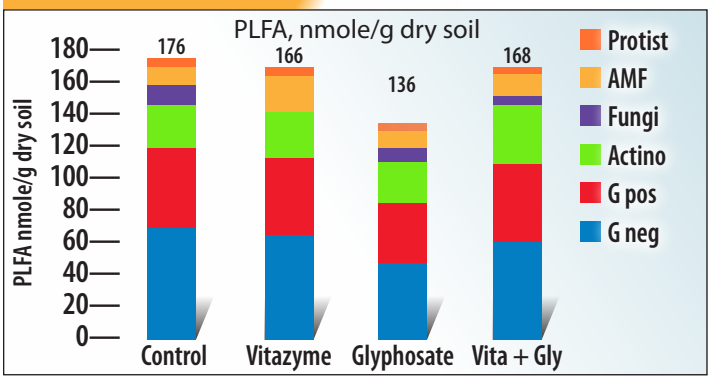


With corn rhizosphere soil samples, the prevalence of Fusarium fungi is much higher when glyphosate is applied to the leaves, but when Vitazyme is added with the glyphosate these fungi are held in check. The same occurs with soybeans.

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.

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Corn *with Vitazyme application*

Researcher: Vadim Plotnikov
Research organization: PE "Bondarenko", Ukraine, Plant Designs, New York, USA, and Agro Expert International, Ukraine
Location: Rozdilna District, Odessa Region, Rozdilna Village, Ukraine
Variety: KVS Kaifus, FAO 330
Seeding rate: 60,000 seeds/ha
Planting date: May 4, 2017
Previous crop: wheat
Soil type: typical Chernozem; humus = 3.9%
Soil preparation: disking to 6-8 cm, plowing to 22-24 cm, harrowing to 5-6 cm
Experimental design: A corn field was divided into Vitazyme treated and untreated control areas to determine the efficacy of this product in promoting yield increases.

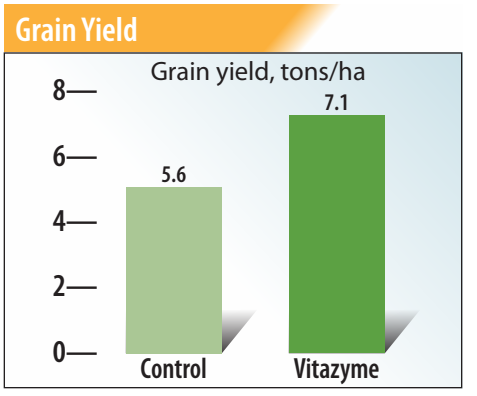
Note the improved ear development with Vitazyme treatment in Ukraine.

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

Fertilization: 50-70 kg/ha of N-S broadcast before planting
Vitazyme application: 1 liter/ha sprayed on the leaves and soil at the 8 to 9-leaf stage
Growing season weather: dry
Yield results:

Treatment	Grain yield	Yield change
	tons/ha	ton/ha
1. Control	5.6	—
2. Vitazyme	7.1	1.5 (+27%)

Increase in grain yield with Vitazyme: 27%



Vadim Plotnikov examines corn sampled from a Vitazyme treatment in Ukraine. Such increases have been highly profitable in the country.

Income results: At a price of $164.67/ton of corn grain, the added 1.5 tons/ha gave an additonal $247/ha income.
Conclusions: A corn trial in southern Ukraine, utilizing 1 liter/ha sprayed on the leaves and soil at the 8 to 9-leaf stage, revealed that the grain yield responded excellently by increasing 1.5 tons/ha (27%). This increase resulted in a profit enhancement of $247/ha, showing how this program is an excellent addition to corn farmers' cultural programs in Ukraine.

Corn *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: Cobalt, FAO 320
Seeding rate: 70,000 seeds/ha
Planting date: May 3, 2017
Previous crop: wheat
Soil type: dark-brown podzolic; humus = 2.6%
Soil preparation: disking to 6-8 cm, plowing to 22-24 cm, cultivation to 5-6 cm
Experimental design: A corn field was divided into Vitazyme treated and control portions to discover the efficacy of this product in promoting grain yield.

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

Fertilization: 115 kg/ha of N broadcast before planting, and 10-26-26 kg/ha $N\text{-}P_20_5\text{-}K_20$ in-furrow at planting

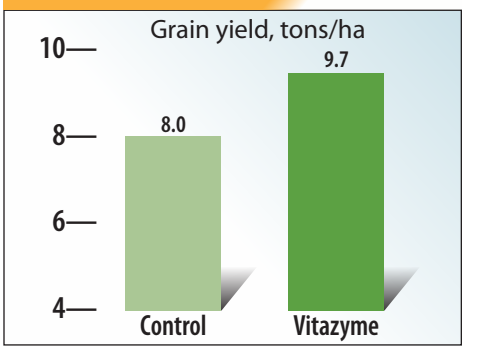
Vitazyme application: 1 liter/ha sprayed on the leaves and soil on June 5, 2017, at the 7 to 8-leaf stage
Growing season weather: dry
Yield results:

Treatment	Grain yield	Yield change
	tons/ha	ton/ha
1. Control	8.0	—
2. Vitazyme	9.7	1.7 (+21%)

Yield increase with Vitazyme: 21%

Income results: At $166.47/ton, the extra 1.7 tons/ha yielded $283/ha greater income.

Grain Yield



Conclusions: A Ukrainian large-scale field trial with corn in 2017, using a single 1 liter/ha foliar/soil application in early June, revealed that grain yield was increased by 1.7 tons/ha (21%), which gave an additional income of $283/ha. These results show the considerable efficacy of utilizing this program for more profitable corn culture in Ukraine.

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

Dr. Nathan displays the Vitazyme treated corn ears on the right, and the control ears on the left. The difference in kernel development is obvious.

Note the superior rooting and ear development for the Vitazyme treatment at the Greenley Center trial.

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
Variety: Unknown
Soil type: clayey
Row spacing: 30 inches
Experimental design: A small plot corn 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 corn, as well as the effects of these products on the rhizosphere soil microbial populations of Fusarium and beneficial bacteria. Soil residues of glyphosate were also evaluated.

Treatment	In-furrow	Foliar, 8-leaf stage
	bu/acre	bu/acre
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 corn growth
Yield results:

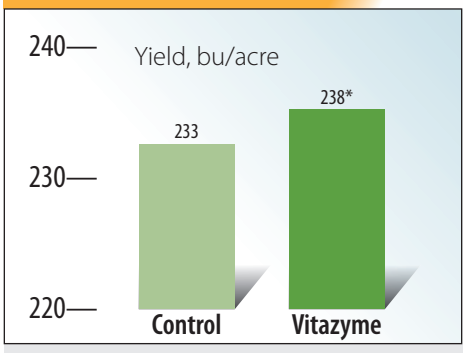
Treatment	Yield	Yield change
	bu/acre	bu/acre
1. Control	229	—
2. Glyphosate	237	8 (+3%)
3. Vitazyme	238	9 (+4%)
4. Vitazyme + Glyphosate	239	10 (+4%)
P>F	0.079	

Increase in corn yield

Glyphosate 3%
Vitazyme 4%
Vitazyme + Glyphosate ...4%

Yield differences were almost significant at P=0.05, with the combined products yielding the most.

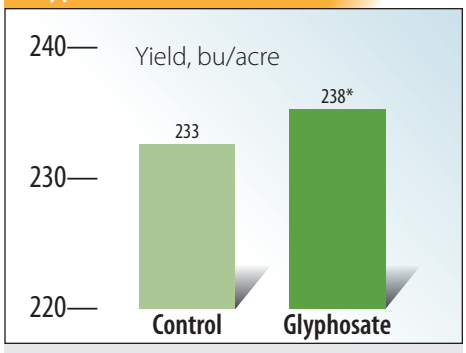
Vitazme Effect on Corn Yield



*Significantly greater than the control at P=0.018.

Increase in yield with Vitazyme: 2%

Glyphosate Effect on Corn Yield



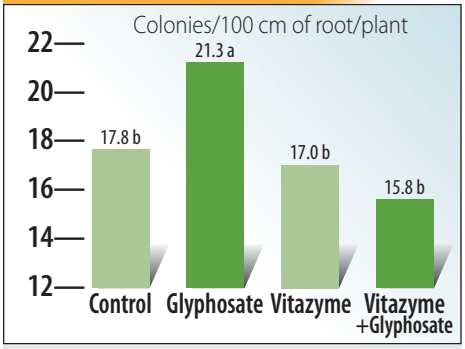
*Significantly greater than the control at P=0.029.

Increase in yield with glyphosate: 2%

For the Vitazyme and glyphosate yield analyses, all plots treated with that material were compared with all plots that were not treated with it.

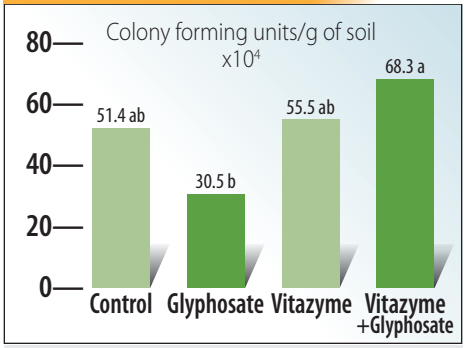
Soil microbial results:

Fusarium Root Colonization[1]



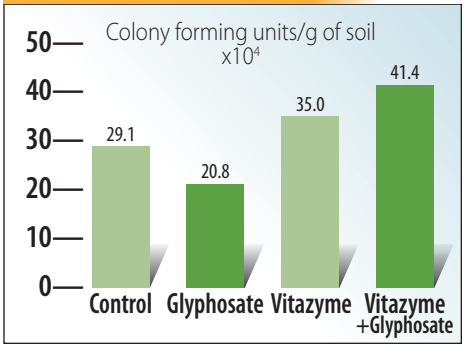
[1]Means followed by the same letter are not significantly different at P=0.05.

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



Changes in Fusarium Colonization

Glyphosate ..... +20%
Vitazyme ..... -4%
Vitazyme + Glyphosate...-11%

Glyphosate increased Fusarium infection, but Vitazyme combined with glyphosate reduced the infection below both Vitazyme and the control.

Changes in Fluorescent Pseudomonas Colonization

Glyphosate ..... -41%
Vitazyme .....+8%
Vitazyme + Glyphosate... +33%

Glyphosate reduced Fluorescent Pseudomonas colonization by 41% below the control, while Vitazyme + Glyphosate increased levels well above the control and Vitazyme levels.

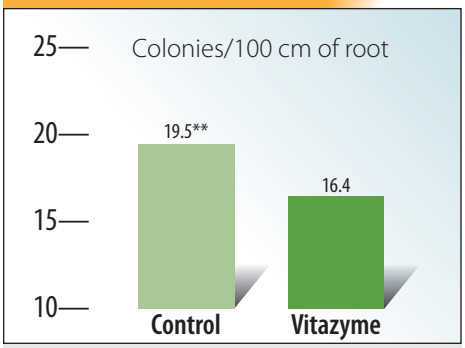
Changes in IAA-Producing Bacteria Colonization

Glyphosate ..... -29%
Vitazyme .....+20%
Vitazyme + Glyphosate... +42%

Glyphosate reduced IAA-producing bacteria below the control, while Vitazyme increased the levels, and the combined products increased levels by 42% above the control.

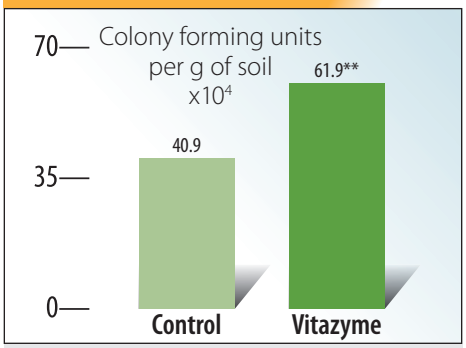
Vitazyme Effects on Fusarium and Bacterial Organism Colonization

Fusarium



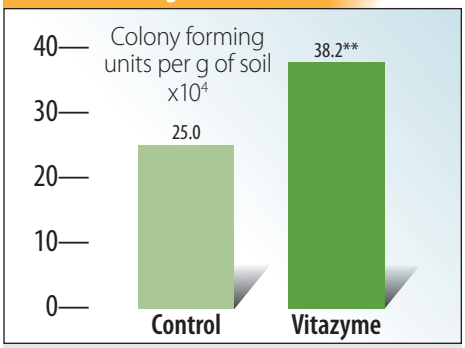
**Significantly greater than Vitazyme at P=0.01.

Fluorescent Pseudomonas



**Significantly greater than the control at P=0.01.

IAA-Producing Bacteria



**Significantly greater than the control at P=0.01.

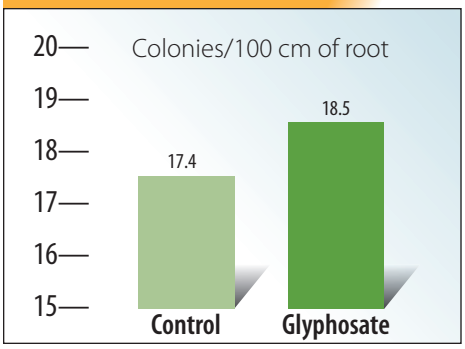
Changes with Vitazyme

Fusarium ..... -16%
Fluorescent Pseudomonas ... +51%
IAA-Producing Bacteria 53%

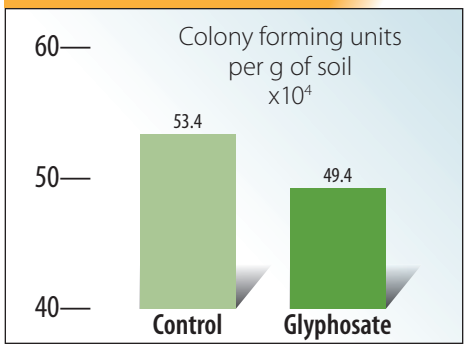
All Vitazyme treated plots were compared with all untreated plots, which revealed a highly significant reduction in Fusarium with Vitazyme, while beneficial bacteria increased by significant 51% and 53% levels.

Glyphosate Effects on Fusarium and Bacterial Organism Colonization

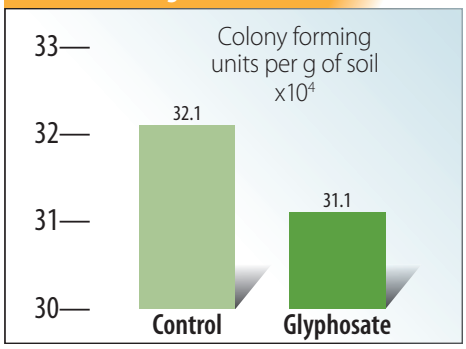
Fusarium



Fluorescent Pseudomonas



IAA-Producing Bacteria



Changes with Glyphosate

Fusarium .....+6%
Fluorescent Pseudomonas ..... -7%
IAA-Producing Bacteria ..... -3%

All glyphosate treated plots were compared with all untreated plots, which revealed a trend toward more Fusarium lesions and fewer beneficial bacteria, though none of these differences are significant.

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 x10⁴	cfu/g soil x10⁴	cfu/g soil x10⁴	ug/kg soil	ug PNP/g soil/hr
1. Control	133	6.25	8.47	1.38	274	173
2. Glyphosate	105 (-21%)	11.9 (+90%)	6.08 (-28%)	0.604 (-56)	940 (+243%)	147 (-15%)
3. Vitazyme	121 (-9%)	4.25 (-32%)	8 .85 (+4%)	2.09 (+51%)	501 (+83%)	262 (+51%)
4. Vitazyme + Glyphosate	122 (-8%)	5.66 (-9%)	8.97 (+6%)	1.64 (+19%)	1,000 (+265%)	216 (+25%)
P>F	0.077	0.154	0.334	0.391	0.383	0.683

[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 x10⁴	cfu/g soil x10⁴	cfu/g soil x10⁴	ug/kg soil	ug PNP/g soil/hr
1. Control	119	9.07*	7.27	0.991	607	160
2. Vitazyme	122	5.04	8.91	1.86**	750	239**
P>F	0.718	**0.019**	0.218	**0.001**	0.148	**0.009**

*Significantly greater than the control at P=0.05; **Significantly greater than the control at P=0.01.

All Vitazyme treated plots were compared with all untreated plots. Note that manganese oxidizers were significantly reduced with Vitazyme, while manganese reducers increased. The reduced form of Mn is the form utilized by plants. This change in oxidation state for Mn resulted in a highly significant increased in the Red/0x Ratio with Vitazyme. The soil enzyme level was also significantly increased 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 x10⁴	cfu/g soil x10⁴	cfu/g soil x10⁴	ug/kg soil	ug PNP/g soil/hr
1. Control	127	5.33	8.66	1.73	387	218
2. Glyphosate	113 (-11%)	8.77* (+65%)	7.52 (-13%)	1.12** (-35)	970** (+151)	181 (-17%)
P>F	0.083	**0.038**	0.380	**0.008**	**0.001**	0.158

*Significantly greater than the control at P=0.001.. **Significantly different than the other treatment at P=0.01.

All glyphosate treated plots were compared with all untreated plots. Phospholipids and soil enzymes were reduced by glyphosate, as were Mn reducers while Mn oxidizers were significantly increased (+65%) above the control. The Red/Ox Ration was reduced by 35%, meaning few Mn^{++} ions were available with glyphosate, and glyphose residues were increased by an amazing 151% with the glyphosate treatment.

Conclusions: This University of Missouri small-plot corn trial, using a Vitazyme in-furrow and foliar application, with and without glyphosate for the foliar application, and with glyphosate alone, revealed that Vitazyme remediated the negative effects of the herbicide on soil organisms and other parameters. Yield was increased by 5 bu/acre — as for glyphosate — and Fusarium root infection was significantly decreased by 16%; at the same time, Fluorescent Pseudomonas and IAA-producing bacteria were significantly increased. Manganese-reducing bacteria were increased by Vitazyme, and Mn-oxidizing bacteria were significantly reduced with Vitazyme, while soil B-glucosamine activity was increased as well. Glyphosate, on the other hand, produced opposite effects from Vitazyme by increasing Mn-oxidizers and Fusarium infection, while reducing beneficial microorganisms like Fluorescent Pseudomonas, IAA-producing bactera, and Mn-reducers, while reducing phospholipid fatty acids and soil enzyme activity. Most notably, when Vitazyme was added to the glyphosate before spraying, the negative effect of the glyphosate on Fusarium and beneficial bacteria were reversed. These data indicate that, besides being a yield booster, Vitazyme, when applied with glyphosate herbicide, can remediate the damage this herbicide can do to the plant and soil, and thus is a natural remedy for farmers to add along with glyphosate in the sprayer tank.

Corn *with Vitazyme application*

Researcher: V. V. Plotnikov
Research institution: Agro Expert International, Vinnytsya, Ukraine
Location: L. L. C. Zlahoda, Vyshnivtsi Village, Onuphriy District, Kirovohrad Region, Ukraine
Variety: DKS 3511, FAO 330
Planting date: April 29, 2016
Seeding rate: 70,000 seeds/ha
Previous crop: winter wheat
Soil type: dark gray podzolic (2.6% 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 corn field was divided into a Vitazyme treated and untreated area, with the objective of determining the effect of this product on the yield of the grain.

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

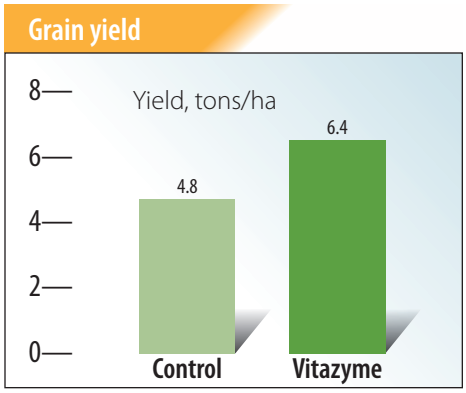
Fertilization: 115 kg/ha of N pre-plant; at planting instead of 12-52-0 kg/ha of $N\text{-}P_2O_5\text{-}K_2O$ in-row
Vitazyme application: 1.0 liter/ha on the leaves and soil at the 7 to 8-leaf stage on June 2, 2016

Yield results:

Treatment	Grain yield	Yield change
	tons/ha	tons/ha
Control	4.8	—
Vitazyme	6.4	1.6 (+33%)

Increase in grain yield with Vitazyme: 33%

Income results: Vitazyme increased net profit by 263 USD/ha.
Conclusions: A corn trial in central Ukraine using Vitazyme at 1.0 liter/ha on the leaves and soil produced a 33% yield increase. Profits were substantially increased proving the viability of this product for corn production in central Ukraine. A yield increase of this magnitude resulting from the 127 kg/ha of N used in this trial reveals the improvement in nitrogen efficiency this program affords.



Corn *with Vitazyme application*

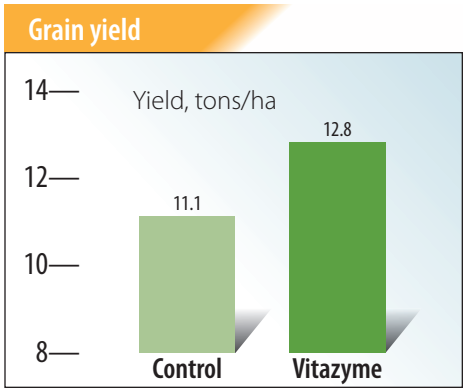
Researcher: V. V. Plotnikov
Research institution: Agro Expert International, Vinnytsya, Ukraine
Location: Family Enterprise Kolyvailo, Miziakivs'ki Hutory Village, Vinnytsya Region, Ukraine.
Variety: DKS 4408 FAO 340
Planting date: April 25, 2016
Seeding rate: 75,000 seeds/ha
Previous crop: winter wheat
Soil type: Chernozem (3.0% 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 corn field was divided into a Vitazyme treated and untreated area, with the objective of determining the effect of this product on the yield of the grain.
Fertilization: 92 kg/ha of N pre-plant; at planting, 10-26-26 kg/ha of N-$P_2 0_5$-$K_2 0$ in-row; 46 kg/ha of N side-dressed
Vitazyme application: 1.0 liter/ha on the leaves and soil at the 7 to 8-leaf stage on May 31, 2016

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

Yield results:

Treatment	Grain yield	Yield change
	tons/ha	tons/ha
Control	11.1	—
Vitazyme	12.8	1.7 (+15%)

Increase in grain yield with Vitazyme: 15%



Income results: Vitazyme increased net profit by 281 USD/ha.

Conclusions: This Vitazyme foliar and soil treatment trial in Ukraine showed that only 1 liter/ha produced a 15% yield increase. Profits were also substantially increased, showing the viability of this product for corn production in central Ukraine on Chernozem soils.

Corn *with Vitazyme application—A Nitrogen Efficiency Study*

Notice the much improved root development when Vitazyme is applied to the seeds and leaves.

The research plots at South Dakota State University produced excellent yield and nitrogen efficiency data for 2016.

Researcher: Dr. David Clay and Graig Reicks
Research institution: Department of Plant Sciences, South Dakota State University, Brookings, South Dakota
Location: South Dakota State University, Field Research Facility, Aurora, South Dakota
Variety: DKC 49-72 (99-day hybrid)
Planting date: May 14, 2016
Planting rate: 32,000 seeds/acre
Planting depth: 2 inches
Row spacing: 30 inches
Soil type: Strayhoss-Maddox Complex, 2% slope, loam texture
Experimental design: A replicated randomized complete block design, with plots 6 rows wide (15 feet) and 20 feet long, was established to determine the effectiveness of Vitazyme as both a seed and a soil treatment for corn. Yield measurements were made, and also ^{15}N measurements were made using a mass spectrometer to determine the effeciency of nitrogen use within the plant. Three fertilizer nitrogen rates were used, and four replications.
Fertilization: Nitrogen fertilizer was applied by hand as urea (46%) to appropriate plots on June 13, 2016, when the corn was at the V3 stage.
Vitazyme application: Seed treatment (at planting on May 14): 112 ml of Vitazyme per 10 lb of seed, or 7.4 oz/acre sprayed on the seeds and mixed on a tarp; ***Foliar treatment*** (on June 29 at V 8-9) at 13 oz/acre, using a 15 gal/acre spray solution, with a non-ionic surfactant (0.25% v/v) and a backpack sprayer.
^{15}N determinations: A mass spectrometer was used at the Department of Plant Science, South Dakota State University.

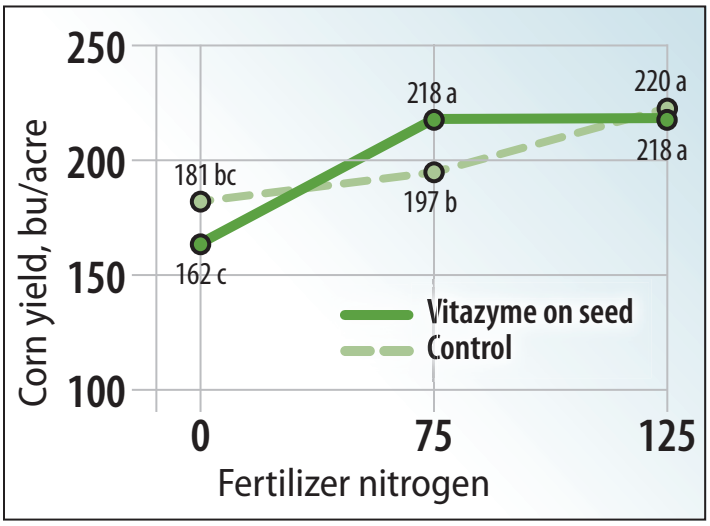
Nitrogen rate	Vitazyme application			
	None	Seeds	Leaves	Seeds + Leaves
lb/acre	(treatment number)			
0	1	4	7	10
75	2	5	8	11
125	3	6	9	12

Yield and nitrogen results: At the time of this reporting, only the seed treatment results are given. The full report will be available at a later date.

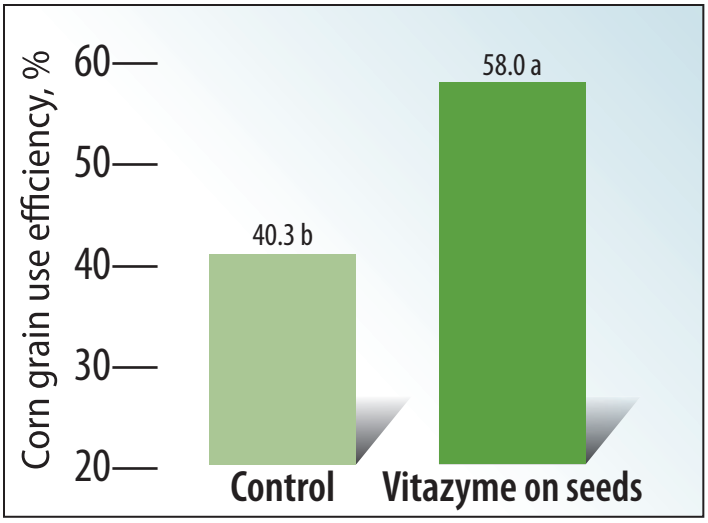
Treatment	Nitrogen fertilizer	Corn yield[1]	Corn grain use efficiency[2]
	bu/acre	bu/acre	%
1. None	125	220 a	43.3 b
	75	197 b	40.3 b
	0	181 bc	—
2. Vitazyme on seeds	125	218 a	42.6 b
	75	218 a	58.0 b
	0	162 c	

[1]Means followed by the same letter are not significantly at P=0.05.
[2]Means followed by the same letter are not significantly different at P=0.10. The calculations used to determine this value are based upon 14N and 15N ratios in the grain, and will not be presented in this report.

Vitazyme Seed Treatment Effect on Corn Yield



Vitazyme Seed Treatment Effect on Corn Grain Use Effeciency at 75 lb/acre nitrogen



Increase in corn yield with Vitazyme seed treatment: 21 bu/acre, or 11%

At the same nitrogen level, with or without a Vitazyme seed treatment, the yield increased by 11%, which was the same yield as for the high nitrogen rate (125 lb/acre) with the seed treatment. Thus, the nitrogen utilization was improved greatly with Vitazyme, as evidenced by the Corn Grain Use Efficiency value.

Ear and root development are improved with a seed and a foliar Vitazyme treatment, as seen here.

Improvement in nitrogen use efficiency of the grain with Vitazyme on seeds: 17.7 %-points

This improvement in the use of nitrogen by the seeds was dramatically shown at the reduced N rate of 75 lb/acre. It did not occur at the 125 lb/acre N rate, showing the potential of Vitazyme's active agents to greatly improve N transfer into the grain when fertilizer N is somewhat limiting.

Conclusions: A small plot, replicated corn trial near Brookings, South Dakota, using 12 treatments with a Vitazyme seed treatment, a foliar treatment, or both, at three nitrogen levels (0, 75, and 125 lb of N/acre), revealed a pronounced yield response at the reduced nitrogen level (75 lb/acre) for the seed treatment. The corn yield jumped by 11%, from 197 to 218 bu/acre, a highly significant increase that equalled the seed treatment yield at the high nitrogen level (125 lb/acre). This high yield was about the same as the yield obtained at 125 lb/acre of nitrogen without Vitazyme on the seeds. Calculations of nitrogen use efficiency using ^{15}N computations revealed that, at the reduced 75 lb/acre nitrogen rate, the efficiency of nitrogen movement into the grain was greatly enhanced with the Vitazyme seed treatment, increasing from 40.3% to 58.0%. This increase occured at the reduced nitrogen rate only, revealing that when more fertility stress existed the brassinosteroids and other active agents in Vitazyme caused more nutrients to be translocated into the grain out of the total fertilizer added, compared to the untreated corn at the same 75 lb/acre nitrogen rate.

Corn *South Dakota State University—Nitrogen and Water Use Efficiency*

Corn receiving 125 lb/acre of N in this nitrogen efficiency trial at South Dakota State University produced a much greater root mass when treated with Vitazyme.

Typical ears for the 125 lb/acre nitrogen treatment reveal greater ear size with Vitazyme applied twice, leading to a 9 bu/acre (6%) yield increase and better nitrogen utilization.

Researchers: David Clay, Ph.D., and Craig Reicks, Research Assistant II
Research institution: South Dakota State University, Department of Plant Science, Brookings, South Dakota
Location: Aurora, South Dakota
Variety: NK N41Y-3000 GT (98-day hybrid)
Plant population: 32,000 seeds/acre
Tillage: conventional
Soil type: Brandt silty clay loam
Planting date: May 16, 2014
Experimental design: A site for small plot studies was selected at the South Dakota State University research facility near Aurora. Plots of 10 x 20 feet (5 x 10 feet harvested) were laid out with four treatments in a randomized complete block design to determine the effects of Vitazyme, applied to the seed, leaves, and both, on the yield, nitrogen-use efficiency, and water-use efficiency of corn. Three nitrogen rates were used.

	Vitazyme application			
Nitrogen rate	None	Seeds	Foliage	Seeds + Foliage
lb/acre	(treatment number)			
0	x(1)	x(4)	x(7)	x(10)
75	x(2)	x(5)	x(8)	x(11)
125	x(3)	x(6)	x(9)	x(12)

Fertilization: Urea was broadcast on June 4 over the appropriate plots at 75 or 125 lb/acre of nitrogen around planting time.
Vitazyme application: (1) seed treatment of 5% Vitazyme, with 3.2 oz misted and mixed by hand with 10 lb of seed; (2) 13 oz/acre sprayed on the leaves and soil at the 6-leaf stage (V6) on July 9, at 15 gal/acre of solution. A non-ionic surfactant was added at 0.5% of the total solution.
Growing season weather: wetter than normal (12.33 inches for June through August, versus the average of 10.73 inches), and cooler than normal (1,585 growing degree days versus the average of 1,668)
Harvest date: The middle two rows of each plot were hand-picked on October 31, ears were dried at 140° F, and then shelled and weighed.

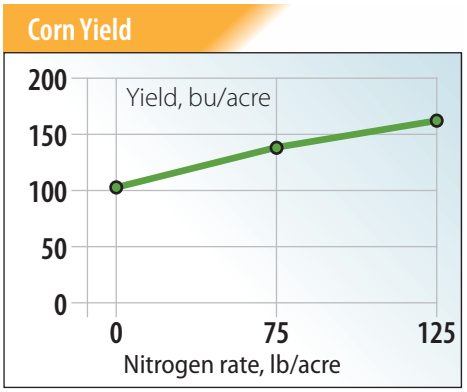
Yield results: NOTE: There were planting difficulties for the seeds treated with Vitazyme—populations were low—so these plots were replanted once the error was detected. However, the plants failed to respond normally, so these data have been eliminated from some analyses.

Nitrogen Fertilizer Effects

Treatment	Yield[1]	Yield change
	bu/acre	bu/acre
No nitrogen	106 c	—
75 lb/acre nitrogen	146 b	40 (+38%)
125 lb/acre nitrogen	160 a	54 (+51%)

[1] Yields followed by different letters are significantly different at P=0.01.

Nitrogen fertilizer produced a straight-line yield response over the three N levels, and over all Vitazyme treatments.



Vitazyme Effects at Three Nitrogen Levels

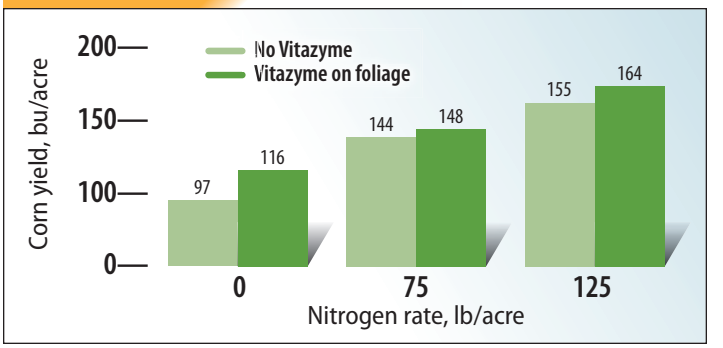
In this analysis, plots that received and did not receive the Vitazyme seed treatment are included.
Vitazyme applied to both the seeds and foliage overcame the drop in corn yield with the seed treatment above. The reason for this is not understood.

Corn *South Dakota State University—Nitrogen and Water Use Efficiency cont.*

Nitrogen rate	Vitazyme	Grain yield	Yield change
lb/acre		bu/acre	bu/acre
0	0 Foliage	97 116	— +19[a](+20%)
75	0 Foliage	144 148	— +4[b](+3%)
125	0 Foliage	155 164	— +9[c](+6%)

[a]Significant at P=0.09; [b]Significant at P=0.40; [c]Significant at P=0.03.

Corn Yield



Yield, nitrogen efficiency, and water efficiency effects:

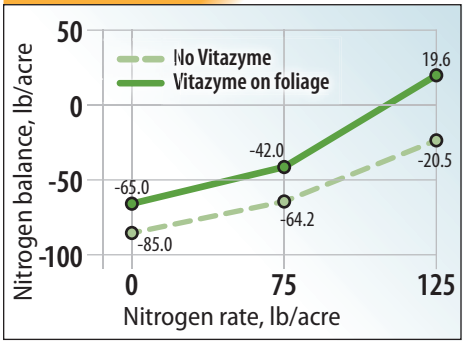
The determination of nitrogen (N) and water efficiency is done through the calculation of isotopes of nitrogen and carbon, using a mass spectrometer. The calculation of these efficiencies, and related parameters, is complex and will not be discussed here, but can be reviewed in a paper by K. Kim, D. Clay, C. Carlson, S. Clay, and T. Trooien entitled "Do synergistic relationships between nitrogen and water influence the ability of corn to use nitrogen derived from fertilizer and soil?" (Agronomy Journal 100 [3], 2008, pages 551-557).

The following analyses were made using only the foliar Vitazyme applications, to avoid the problems associated with the seed treatment, as discussed earlier. Probabilities of significant differences are indicated beneath each pair of values.

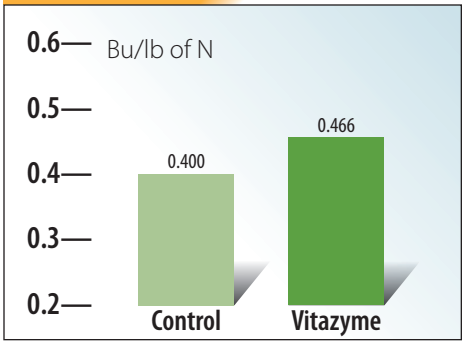
N-rate	Treatment	N-efficiency	N-balance[1]	^{15}N%	^{13}C%	^{15}N%	^{13}C%	Soil inorganic N balance
		bu/lb of N		—% in grain—		—% in stover—		lb/acre
0	Vitazyme	—	- 65.0	0.36	- 11.2	- 0.83	- 11.9	0.23
	Control	—	- 85.0	1.05	- 11.3	- 2.81	- 11.8	- 11.2
			p=0.48	p=0.41	p=0.72	p=0.30	p=0.34	p=0.58
75	Vitazyme	0.538	- 42.0	0.116	- 11.19	- 2.12	- 11.93	- 5.6
	Control	0.563	- 64.2	0.632	- 11.26	- 0.53	- 11.97	- 14.3
		p=0.61	p=0.11	p=0.16	p=0.08	p=0.65	p=0.79	p=0.49
125	Vitazyme	**0.466**	**19.6**	0.765	- 11.33	**- 0.66**	- 11.94	**29.5**
	Control	**0.400**	**- 20.5**	1.251	- 11.43	**5.76**	- 12.11	**- 16.2**
		p=0.01	**p=0.01**	p=0.44	p=0.23	**p=0.02**	p=0.43	**p=0.01**

[1]A higher value means more efficient uptake of N.

Nitrogen Balance



Nitrogen Efficiency at 125 lb/acre N



Increase in N-efficiency with Vitazyme: 17%

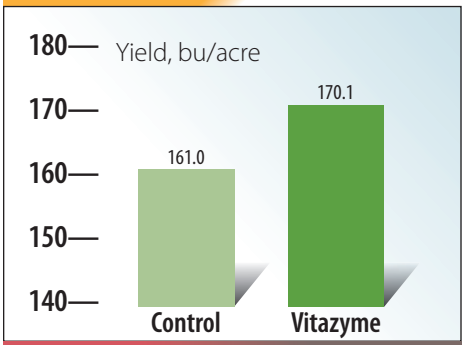
At all three nitrogen rates, foliar Vitazyme treatment increased N-use efficiency, especially at 125 lb/acre N.

At the typical farm-applied rate of 125 lb/acre of N, Vitazyme treated corn produced 0.066 more bushels/acre per pound of nitrogen than the control.

Corn *South Dakota State University—Nitrogen and Water Use Efficiency cont.*

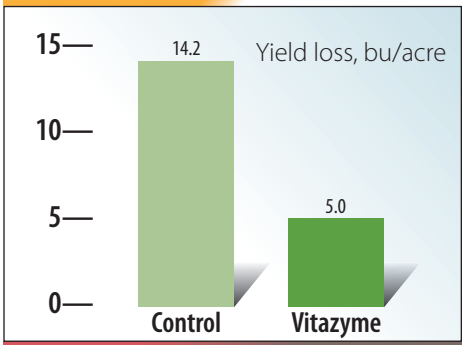
N-rate	Treatment	Grain yield	Yield loss, nitrogen stress	Yield loss, water stress
lb/acre		bu/acre	bu/acre	bu/acre
0	Vitazyme	94.4	20.1	60.9
	Control	105.8	12.4	57.2
		p=0.49	p=0.32	p=0.75
75	Vitazyme	146.2	5.66	23.7
	Control	152.0	2.60	21.1
		p=0.16	p=0.58	p=0.75
125	Vitazyme	**170.1**	0.634	**5.0**
	Control	**161.0**	0.470	**14.2**
		p=0.01	p=0.53	**p=0.02**

Grain Yield with 125 lb/acre N



Increase in grain yield with Vitazyme: 6%

Yield Loss from Water Stress at 125 lb/acre N



Yield loss reduction due to water stress with Vitazyme: 9.2 bu/acre

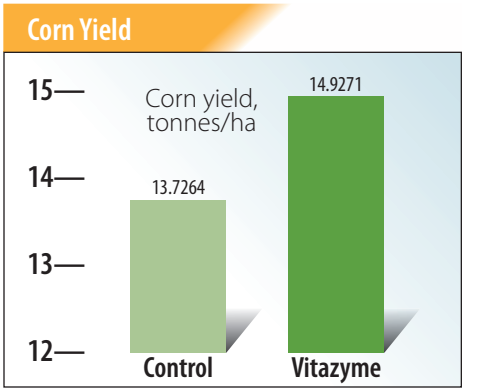
Conclusion: A corn trial in eastern South Dakota designed to evaluate the effects of Vitazyme seed and foliar treatments on grain yield, and nitrogen (N) and water use efficiency at three N levels, was impaired by a poor plant population for the seed treated plots. Thus, in most cases only the foliar treatment treated at V6 was evaluated. In spite of this limitation, Vitazyme improved grain yield significantly at the 125 lb/acre N rate (+6%), increased N-efficiency by 17%, and reduced the yield loss due to water stress by 9.2 bu/acre; the control yield loss at 125 lb/acre N was 14.2 bu/acre. The 0 and 75 lb/acre N rates did not show significant yield or N and water use responses, for unknown reasons. Moreover, N-balance was improved at all fertility levels, especially at the 125 lb/acre N application rate. Since this highest of the three rates is similar to a typical farmer N application rate, the value of Vitazyme use for improved nitrogen and water use efficiency is displayed in this study, the result being a 9.1 bu/acre yield increase. A seed treatment along with the foliar application would likely have triggered significant responses for all parameters at all three N application rates.

Corn *with Vitazyme application*

Researchers: Ernesto Infante, Lucero Fernandez, and Edgar Ortiz
Research organizations: La Mazorca and Quimica Lucava
Location: Daniel Hernandez Farm, La Barca, Jalisco, Mexico
Variety: Asgrow Antelope
Planting date: April 30, 2015
Row Spacing: 0.75 meter
Experimental design: A corn field of 4.75 ha was selected to treat 1.0 ha with Vitazyme, to determine effects of the product on crop growth, insect infestation, and yield. Two Vitazyme applications were made.

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

Fertilization: unknown
Vitazyme application: (1) seed treatment on a tarp before planting on April 30 using 250 ml of Vitazyme with a backpack sprayer, and allowing the seeds to dry before planting; (2) 1 liter/ha sprayed on the leaves and soil 30 days later on May 30
Harvest date: October 20, 2015
Growth results: The treated corn grew much faster than the control, being 10 to 15 cm taller in the early stages with darker green leaves and considerably less incidence of fall army worm.
A growth difference was visible even up to harvest, when the Vitazyme treated portion of the field was taller, with more leaf area, and larger ears.



Yield results: On October 20, 16 rows of the treated and the control areas were harvested for 205.6m, giving a harvested area of 2,467.2m^2

Treatment	Plot yield	Grain moisture	Moisture-corrected yield[1]	Yield change
	kg/2,467m^2	%	kg/ha	kg/ha
Control	3,385	13.96	13,726.4	—
Vitazyme	3,670	13.70	14,927.1	1,200.7 (+9%)

[1]Correction factor: (100-% H_2O)/86: Dry yield = (Correction factor) (Harvested yield/ha).

Increase in corn yield with Vitazyme: 9%

Income results: Using a corn price of $0.225 (U.S.)/kg, the income is as follows:

Treatment	Dry yield	Gross income	Income change	Net income change[1]	Cost : benefit[2]
	tons/ha	USD/ha	USD/ha	USD/ha	
Control	13.7264	3,088.44	—	—	—
Vitazyme	14.9271	3,358.60	270.16	226.89	5.2

[1]Vitazyme costs for overall 1.25 L/ha, including labor = 43.34 USD/ha. [2]Cost : Benefit = (Net income increase)/(Vitazyme cost).

Conclusions: This corn study in Mexico revealed that a 0.25 liter/ha Vitazyme seed treatment at planting, followed by a 1.0 liter/ha foliar and soil application 30 days later, greatly improved corn growth and yield. Faster growth of the plant, more leaf chlorophyll, and less army worm incidence led to a yield increase of 9%, and an excellent cost : benefit of 5.2, showing the excellent efficacy of this program for corn growers in Mexico.

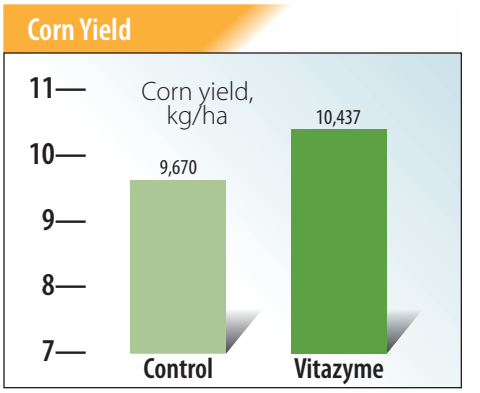
Corn *with Vitazyme application*

Researchers: Bartolo González and Lucero Fernandez
Farmer: Irrigation District 011
Research organizations: CVYTTS and Quimica Lucava
Location: Irapuato, Guanajuato, Mexico
Variety: CERES XR47
Planting date: May 12, 2014
Experimental design: A 1 hectare area of a corn field was treated twice with Vitazyme to determine its effects on growth, yield, and profitability compared to an adjoining untreated control area.
Fertilization: unknown
Vitazyme application: (1) a seed treatment at 250 ml/ha on May 12, 2014; (2) foliar and soil spray at 1 liter/ha on June 20, 2014
Growth observation: The Vitazyme treated plants had *more extensive roots* and *greater plant vigor*.
Harvest date: December 16, 2014

Yield results:

Treatment	Yield	Yield change
	kg/ha	kg/ha
Control	9,670	—
Vitazyme	10,437	767 (+8%)

Increase in corn yield with Vitazyme: 8%



Income results: The corn price was USD 0.25/kg. Vitazyme overall cost, including labor = USD 46.43/ha.

Added income with Vitazyme: 191.75 USD/ha
Added profit with Vitazyme: 145.32 USD/ha
Cost : Benefit with Vitazyme: 3.13

Conclusions: This Mexican corn trial showed an excellent yield increase (8%) and income improvement (145.32 USD/ha) with two Vitazyme applications, proving it's great efficacy for use in corn production in Mexico.

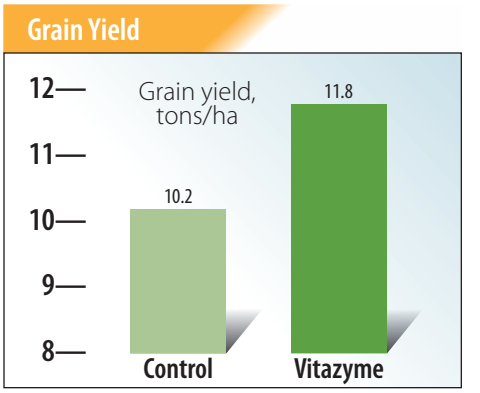
Corn *with Vitazyme application*

Researcher: V. V. Plotnikov
Research organizations: Agricultural LLC, "Palmira Vidhodivlya", Ukraine
Location: Zolotonosha District, Cherkasy Region, Voznesens'ke Village, Ukraine
Variety: DKS 4590 hybrid
Seeding rate: 75,000/ha
Planting date: April 26, 2015
Previous crop: soybeans
Cultivation methods: disking to 8 cm, plowing to 24 cm, cultivation to 6 cm
Experimental design: A trial with Vitazyme on corn involved dividing a field into a Vitazyme treated and an untreated area. The purpose of the trial was to evaluate the product's effects on corn yield and profitability.
Fertilization: 10 kg/ha N, 26 kg/ha $P_2 0_5$, and 26 kg/ha $K_2 0$ in-furrow at planting; 115 kg/ha N broadcast pre-plant

Vitazyme application: 1 liter/ha on the leaves and soil on May 31, 2015, at the 7 to 8-leaf stage
Yield results: Harvest date is unknown

Treatment	Yield	Yield change
	tons/ha	tons/ha
Control	10.2	—
Vitazyme	11.8	1.6 (+16%)

Increase in grain yield with Vitazyme: 16%



Income results: A 1 liter/ha application gave a profit increase of 4,710 UAH/ha.

Conclusions: In this Ukraine corn trial, a single soil and foliar Vitazyme application of 1 liter/ha, at the 7 to 8-leaf stage, resulted in a substantial yield increase of 16%, and a profit improvement of 4,710 UAH/ha. This result indicates the great efficacy of this program for use by corn growers in Ukraine.

Corn *with Vitazyme application*

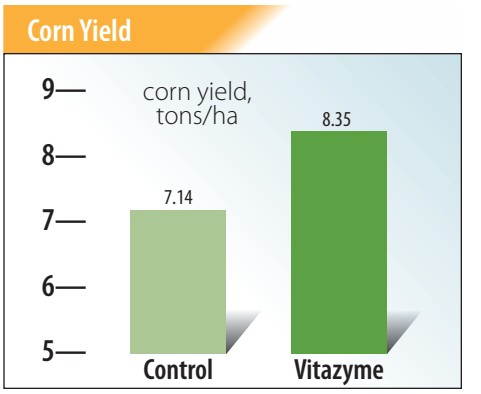
Researcher: V. V. Plotnikov
Research organization: Small Private Enterprise, "Firm Harant", Ukraine
Location: Teplyts'kyi District, Vinnytsya Region, Teplyk Town, Ukraine
Variety: P9175 hybrid
Seeding rate: 70,000/ha
Planting date: April 24, 2015
Previous crop: winter wheat
Soil type: podzolized chernozem
Cultivation methods: disking to 8 cm, plowing to 24 cm, cultivation to 6 cm
Experimental design: A corn field was divided into a Vitazyme treated and an untreated area to determine the effectiveness of Vitazyme for improving grain yield and profitability.

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

Fertilization: 18 kg/ha N, 18 kg/ha P_20_5, and 18 kg/ha K_20 in-furrow at planting; 90 kg/ha N pre-plant broadcast
Vitazyme application: 1 liter/ha sprayed on the leaves and soil at the 7 to 8-leaf stage, on May 28, 2015.
Yield results: Harvest date is unknown

Treatment	Yield	Yield change
	tons/ha	tons/ha
Control	7.14	—
Vitazyme	8.35	1.21 (+17%)

Increase in corn yield with Vitazyme: 17%



Income results: Profit increased by 3,442 U UAH/ha with Vitazyme.

Conclusions: A corn trial in Ukraine in 2015, with 1 liter/ha sprayed on the leaves and soil at the 7 to 8-leaf stage, resulted in the yield increasing by a substantial 17%, giving 3,442 UAH/ha more profit. This great increase reveals the considerable efficacy of this program for corn in Ukraine.

Corn *A Synergism Study with Seaweed*

Researcher: Bertel Schou, Ph.D.
Research organization: ACRES Research, Cedar Falls, Iowa
Location: Cedar Falls, Iowa
Variety: Pioneer P0636AM
Seeding rate: 38,000 seeds/acre
Planting depth: 1.5 inches
Row width: 30 inches
Soil type: Floyd loam (pH=6.3, organic matter=4.0%, cation exchange capacity=15.5 meg/100g, fertility level=excellent, drainage=excellent)
Planting date: May 2, 2015
Experimental design: A small-plot corn trial, using a randomized and 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 corn yield, alone and together.

Corn treated twice with Vitazyme in this Iowa trial produced a much more massive root system, plus a 5% yield increase, than the untreated control. Seaweed did not produce a synergism with Vitazyme.

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

Fertilization: All plots received a fall (2014) broadcast application of 18-16-60 16/acre of N-P_2O_5-K_2O, and 100 lb/acre of N in 2015.
Vitazyme application: For Treatments 2 and 4, (1) 13 oz/acre in-furrow at planting on May 2; (2) 13 oz/acre on the leaves and soil at V6 on June 24.
Seaweed application: For Treatments 3 and 4, (1) 2 qts./acre in-furrow at planting on May 2; (2) 2 qts./acre on the leaves and soil at V6 on July 2; (3) 2 qts./acre on the leaves and soil at VT on July 29. The seaweed was from Ocean Organics bared 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=81°.
Harvest date: October 10, 2015

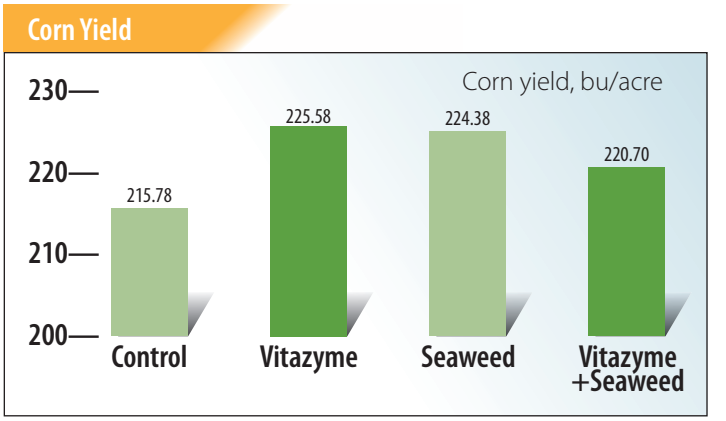
Corn moisture and population results: Grain moisture varied from 16.08 to 16.75% among treatments, and was not significant, while plant population also varied little among treatments.
Yield results: The corn was harvested using a Massey-Ferguson plot combine, with an electronic scale and moisture meter.

Increase in Corn Yield

Vitazyme alone 5%
Seaweed alone..... 4%
Vitazyme + Seaweed..... 2%

Treatment	Corn yield[1]	Yield change
	bu/acre	bu/acre
1. Control	215.78 b	—
2 Vitazyme	225.58 a	9.80 (+5%)
3. Seaweed	224.38 ab	8.60 (+4%)
4. Vita + Seaweed	220.70 ab	4.92 (+2%)
LSD (P=0.05) ($P_2$0.05)	9.52	
CV	2.79	
Replicate probability	0.6926	
Treatment probability	0.2542	

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



Corn *A Synergism Study with Seaweed cont.*

Conclusions: A corn study conducted in east-central Iowa, using small plots with four replications, revealed that Vitazyme, applied at planting in-furrow and sprayed at V6, significantly increased corn yield by 9.80 bu/acre (5%). Seaweed alone, applied in-furrow and twice foliar, increased the yield by 8.60 bu/acre (4%), but the two products combined did not provide additive effects, increasing the yield by 4.92 bu/acre (2%). Grain moisture and plant population were not significantly affected by either product. Results in 2014 with corn at ACRES Research did not show a synergism between the two products when they were applied together, and it was hoped that by separating foliar applications by several days a synergism might occur. However, it did not. Both Vitazyme and seaweed applied alone gave excellent responses to corn yield in 2015.

Corn *A Study with Wet-Sol Adjuvent*

Researcher: Bertel Schou, Ph.D.
Research institution: ACRES (Agricultural Research and Education Services), Cedar Falls, Iowa
Location: Cedar Falls, Iowa
Variety: Pioneer P0636AM (GMO-RR)
Planting date: April 30, 2015
Planting rate: 38,000 seeds/acre
Planting depth: 1.5 inches
Row spacing: 30 inches
Soil type: Floyd Loam (pH=6.1, organic matter=4.0%, cation exchange capacity=15.5 meg/100g, fertility level=excellent, drainage=excellent)
Experimental design: A small-plot corn study was arranged in a randomized complete block design and four replicates, with plots that were 15 (6 rows) x 30 feet; the two center rows from each plot were harvested. The purpose of the study was to evaluate the effect of Wet-Sol 233, a non-ionic adjuvant, at different rates in-furrow and foliar, with and without Vitazyme, on the growth and yield of corn.

	Vitazyme		Wet-Sol 233	
Treatment	In-furrow	Foliar	In-furrow	Foliar
	----------oz/acre----------			
1	0	0	0	0
2	13	13	0	0
3	0	0	16	16
4	0	0	32	16
5	0	0	48	16
6	13	13	16	16

Fertilization: All plots received 18-16-60 lb/acre of N-$P_2 0_5$-$K_2 0$) in the fall of 2014, and 1.00 lb/acre of N in 2015.
Vitazyme application: For Treatments 2 and 6, (1) 13 oz/acre in-furrow at planting on April 30, 2015; (2) 13 oz/acre on the leaves and soil at V7 on June 23, 2015.
Wet-Sol 233 application: Wet-Sol 233 is a non-ionic surfactant produced by Scheaffer Oil, St. Louis, Missouri. For Treatments 3 to 6, (1) 16 to 48 oz/acre in-furrow at planting on April 30, 2015; (2) 16 oz/acre on the leaves and soil at V7 on June 23, 2015. For Treatment 6, Vitazyme was mixed with Wet-Sol.
Growing season weather: Excellent, with rainfall evenly distributed throughout the spring and summer, and the average temperatures were good for growth. Rainfall: April=2.97in.; 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=81.
Harvest date: October 8, 2015
Plant population results (final): There were no significant differences among treatments from final population.

The dramatic improvement in rooting with Vitazyme can be seen on the right; two applications improved yield by 13.1 bu/acre (6%) above the untreated control.

Grain moisture results: Harvest was completed using a Massey-Ferguson plot combine having an electronic scale and moisture tester.

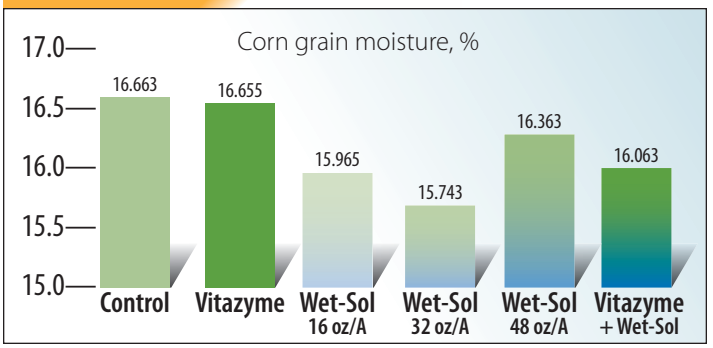
Treatment	Grain moisture[1]	Moisture change
	%	%
1. Control	16.663 a	—
2. Vitazyme	16.655 a	(-)0.008
3. Wet-Sol 16 oz/A	15.965 a	(-) 0.698
4. Wet-Sol 32 oz/A	15.743 a	(-) 0.920
5. Wet-Sol 48 oz/A	16.363 a	(-) 0.300
6. Vita + Wet-Sol	16.063 a	(-) 0.600
LSD (P=0.05)	0.941	
CV	3.84	
Replicate probability	0.0334	
Treatment probability	0.2548	

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

While none of the treatment means are significant, there was a definite trend for all of the Wet-Sol treatments to produce drier grain at harvest, up to 0.92% point at 32 oz/acre; Vitazyme alone did not produce such a decrease.

Corn *A Study with Wet-Sol Adjuvent cont.*

Corn Grain Moisture



Decrease in Grain Moisture, %-points

Wet-Sol, 16 oz/acre..... 0.698
Wet-Sol, 32 oz/acre..... 0.920
Vitazyme + Wet-Sol, 16 oz/acre 0.600

Conclusion: A corn study in east-central Iowa in 2015, a very good cropping year with near-record yields in the area, showed that both Vitazyme and Wet-Sol 233 produced significantly greater yields (P=0.05) than the control. This increase occurred at the 16, 32, and 48 oz/acre rates, with Vitazyme alone producing the highest overall yield of 223.0 bu/acre, an increase over the control of 6%. Vitazyme combined with Wet-Sol 233 did not produce on additive effect on yield, with a 4% yield increase. Wet-Sol 233 tended to produce drier corn at harvest, though not significantly so. These results show the ability of both Vitazyme and Wet-Sol to increase corn grain yields during an especially good cropping year, and their viability as major production tools for agriculture in the Corn Belt of the United States.

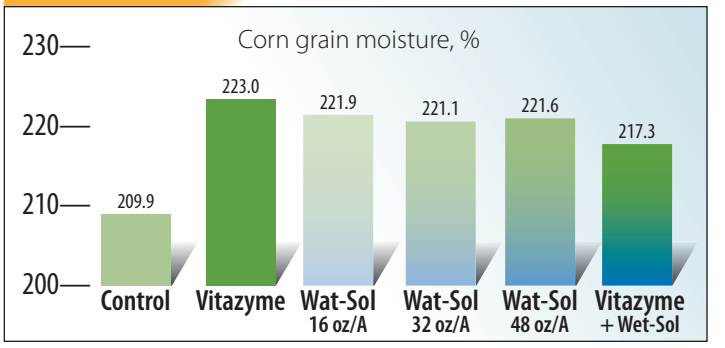
Yield results:

Treatment	Corn Yield[1]	Yield change
	bu/acre	bu/acre
1. Control	209.9 b	—
2. Vitazyme	223.0 a	13.1 (+6%)
3. Wet-Sol 16 oz/A	221.9 a	12.0(+6%)
4. Wet-Sol 32 oz/A	221.1 a	11.2 (+5%)
5. Wet-Sol 48 oz/A	221.6 a	11.7 (+6%)
6. Vita + Wet-Sol	217.3 ab	7.4 (+4%)
LSD (P=0.05)	8.2	
CV	2.49	
Replicate probability	0.0001	
Treatment probability	0.0355	

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

Vitazyme alone produced the greatest yield increase, at 13.1 bu/acre (6%), a significant increase above the control but statistically equal to all three Wet-Sol treatments. Vitazyme and Wet-Sol together did not produce a positive interaction, though the yield was not significantly less than the other treatments; neither was it greater than the control.

Corn Grain Moisture



Increase in Corn Yield, %

Vitazyme only 6%
Wet-Sol, 16 oz/acre..... 6%
Wet-Sol, 32 oz/acre..... 5%
Wet-Sol, 48 oz/acre..... 6%
Vitazyme + Wet-Sol, 16 oz/acre 4%

VitaEarth 2015 Crop Results

Corn *A Summary of Yield and Income Results in Mexico: 2012–2015*

Untreated corn in Atotonilco, Jalisco, Mexico, shows good growth,but nothing like that for Vitazyme (see the adjoining photo).

Two Vitazyme treatments greatly enhanced the growth of this corn, which is typical of the many trials conducted with this product in Mexico since 2012.

The following results for corn trials in Mexico were compiled by Juan Carlos Diaz of Ag Biotech.

Vitazyme application: Seed treatment at 0.25 liter/ha, and a foliar treatment at 1 liter/ha 30 days after planting

Conclusion: These eight Mexican corn trials revealed the excellent efficacy of Vitazyme use, with a seed treatment and single foliar application.

		Corn yield					
Test site	**Year**	**Control**	**Vitazyme**	**Change**	**Income[1]**	**Net Profit**	**Cost : Benefit**
		tons/ha	tons/ha	tons/ha	USD/ha	USD/ha	
El Monte, Villa Corona, Jalisco	2012	8.6	10.5	1.9 (+22%)	426.06	382.87	8.9
La Mesita, Cocula, Jalisco	2012	12.8	15.3	2.5 (+20%)	560.60	517.41	12.0
El Llano, San Martin Hidalgo, Jalisco	2012	7.30	8.21	0.91 (+13%)	204.06	160.87	3.7
Camino a la Coronilla, Arneco, Jalisco	2012	11.1	13.0	1.9 (+17%)	426.06	382.87	8.9
Odilón Ramos, San Juan Acozac, Puebla	2012	4.75	10.00	5.25 (+111%)	1,177.26	1,134.07	26.3
Las Margaritas, Ayotlan, Jalisco	2014	13.00	13.81	0.81 (+6%)	182.20	139.01	3.2
Distrito Riego 11 Irapuato, Guanajuato	2014	9.670	10.437	0.767 (+8%)	171.99	128.80	3.0
El Cabezón, Ameco, Jalisco	2014	11.51	12.84	1.33 (+12%)	297.57	254.38	5.9
Daniel Hernandez, La Barca, Jalisco	2015	13.73	14.93	1.20 (+9%)	269.24	226.05	5.2
Mean		10.27	12.11	1.84 (+18%)	412.78	369.59	8.6

[1]Corn price = 224.24 USD/ton. Vitazyme cost = 27.27 USD/liter; at 1.25 liters/ha, the total cost was 34.10 USD/ha. Spraying cost (labor) for two sprayings = 9.09 USD/ha. Overall Vitazyme cost = 43.19 USD/ha.

Yield increase with Vitazyme: +18%

Net profit increase with Vitazyme: 369.59 USD/ha

Cost: Benefit increase with Vitazyme: 8.6

It is clear that this program provides excellent yield and profit increases for corn farmers in Mexico.

Vital Earth Resources
706 East Broadway, Gladewater, Texas 75647
(903) 845-2163 FAX: (903) 845-2262

2014 Crop Results

Vitazyme on Corn

Five Trials in Mexico

Researcher: unknown *Research organization*: Quimica Lucava

Experimental design: All trials utilized a split field, with Vitazyme applied to a portion to determine effects of the product on yield.

1. Control **2. Vitazyme (2X)**

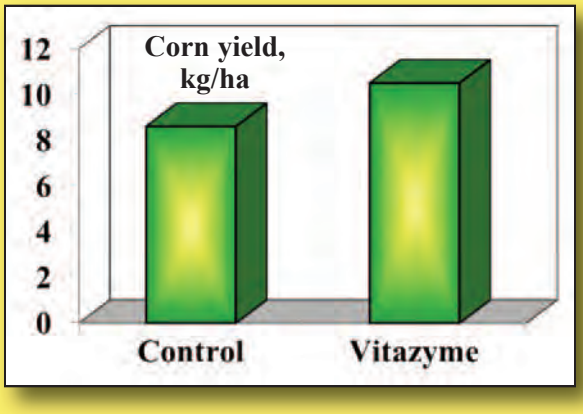
Fertilization: unknown

Vitazyme application: (1) 0.25 liter/ha on the seeds at planiting; (2) 1 liter/ha sprayed on the plants and soil 30 days later.

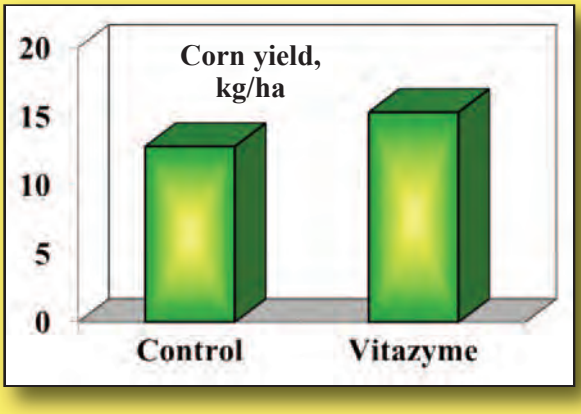
El Monte, Jalisco, Mexico

Treatment	Corn yield	Yield change
	tons/ha	
Control	8.6	—
Vitazyme	10.5	1.9 (+22%)

Increase in corn yield with Vitazyme: 22%



La Mesita, Jalisco, Mexico



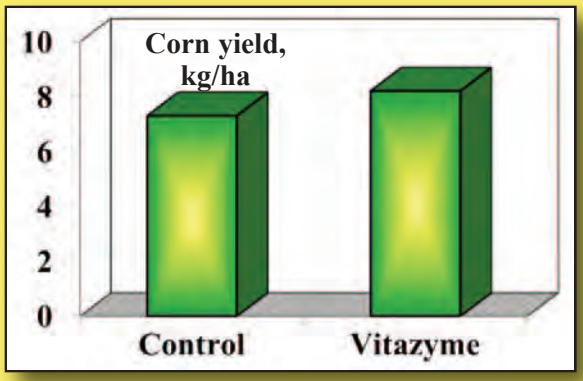
Treatment	Corn yield	Yield change
	tons/ha	
Control	12.8	—
Vitazyme	15.3	2.5 (+20%)

Increase in corn yield with Vitazyme: 20%

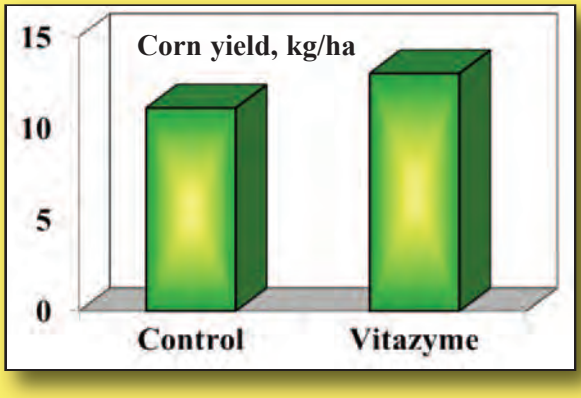
El Llano, Jalisco, Mexico

Treatment	Corn yield	Yield change
	tons/ha	
Control	7.30	—
Vitazyme	8.21	0.91 (+12%)

Increase in corn yield with Vitazyme: 12%



Camino a la Coronilla, Jalisco, Mexico



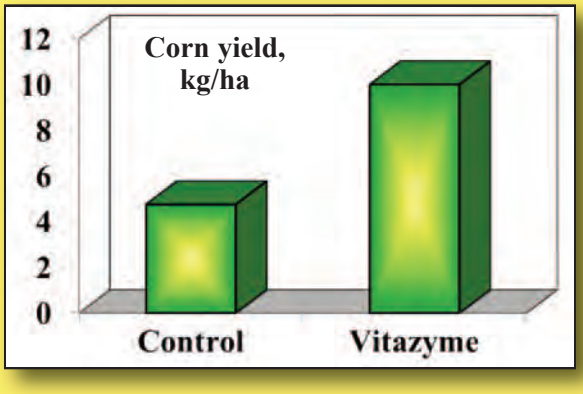
Treatment	Corn yield	Yield change
	tons/ha	
Control	11.1	—
Vitazyme	13.0	1.9 (+17%)

Increase in corn yield with Vitazyme: 17%

San Juan Acozac, Puebla, Mexico

Treatment	Corn yield	Yield change
	tons/ha	
Control	4.75	—
Vitazyme	10.00	5.25 (+111%)

Increase in corn yield with Vitazyme: 111%



Economic Evaluation of All Trials

Income from the average yield increase (2.49 tons/ha) ..... 7,476 pecos
Cost of Vitazyme (1.25 liters/ha) ..... 500 pecos
Cost of application ..... 150 pecos
Profit (income versus costs) ..... 6,826 pecos
Cost:Benefit ratio 13.7:1

Conclusions: These five Mexican corn trials showed excellent yield responses to Vitazyme, when applied to the seeds and later to the leaves and soil. The average yield increase was 2.49 tons/ha, or 36% more than the control plants, giving an overall increase in profit of 6,826 pecos/ha ($546.08/ha). With a cost:benefit rates of 13:7:1, this Vitazyme program is highly recommended for corn growers across Mexico.

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2014 Crop Results

Vitazyme on Corn

University of Missouri - Bradford Research Center

Researcher: Manjula Nathan, Ph.D. *Location*: University of Missouri Bradford Research Center, Columbia, Missouri *Variety*: Dekalb 62-97 *Population*: 32,000 seeds/acre
Row spacing: 30 inches *Planting date*: May 16, 2013

Experimental design: A replicated corn study (six replications), in a randomized complete block design, was established using six-row plots for each treatment, each being 100 feet long (0.03443 acre/plot). The objective of the study was to evaluate the effect of Vitazyme, applied to the seeds and later on the leaves, on leaf nutrient and yield parameters.

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

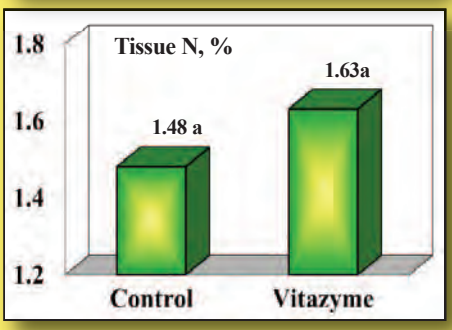
Fertilization: according to soil test recommendations using 160-46-62 lb/acre N-P_2O_5-K_2O before planting

Vitazyme application: (1) 13 oz/acre equivalent on the seeds, mixed thoroughly, just before planting (6.5 oz of Vitazyme applied to 16,000 seeds); (2) 13 oz/acre on the leaves and soil at the 8-leaf stage (knee height) on July 3.

Weather during the 2013 growing season: A wet spring delayed planting; otherwise, conditions for growth were favorable except for a short-duration drought in August and early September. Heavy rain after fertilizer application in May could have caused some nitrogen loss.

Tissue nutrient levels: Ear leaf samples were collected July 26 at silking. These samples were analyzed for N, P, K, Ca, and Mg at the University of Missouri.

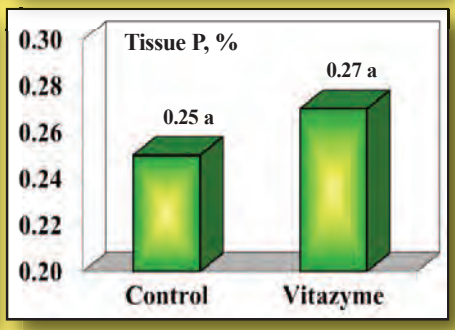
Corn Tissue Nitrogen



P > F = 0.208

Increase in N with Vitazyme: 10%

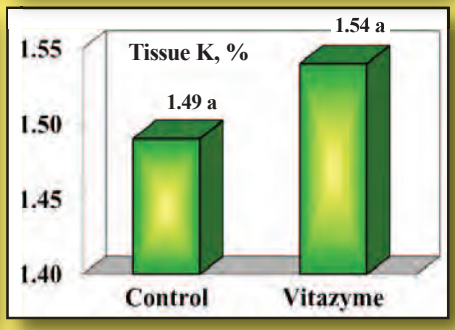
Corn Tissue Phosphorus



P > F = 0.604

Increase in P with Vitazyme: 8%

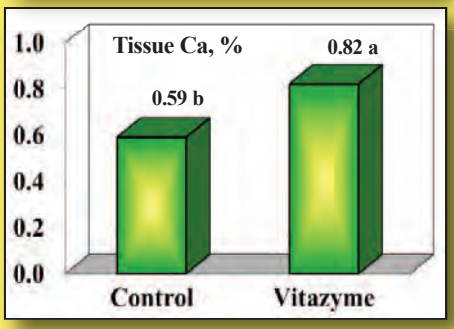
Corn Tissue Potassium



P > F = 0.506

Increase in K with Vitazyme: 3%

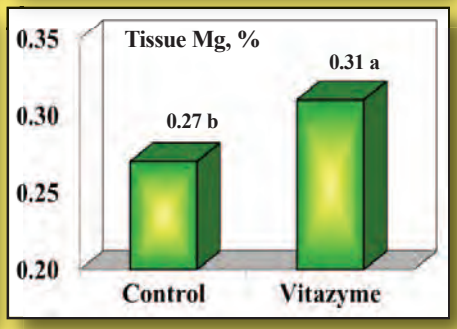
Corn Tissue Calcium



P > F = 0.034

Increase in Ca with Vitazyme: 39%

Corn Tissue Magnesium



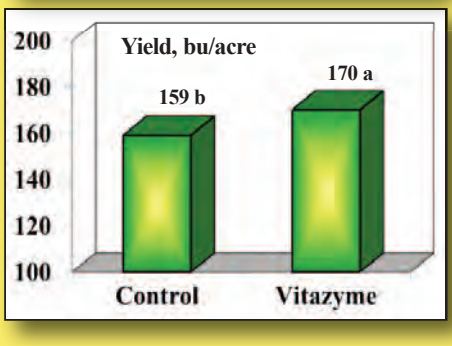
P > F = 0.079

Increase in Mg with Vitazyme: 15%

Vitazyme increased all five tissue elements analyzed, with increases ranging from 3% (K) to 39% (Ca). The Ca and Mg increases were significant, especially Ca (39%), while N, P, and K increases were not significant.

Yield parameter results:

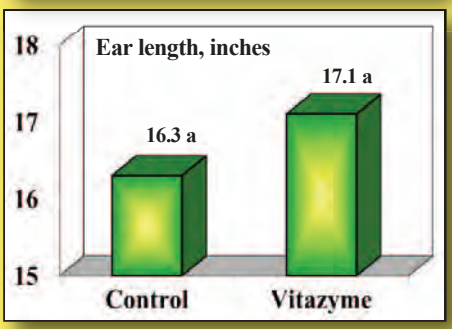
Grain Yield



P > F = 0.99. Two applications of Vitazyme greatly improved corn grain yield, by 11 bu/acre, above the control.

Increase in grain yield with Vitazyme: 7%

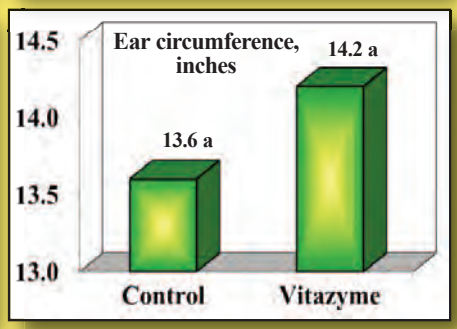
Ear Length



P > F = 0.345

Increase in ear length with Vitazyme: 5%

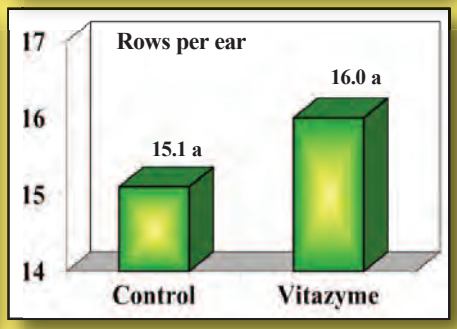
Ear Circumference



P > F = 0.113

Increase in ear circumference with Vitazyme: 4%

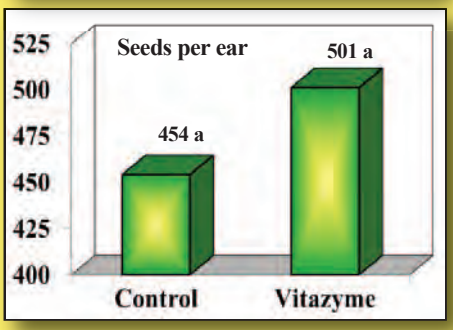
Rows On Ears



P > F = 0.317

Increase in rows on ears with Vitazyme: 0.9 row

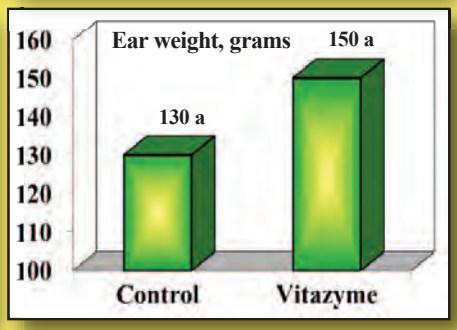
Seeds Per Ear



P > F = 0.172

Increase in seeds per ear with Vitazyme: 10%

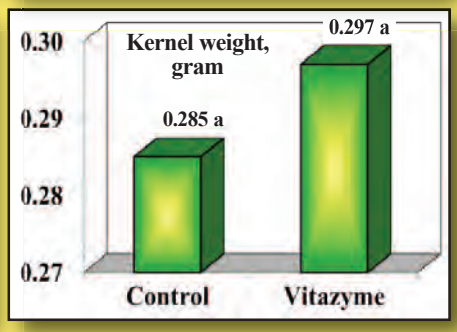
Weight Per Ear



P > F = 0.253

Increase in ear weight with Vitazyme: 15%

Weight Per Kernel



P > F = 0.474

Increase in weight per kernel with Vitazyme: 4%

Conclusions: A replicated corn trial at the University of Missouri in 2013 revealed that Vitazyme, applied on the seeds before planting, and again at 13 oz/acre to the leaves and soil at V8, improved tissue nutrient levels as well as yield and all harvest parameters, several significantly. A summary of these effects is as follows:

Increase with Vitazyme

Yield Parameters		Tissue Parameters	
Grain yield	10%*	Nitrogen	10%
Ear length	5%	Phosphorus	8%
Ear circumference	4%	Potassium	3%
Rows per ear	0.9 row/ear	Calcium	39%*
Seeds per ear	10%	Magnesium	15%*
Weight per ear	15%		
Weight per kernel	4%		

*Significantly greater than the control, at P=0.10 or less.

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2014 Crop Results

Vitazyme on Corn

Agricultural Custom Research and Education Services (ACRES)

Researcher: Bertel Schou, Ph.D.
Research organization: Agricultural Research and Educational Services
Location: Cedar Falls, Iowa
Variety: Pioneer PO453 AM (Roundup Ready)
Planting rate: 38,000 seeds/acre
Planting date: May 8, 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 = 18.29 meq/100 g, pH = 5.8, organic matter = 2.7%, nitrogen = 74 lb/acre, sulfur (as sulfate) = 36 lb/acre, phosphorus (P) = 131 lb/acre, calcium (Ca) = 2,973 lb/acre, magnesium (Mg) = 707 lb/acre, potassium (K) = 264 lb/acre, sodium (Na) = 80 lb/acre, boron (B) = 3.16 lb/acre, iron (Fe) = 693.6 lb/acre, manganese (Mn) = 118.4 lb/acre, copper (Cu) = 2.8 lb/acre, zinc (Zn) = 5.6 lb/acre; percent base saturations: Ca = 54.3, Mg = 16.10, K = 1.85, Na = 0.95, other bases = 5.80%, H = 21.00.
Row width: 30 inches
Planting conditions: good
Tillage: conventional
Previous crop: soybeans
Experimental design: A small-plot corn study was conducted to evaluate the effect of Vitazyme and seaweed exact, using two applications, alone and in combination, on the yield of corn. There were four replications, with each plot four rows x 30 feet (10.00689 acres/plot); the two middle rows were harvested for analysis. A randomized complete block design was used.

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: All areas received 90 lb/acre of urea ammonium nitrate (UAN) on June 9.
Vitazyme application: (1) 13 oz/acre in-furrow at planting (May 8, 2014) using 38 ml/gallon at 10 gallons/acre; (2) 13 oz/acre on the leaves and soil at V6 (July 2, 2014), using 26 ml/gallon at 15 gallons/acre
Seaweed application: obtained from Ocean Organics; (1) 2 quarts/acre applied in-furrow at planting (May 8, 2014), using 189 ml/gallon at 10 gallon/acre; (2) 2 quarts/acre applied foliar after V6 (July 2, 2014) using 126 ml/gallon at 15 gallons/acre
Weather for 2014: Growing conditions for the trial were very good, with temperatures below normal and precipitation consistent throughout the crop cycle, except for a few days in June and August.
Irrigation: overhead center-pivot irrigation on June 12 and 13, and on August 11 to 14, and 18
Harvest date: October 21, 2014, using a Massey-Ferguson plot combine

Plant population results: Populations for the four treatments were very similar, without significant differences.

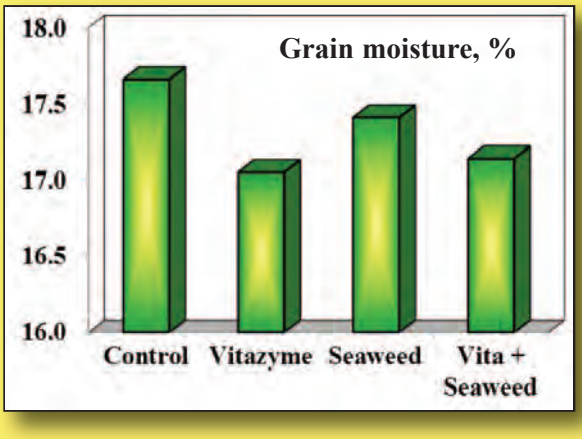
Treatment	Population*	Population change
	plants/acre	plants/acre
1. Control	34.065 a	—
2. Vitazyme	35,140 a	1,075 (+3%)
3. Seaweed	34,489 a	424 (+1%)
4. Vitazyme + Seaweed	34,111 a	46 (0%)
LSD (P = 0.05)	2,388	
CV	4.24%	
Treatment F	0.462	
Treatment probability	0.716	

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

Grain moisture results:

Treatment	Grain moisture*	Moisture change
	%	%
1. Control	17.66 a	—
2. Vitazyme	17.05 a	(-) 0.61
3. Seaweed	17.41 a	(-) 0.25
4. Vitazyme + Seaweed	17.14 a	(-) 0.52
LSD (P = 0.05)	0.78	
CV	2.82%	
Treatment F	1.276	
Treatment probability	0.340	

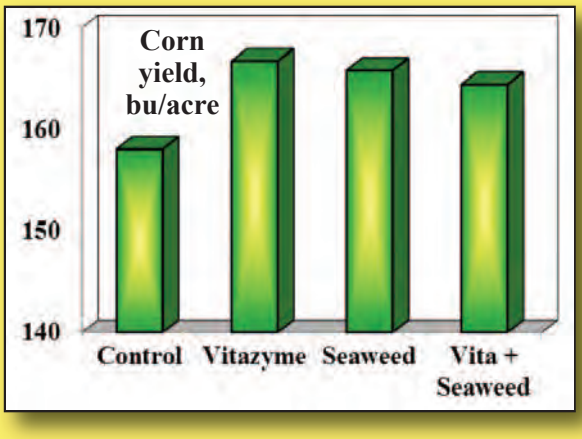
*Means followed by the same letter are not significantly different at P = 0.05, according to the Student-Newman-Keuls Test.



All three applications reduced grain moisture at harvest a small amount, with Vitazyme alone reducing moisture by 0.61 percentage-point.

Reduction in grain moisture with Vitazyme: 0.61 %-point

Grain yield results: The two center rows of each plot were harvested.



The three treatments all increased yield above the control, though not significantly, due to experimental error. Even so, Vitazyme increased yield by 5.5%.

Treatment	Corn yield*	Yield change
	bu/acre	bu/acre
1. Control	158.03 a	—
2. Vitazyme	166.70 a	8.67 (+5.5%)
3. Seaweed	165.78 a	7.75 (+4.9%)
4. Vitazyme + Seaweed	164.40 a	6.37 (+4.0%)
LSD (P = 0.05)	10.03	
CV	3.83%	
Treatment F	1.558	
Treatment probability	0.266	

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

Increase in corn yield with Vitazyme: 5.5%

Conclusions: A replicated corn study in east-central Iowa revealed that Vitazyme increased corn yield by 5.5%, followed closely by seaweed at 4.4%, and the combined products at 4.0%. Those increased were consistent, but no synergism was displayed between the two materials. Grain moisture was reduced by 0.61 percentage-point with Vitazyme, which gave the greatest reduction for the three treatments compared with the control. While these increases for the three treatments were not significant, they were consistently greater tha the control so can be assumed to be real.

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2014 Crop Results

Vitazyme on Corn

Researcher: unknown *Research organization*: Kernel Company, LLC, Ukraine
Location: Man'kivs'ky District, Cherkasy Region, Viktorivka Village, Ukraine *Variety*: DK 440
Planting rate: 75,000/ha *Planting date*: April 8, 2014 *Previous crop*: soybeans
Soil type: Chernozern, with 3.7% organic matter
Seedbed preparation: disk-plowing to 6-8 cm, plowing to 22-24 cm, harrowing, two cultivations to 5 - 6 cm.
Experimental design: A corn field was divided into a Vitazyme treated area and an adjoining control area, with the objective of evaluating the effect of this product on soybean yield. All other treatments — herbicides and fertilizers — were identical over the entire area.

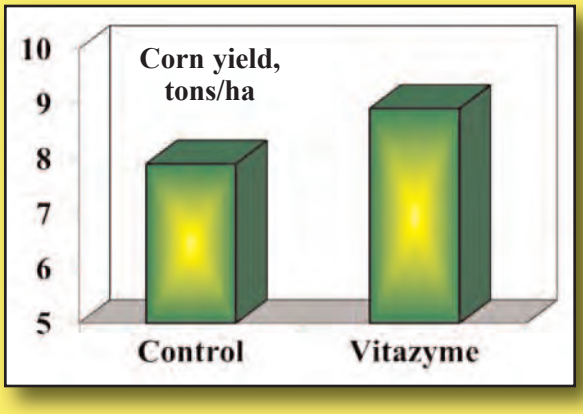
1. Control **2. Vitazyme**

Fertilization: 90 kg/ha of nitrogen broadcast and incorporated before planting, and 10-26-26 kg/ha of N-P_2O_5-K_2O applied in-furrow at planting.

Vitazyme application: 1 liter/ha sprayed on the leaves and soil at the 5 to 6 - trifoliate stage, on May 3
Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
Control	7.91	—
Vitazyme	8.91	1.01 (+13%)

Increase in corn yield with Vitazyme: 13%



Income results: The gross income minus expenses for the two treatments revealed the Vitazyme improved net income by 2,090 UAH/ha ($132.72/ha at 1UAH = 0.0635 USD).

Increase in income with Vitazyme: 2,090 UAH/ha

Conclusions: This corn trial in Ukraine, using a single 1 liter/ha Vitazyme application at the 5 to 6-leaf stage, revealed a substantial 13% yield increase, which netted the farmer an extra 2, 090 UAH/ha ($32/72/ha). This result shows as have many other corn trials in Ukraine over the past years, the great efficacy of the Vitazyme program to boost yields and profits.

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2013 Crop Results

Vitazyme and Fish on Corn

Responses at Four Nitrogen Levels

Researcher: Sara Berg and Ron Gelderman, Ph.D.
Research institution: Department of Agronomy and Soils, South Dakota State University, Brookings, South Dakota
Location: South Dakota State University Research Farm, Aurora, South Dakota
Variety: Dekalb 45-51 *Soil type*: Brandt silty clay loam
Soil test results: tested April 30, 2013; organic matter = 4.4%, NO_3-N = 32 lb/acre (to 24 inches), P (Olsen) = 20 lb/acre, K = 292 lb/acre, Zn = 2.56 lb/acre, S = 50 lb/acre (to 24 inches), pH = 5.5, salts (1:1) = 0.2 mmhos/cm *Planting date*: May 15, 2013
Planting rate: 32,000 seeds/acre *Row spacing*: 30 inches
Experimental design: A small plot (10 x 45 feet, or 0.01033 acre) design with four replications was used to evaluate the effectiveness of Vitazyme and liquid fish in enhancing corn yield, plant population, and grain nutrient content as influenced by nitrogen rate. The fish was applied alone and with Vitazyme at the high nitrogen rate only. Statistics were calculated for Treatments 1 to 8, and also for Treatments 7 to 10.

Treatment	Nitrogen rate	Vitazyme	Fish
	% of optimal		
1. Control, 0% N	0	0	0
2. Vitazyme, 0% N	0	X	0
3. Control, 50% N	50	0	0
4. Vitazyme, 50% N	50	X	0
5. Control, 75% N	75	0	0
6. Vitazyme, 75% N	75	X	0
7. Control, 100% N	100	0	0
8. Vitazyme, 100% N	100	X	0
9. Fish, 100% N	100	0	X
10. Fish + Vitazyme, 100% N	100	X	X

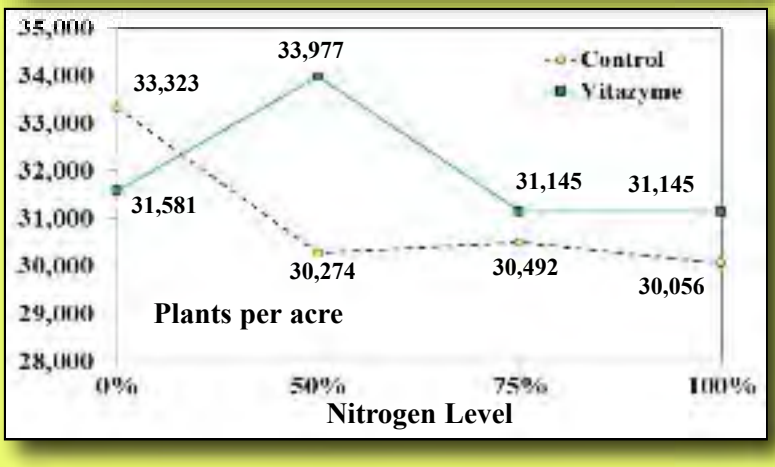
Fertilization: Nitrogen fertilizer (NH_4NO_3) was applied broadcast to the soil surface on May 15, just after planting. 100% N = 122 lb/acre of N; 75% N = 92 lb/acre of N; 50% N = 61 lb/acre of N.
Vitazyme application: (1) 13 oz/acre (1 liter/ha) in-furrow at planting, with 3 gallons of water per acre along with 10-34-0% N-P_2O_5-K_2O fertilizer; (2) 13 oz/acre (1 liter/h)a sprayed with a hooded plot sprayer on the leaves and soil at V8, on July 10, 2013
Fish application: (1) 2 gal/acre in a 5 gal/acre volume, with Vitazyme and 10-34-0% N-P_2O_5-K_2O, in-furrow at planting; (2) 2 gal/acre sprayed on the leaves and soil with a hooded plot sprayer at V8, on July 10, 2013; (3) 2 gal/acre on the leaves, hand-sprayed with a backpack sprayer at silking

Harvest date: October 25, 2013

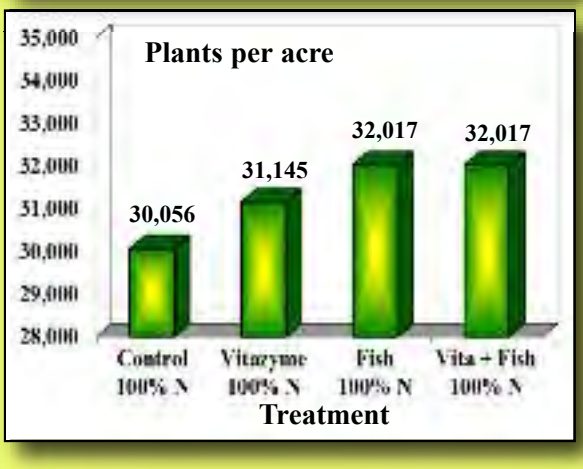
Chlorophyll results: Chlorophyll readings were made with a Minolta SPAD meter at V10 (July 17, 2013), and again at R1 (August 1, 2013). No consistent results were noted, although the highest overall value recorded was for 100% N + Vitazyme at R1 (54.6), which was 1.2 points higher than the respective control treatment.

Population results: There was some benefit to plant stand shown with Vitazyme at three out of the four nitrogen levels.

Plant Population and Nitrogen Rate



Plant Population With Vitazyme and Fish



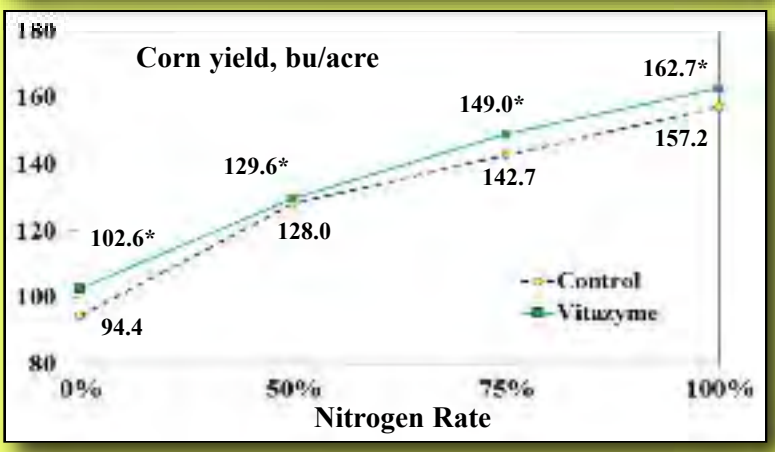
In every case except at 0% N, the Vitazyme and fish treatments exceeded the control treatments. Fish alone and Vitazyme + fish significantly exceeded the control in plants/acre.

Grain moisture results: There were no clear relationships between Vitazyme, fish, and nitrogen rates. At-harvest moisture was around 16.0 to 17.0%

Grain test weight results: Weight per bushel of grain varied little across all of the treatments, ranging from 53.4 to 55.9 lb/bu for the eight nitrogen rate treatments. The Vitazyme + Fish treatment, however produced the heaviest grain at 56.4 lb/bu.

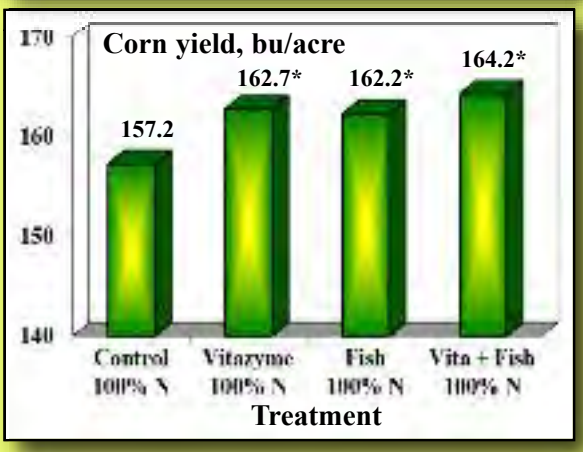
Grain yield results:

Grain Yield and Nitrogen Rate



*Significantly greater than the control treatment at the same nitrogen level at P = 0.05, according to the Statistical Analysis System, GLM.

Grain Yield With Vitazyme and Fish



*Significantly greater than the control treatment at the same nitrogen level at P = 0.05, according to the Statistical Analysis System, GLM.

Increase in Grain Yield With Vitazyme

0% N	8.7%
50% N	1.3%
75% N	4.4%
100% N	3.5%

Grain yield increases were consistent across all nitrogen levels, but the largest percentage increase (8.7%) was with no fertilizer nitrogen added.

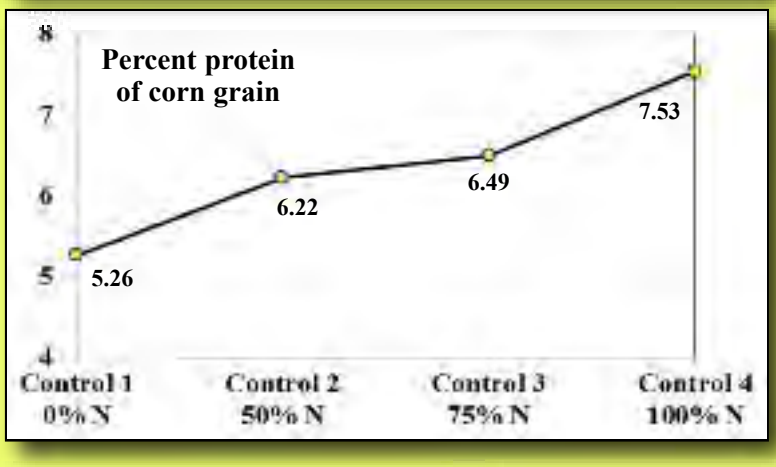
Increase in Grain Yield With Vitazyme and Fish - 100% N

Vitazyme only	3.5%
Fish only	3.2%
Vitazyme + Fish	4.5%

Both Vitazyme and fish alone significantly improved grain yield, but the combined Vitazyme and fish produced the highest yield — 4.5% higher than the 100% control — which was the highest yield of all ten treatments (164.2 bu/acre).

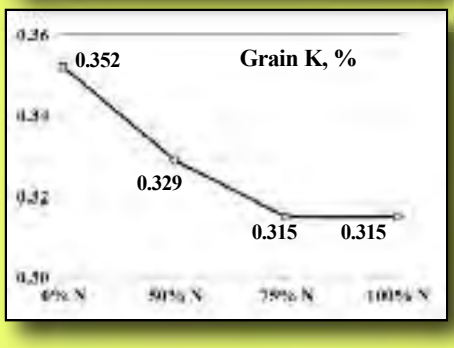
Grain quality results: Analyses of oil, protein, and starch were performed at the South Dakota State University diagnostic laboratory. Oil varied from 2.94 to 3.29%, protein from 5.26 to 7.53%, and starch from 57.74 to 58.87%. There was no effect of Vitazyme and fish on these contents although nitrogen levels increased the protein for the control and Vitazyme treatments. See the following graph.

Protein of Grain and Nitrogen Level

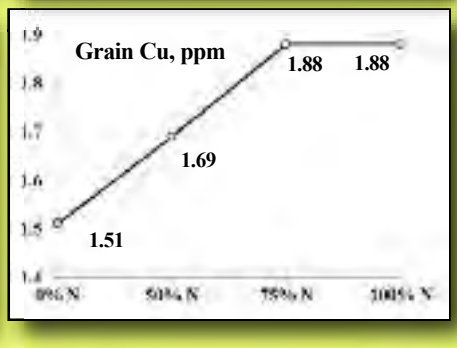


Analyses of grain potassium, copper, iron, zinc, manganese, phosphorus, sulfur, magnesium, and calcium revealed no clear patterns of effects for Vitazyme and fish on these nutrients, although fish tended to increase potassium and phosphorus. Nitrogen increased some nutrient levels and reduced others. Values of both the control and Vitazyme treatments are averaged for each N level.

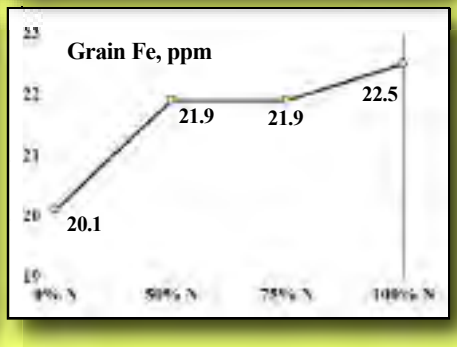
Grain K and N Level



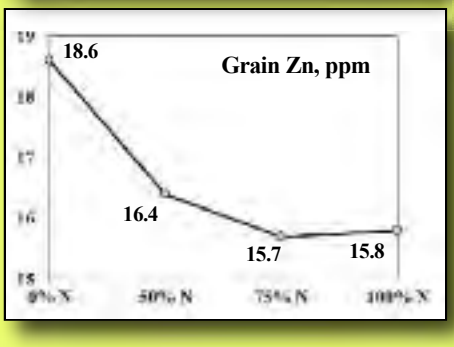
Grain Cu and N Level



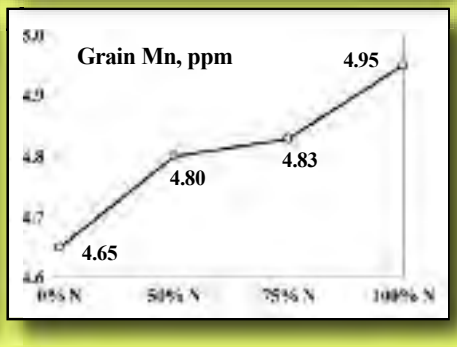
Grain Fe and N Level



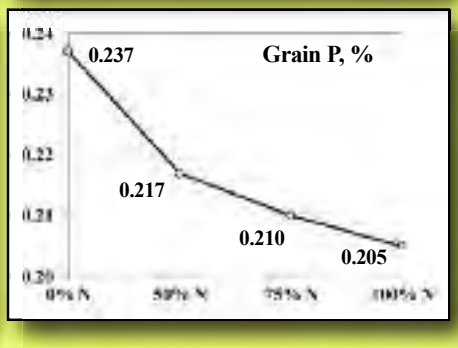
Grain Zn and N Level



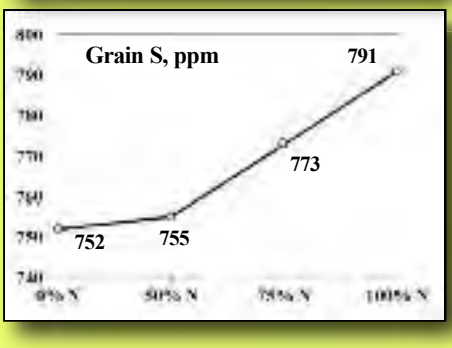
Grain Mn and N Level



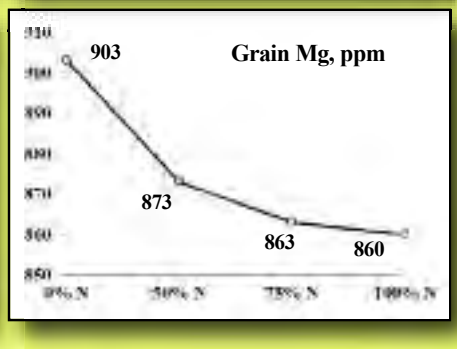
Grain P and N Level



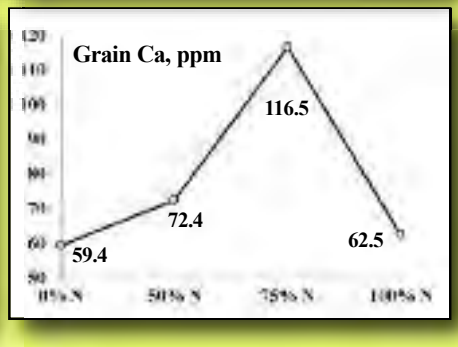
Grain S and N Level



Grain Mg and N Level



Grain Ca and N Level



Conclusions: A small plot corn study in east central South Dakota revealed that Vitazyme and fish — Vitazyme applied at planting and at V8, and fish applied at planting, V8, and silking — significantly increased corn yield at all nitrogen fertilizer levels, by up to 8.7% at the 0% N level. The Vitazyme plus fish treatment at 100% N gave the highest yield of all ten treatments (164.2 bu/acre). Vitazyme increased plant population at the three highest nitrogen levels, and fish and fish plus Vitazyme also increased population at 100% N. Grain quality parameters were affected by nitrogen levels to some degree, the contents of protein, copper, iron, manganese, and sulfur increasing and the contents of potassium, zinc, phosphorus, and magnesium decreasing with increasing nitrogen fertilizer. This study reveals the usefulness of Vitazyme and fish, and especially the two combined, to increase corn yields under rainfed conditions in eastern South Dakota.

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2013 Crop Results

Vitazyme on Corn

Researcher: Juan Carlos Diaz, Ph.D. *Farmer*: Ramiro Carlos Fonseen
Location: El Ahuaje de Abajo Farm, San Nicolas, Cocula, Jalisco, Mexico
Variety: N 432 HJ (Eagle) *Planting date*: May 8, 2012
Experimental design: Corn to be used for leaves to wrap tamales was treated with Vitazyme on the seeds, and later on the leaves and soil, to one portion of a field, and compared with an untrteated control to evaluate leaf production. The treated area was 1 ha.

1. Control **2. Vitazyme**

Fertilization: unknown
Vitazyme application: (1) Seed treatment of 50 ml in 450 ml of water, to treat 55,000 seeds (a 20 kg bag planted 1 ha); (2) soil and foliar treatment of 1 liter/ha (13 oz/acre) at an unknown date.
Leaf yield result: Actual yield numbers for the two plots were not available, but the data reported an 8% increase in leaves with Vitazyme versus the control.

Increase in yield with Vitazyme: 8%

Conclusion: This Mexican corn study, utilizing two Vitazyme applications — a seed and a soil/foliar treatment — showed that this product significantly enhanced leaf production of the corn plants.

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2013 Crop Results

Vitazyme on Corn

Researcher: Juan Carlos Diaz, Ph.D.
Location: Camino a la Coronilla Farm, Ameca, Jalisco
Planting date: May 8, 2012
Farmer: Eng. Jose Guadalupe Orozco Flores
Variety: Pioneer 3055
Planting rate: 80,000 seeds/ha

Experimental design: A 1 ha plot was selected from a corn field to treat with Vitazyme, on both the seeds and leaves, to determine the effectiveness of the product to increase yield.

1. Control **2. Vitazyme**

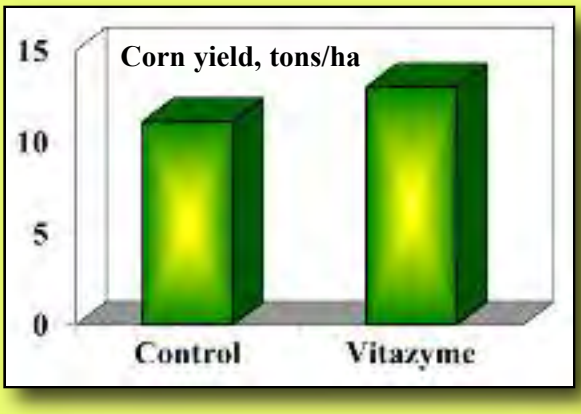
Fertilization: unknown

Vitazyme application: (1) A seed treatment of 50 ml in 450 ml of water, applied with Regent; (2) a soil and foliar spray treatment of 1.0 liter/ha at an unknown date

Yield results:

Treatment	Grain yield	Yield change
	tons/ha	tons/ha
Control	11.1	—
Vitazyme	13.0	1.9 (+17%)

Increase in grain yield with Vitazyme: 17%



Conclusions: A corn study with Vitazyme in Mexico proved that the product increased grain yield substantially, by 17%, over the untreated control, showing the great effectiveness of this material to stimulate corn yield.

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2013 Crop Results

Vitazyme on Corn

Researcher: Tim Heikens and Leonard Jansen
Location: Lake Park, Iowa
Row spacing: 30 inches
Planting date: May 11, 2013
Farmer: Leonard Jansen
Variety: Golden Harvest H7891
Plant population: 33,000 seeds/acre
Soil type: silty clay loam (Mollisol)

Experimental design: A 30-acre uniform corn field was sprayed with Vitazyme in alternating 90-foot sprayer strips through the field after the corn was growing. The purpose of the study was to determine if a single application could improve grain yield.

1. Control **2. Vitazyme**

Fertilization: Total nutrients applied were 140-100-120 lb/acre of N-P_2O_5-K_2O.

Vitazyme application: 20 oz/acre (1.5 liters/ha) sprayed on the leaves and soil on July 6 at the 10 to 11 leaf stage

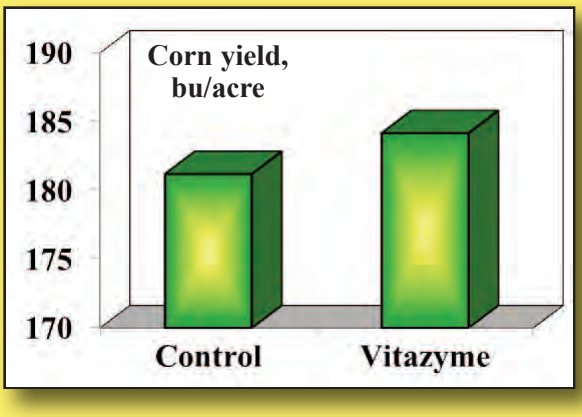
Weed control: 1.5 pints/acre Steadfast on May 9; 1 quart/acre Roundup on June 17

Weather during the season: a wet spring and a dry summer and fall

Harvest date: October 24, 2013

Yield results: A weigh wagon was used to quantify yields.

Treatment	Yield	Yield change
	bu/acre	bu/acre
Control	181.19	—
Vitazyme	184.16	2.97 (+2%)



Grain moisture results: the Vitazyme treated corn had 17% moisture and the control corn had 18% moisture.

Reduction in grain moisture with Vitazyme: 1.0%

Conclusions: This corn trial in northwestern Iowa revealed that Vitazyme, applied at the 10 to 11-leaf stage at 20 oz/acre, produced about a 3 bu/acre yield increase. Grain moisture was 1.0% less. Had the product been applied at planting as well the yield improvement would likely have been much greater.

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2013 Crop Results

Vitazyme on Corn

Researcher: unknown *Farmer*: Linh Thi Ngan *Location*: Dak Will, Cu Jut District, Dak Nong, Viet Nam *Variety*: P4199 *Planting date*: August 10, 2013
Planting rate: 50,000 plants/ha
Experimental design: A corn field was divided into a Vitazyme treated and control area to determine the effects of this product on corn growth and yield.

1. Control **2. Vitazyme**

Fertilization: unknown
Vitazyme application: (1) seed treatment with a 5% solution before planting; (2) 2 liters/ha spray on the leaves and soil 15 days after planting; (3) 2 liters/ha spray on the leaves and soil 30 days after planting.
Germination results: Both treatments had over 95% germination.
Harvest date: December 12, 2013, 120 days after planting
Harvest and Yield results:

Treatment	Plant height	Ear height	Drought resistance	Weight of 1,000 seeds	Seed color	Yield
	cm	cm		grams		tonnes/ha
Control	185	100	Fair	310	Light yellow	8.0
Vitazyme	192 (+4%)	110 (+10%)	Good	315 (+2%)	Dark yellow	9.0 (+13%)

Increase in plant height: 4%

Increase in ear height: 10%

Increase in 1,000 seed weight: 2%

Increase in yield: 13%

Income results: The Vitazyme treated corn sold for 4,000 VND/kg, versus 3,800 VND/kg for the control corn.

Costs with Vitazyme: 1,420,000 VND/ha
Increased income with Vitazyme: 4,180,000 VND/ha
Return On Investment with Vitazyme: 2,94 : 1

Conclusions: A corn study in Viet Nam proved that a Vitazyme seed treatment, plus two soil and foliar applications, produced an excellent 13% yield increase. Drought tolerance was improved, as was seed weight (2%), and plant height (4%). Income was substantially increased, giving a Return On Investment of 2.94 : 1. This program is an excellent one for corn production in Viet Nam.

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2013 Crop Results

Vitazyme on Corn

Researcher: Juan Carlos Diaz, Ph.D.
Location: La Mesita Farm, Cocula, Jalisco, Mexico
Planting date: 90,000 seeds/ha
Farmer: Eng. Juan Carlos Flores Orozco
Variety: Pioneer 3055
Irrigation: sprinkler

Experimental design: A 1.0 ha area of an irrigated corn field was treated with Vitazyme on the seeds, and later on the leaves and soil, in order to evaluate the product's ability to increase grain yield.

1. Control **2. Vitazyme**

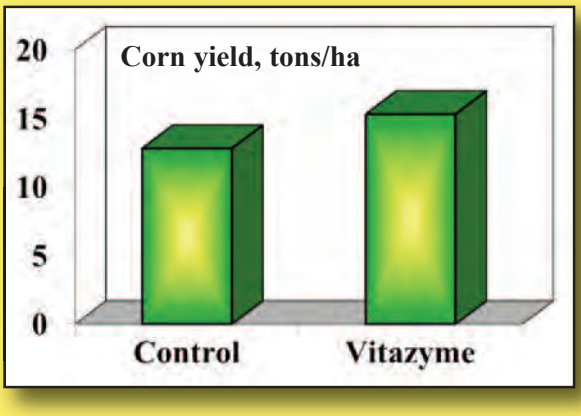
Fertilization: unknown

Vitazyme application: (1) Seeds were treated with a 10% solution; (2) leaves and soil were sprayed with 1 liter/ha (13 oz/acre) during growth at an unspecified time.

Yield results:

Treatment	Grain yield	Yield change
	tons/ha	tons/ha
Control	12.8	—
Vitazyme	15.3	2.5 (+20%)

Increase in grain yield with Vitazyme: 20%



Conclusions: A corn study under irrigation, using a seed treatment and an additional foliar and soil spray, revealed that Vitazyme improved grain yield by 20% above the untreated control.

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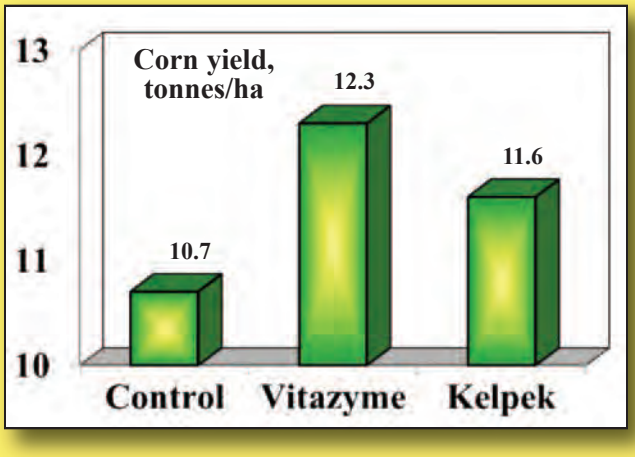
2013 Crop Results

Vitazyme and Kelpek on Corn

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*: DKS 2960, FAO 250 *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*: winter wheat *Planting date*: May 10, 2013
Soil preparation: disking, plowing, harrowing, cultivating *Seeding rate*: 80,000 seeds/ha
Experimental design: A small plot experiment with four replications was prepared to evaluate the effects of Vitazyme and Kelpek on the yield and growth of corn.

1. Control **2. Vitazyme** **3. Kelpek**

Fertilization: Before planting, 100-60-60 kg/ha of N-P_2O_5-K_2O were applied to the active test area.
Vitazyme application: 1 liter/ha sprayed on the leaves and soil at the 7 to 8-leaf stage (June 11, 2013)
Kelpek application: 2 liters/ha sprayed on the leaves and soil at the 7 to 8-leaf stage (June 11, 2013)
Yield results:



Increase in yield	
Vitazyme	15%
Kelpek	8%

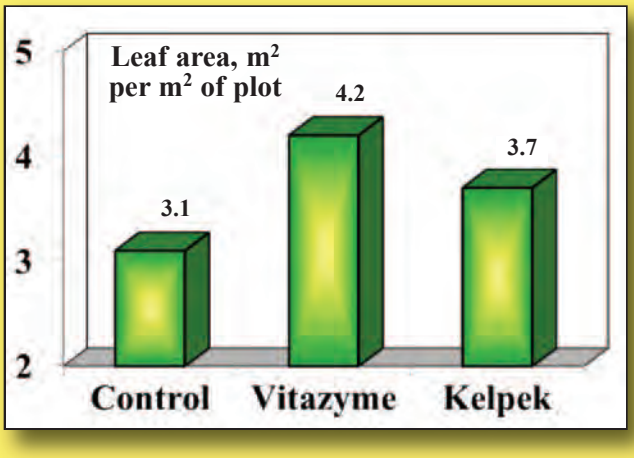
Both Vitazyme and Kelpek substantially increased corn yield, but Vitazyme produced nearly double the increase of Kelpek (15%)

Income results:

Increase in net income	
Vitazyme	1,690 UAH/ha
Kelpek	780 UAH/ha

Vitazyme clearly produced the greater income of the two products, more than doubling that achieved by Kelpek.

Leaf area results:



Increase in leaf area	
Vitazyme	35%
Kelpek	19%

Vitazyme nearly doubled the leaf area of corn versus Kelpek.

Conclusions: The authors of the report stated,

1. The treatment of corn hybrid DKS 2960 at the 7-8 leaf stage with Vitazyme, at 1 L/ha, gave a corn grain yield increase of 106 tonnes/ha, or 15%. When applying the competitive chemical Kelpek at a rate of 1 L/ha at the 7-8 leaf stage, the increase of corn grain yield was 0.9 tonne/ha, or 8%, and was 0.7 tonne/ha less than with Vitazyme.

2. With Vitazyme at 1 L/ha, the profit was 1,690 UAH/ha, which is 910 UAH/ha more than when applying Kelpek at 2 L/ha.

3. Vitazyme application at 1 L/ha gave an increase in corn leaf area of 1.1 m^2/m^2 of the plot. Applying Kelpek at 2 L/ha gave a corn leaf area increase of 0.6 m^2/m^2 of the plot, which is 0.5 m^2/m^2 less than when applying Vitazyme.

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2013 Crop Results

Vitazyme on Corn

Researcher: Juan Carlos Diaz, Ph.D.
Farmer: Odilon Ramos
Location: San Juan Acozac, Puebla, Mexico
Variety: unknown

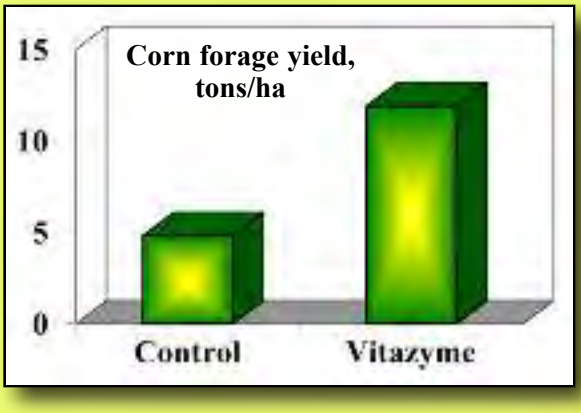
Experimental design: A corn field for fodder was divided into Vitazyme and control areas of 4,000 m^2 (0.4 ha) each, to evaluate the effect of the product on corn yield.

1. Control **2. Vitazyme**

Fertilization: unknown
Vitazyme application: 1 liter/ha (13 oz/acre) two times (timing unknown)
Yield results: Two cuttings were weighed for each treatment.

Treatment	Forage yield		Yield change
	tons	tons/ha	tons/ha
Control	1.9	4.8	—
Vitazyme	4.0	11.9	7.1 (+148%)

Increase in forage yield with Vitazyme: 148%



Conclusions: A forage corn study in Mexico revealed that Vitazyme applied twice during the growing season produced a remarkable 111% increase in yield. This program is highly effective for corn growers in Mexico.

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2013 Crop Results

Vitazyme on Corn

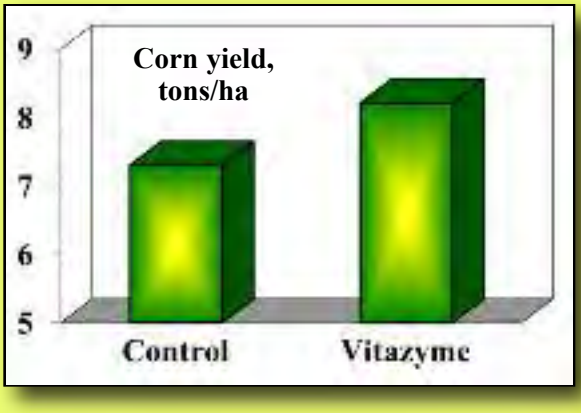
Researcher: Juan Carlos Diaz, Ph.D. *Farmer*: Eng. Salvador Sanchez Rica
Location: El Chivero Field, El Llano Farm, San Martin Hidalgo, Jalisco, Mexico
Variety: Cimarron
Experimental design: A corn field had 1 ha. selected to be treated with Vitazyme, applied to the seeds and later as a foliar spray, to evaluate effects on yield compared to an adjacent untreated area.

1. Control **2. Vitazyme**

Fertilization: unknown
Vitazyme application: (1) Seeds were treated with 100 ml/20 kg of seed; (2) a spray of 1 liter/ha (13 oz/acre) was made to the leaves and soil sometime during growth.
Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
Control	7.30	—
Vitazyme	8.21	0.91 (+12%)

Increase in yield with Vitazyme: 12%



Conclusions: This Mexican corn study revealed that a Vitazyme seed treatment and single foliar treatment increased grain yield by 12%, showing the program to be highly valuable for corn production in Mexico.

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2013 Crop Results

Vitazyme and Fish on Corn

Researcher: Bertel Schou, Ph.D. *Research organization*: ACRES (Agricultural Research and Educational Services), Cedar Falls, Iowa
Location: Cedar Falls, Iowa *BBCH scale*: BCOR
Variety: Pioneer P0453HR (Roundup Ready) *Maturity*: 104 days *Planting Depth*: 1.5 inches
Planting rate: 38,000 seeds/acre *Row spacing*: 30 inches *Slope of plot*: 5%
Planting date: May 17, 2013 *Previous crop*: soybeans *Soil type*: Kenyon loam
Tillage: conventional (field cultivating and harrowing)
Soil test values: pH = 6.9 , organic matter = 2.7%, cation exchange capacity = 20.0 meq/100 g, N = 74 lb/acre, SO_4-S = 16 lb/acre, P_2O_5 = 246 lb/acre, Ca = 5,743 lb/acre, Mg = 807 lb/acre, K2O = 302 lb/acre, Na = 94 lb/acre, B = 1.45 lb/acre, Fe = 539 lb/acre, Mn = 143.7 lb/acre, Cu = 2.3 lb/acre. Zn = 11.8 lb/acre; percent base saturations: Ca = 71.6%, Mg = 16.8%, K = 1.9%, Na = 1.0%, other bases = 4.6%, H = 4.0%.
Experimental design: A corn study having individual plots 15 x 30 feet (450 ft^2, or 0.0103 acre) was set up in a randomized complete block design, with six replicates. The purpose of the study was to determine the effects of Vitazyme and fish applied separately, and the two applied together in-furrow and foliar, on crop yield, moisture, and plant population.

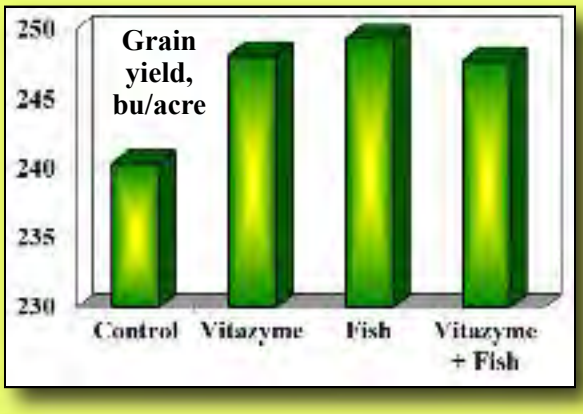
Treatment	At planting	At V6R1	At R4
1. Control	0	0	0
2. Vitazyme	13 oz/acre	13 oz/acre	0
3. Fish	2 gal/acre	2 gal/acre	2 gal/acre
4. Vitazyme + Fish	13 oz + 2 gal (Trt. 2 + 3)	13 oz + 2 gal (Trt. 2 + 3)	2 gal/acre (Fish only)

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. At 14 inches corn height, 100 lb/acre of N was applied as UAN (urea ammonium nitrate).
Vitazyme application: At planting (for Treatments 2 and 4), 13 oz/acre (1 liter/ha) in-row in a 10 gallon/acre solution; at V6 (Treatments 2 and 4), 13 oz/acre (1 liter/ha) sprayed on June 20 at 15 gallons/acre.
Fish application: Emulsified fish was applied at 2 gallons/acre in-row at planting (Treatments 3 and 4), and at 2 gallons/acre by foliar spray at V6 (Treatments 3 and 4) on June 20, as well as at V10 (Treatments 3 and 4) on August 26. The fish was mixed with water to give a 20 gal/acre output.
Weed control: Harness Xtra preplant (1.2 quarts/acre); Roundup postemergence at the recommended rate
Harvest date: October 25, 2013

Yield results: Means followed by the same letter are not significantly different at P=0.05 according to the Student-Newman-Kuels Test.

Treatment	Yield[1]	Yield change
	bu/acre	bu/acre
1. Control	240.3 b	—
2. Vitazyme	248.1 ab	7.8 (+3.2%)
3. Fish	249.3 a	9.0 (+3.7%)
4. Vitazyme + Fish	247.9 ab	7.6 (+3.2%)
LSD (P = 0.05)	8.0	
Standard deviation	6.5	
CV	2.6%	
Replicate F	1.73	
Treatment F	2.40	

[1]Adjusted to 15.5% moisture.



Increase in corn yield with Vitazyme: 3.2%

Increase in corn yield with Fish: 3.7%

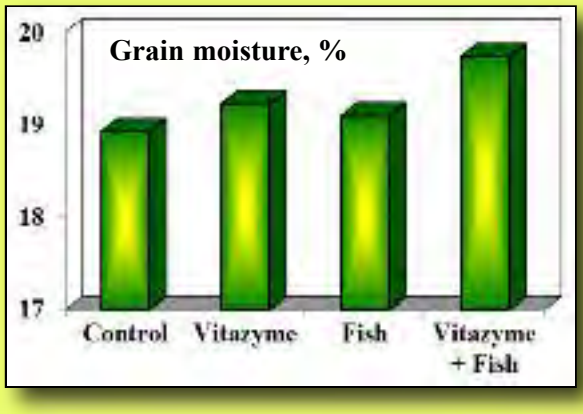
Increase in corn yield with Vitazyme + Fish: 3.2%

Although only the fish treatment statistically exceeded the control, the three Vitazyme and fish treatments were equal, differing by 0.5% from each other. Vitazyme increased yield at the 6% confidence level, but the combined Vitazyme and fish did not enhance the yield above either product alone.

Plant population results: All final population values were nearly equal (36,459 to 36,776 plants/acre).

Grain moisture results:

Treatment	Grain moisture	Moisture change
	%	%
1. Control	18.92 b	—
2. Vitazyme	19.22 ab	+0.30
3. Fish	19.09 ab	+0.17
4. Vitazyme + Fish	19.73 a	+0.81
LSD (P = 0.05)	0.62	
Standard deviation	0.50	
CV	2.6%	
Replicate F	1.73	
Treatment F	2.92	



Only the combined Vitazyme + Fish treatment exceeded the control in grain moisture at P = 0.05. The other treatments were very close to each other.

Conclusions: A replicated corn trial in east-central Iowa revealed that both Vitazyme and liquid fish, and the products combined, increased the yield of corn grain significantly — Vitazyme alone and the two products together at P = 0.06, and fish alone at P = 0.05 — with the combined products not showing a synegistic effect. These yield increases were 7.8, 9.0, and 7.6 bu/acre for the Vitazyme, fish, and combined treatments, respectively. Plant population was not affected by either material, but grain moisture was greater than the control for the combined products by 0.81 percentage point at P =0.05.

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2013 Crop Results

Vitazyme on Corn

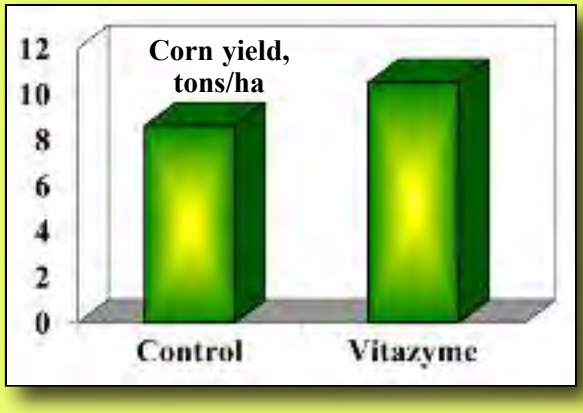
Researcher: Juan Carlos Diaz, Ph.D.
Farmer: Eng. Jose Isabel Hernandez Soto
Location: El Monte Farm, Villa Corona, Jalisco, Mexico
Variety: Cayman
Planting date: May 8, 2012
Experimental design: A corn field was divided into Vitazyme treated and control areas to determine the effect of a seed and foliar treatment on corn yield. The treated area was 1 ha.

1. Control **2. Vitazyme**

Fertilization: unknown
Vitazyme application: (1) Seed treatment, at 100 ml/20 kg of seed; (2) soil and foliar spray at 1 liter/ha (13 oz/acre) at an undetermined time
Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
Control	8.6	—
Vitazyme	10.5	1.9 (+22%)

Increase in yield with Vitazyme: 22%



Conclusions: Applying a seed treatment and foliar spray to this corn study resulted in an excellent 22% yield increase.

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2013 Crop Results

Vitazyme on Corn

A Nitrogen Rate Study

Researcher: Timothy Veldkamp *Research Organization*: SGS Ag Research
Location: Aurora, South Dakota *Variety*: 4055 Roundup Ready *BCCH Scale*: BCOR
Planting Date: June 14, 2013 *Planting rate*: 32,000 seeds/acre *Planting depth*: 1.5 inches
Row spacing: 30 inches *Tillage*: conventional *Previous crop*: soybeans
Soil type: Strayhoss Loam (pH = 6.5, organic matter = 4.5%, cation exchange capacity = 25 meq/100 g of soil, P = 14 lb/acre, K = 174 lb/acre, Zn = 1.22 lb/acre)
Experimental design: A small plot soybean study was designed to evaluate the effect of Vitazyme, at two nitrogen levels, on the yield of corn. The plots were 10 x 40 feet (0.009183 acre), and arranged in a randomized complete block design, with four replicates.

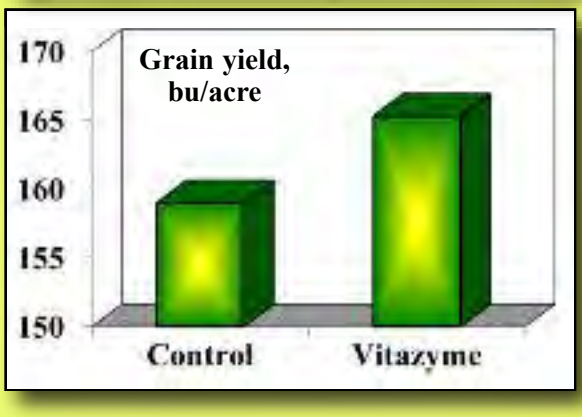
1. Control, 50% N 2. Vitazyme, 50% N 3. Control, 100% N 4. Vitazyme, 100% N

Fertilization: 50% N plots received 65 lb/acre of N; 100% N plots received 130 lb/acre of N
Vitazyme application: (1) 13 oz/acre (1 liter/ha) in the seed row at planting; (2) 13 oz/acre (1 liter/ha) on the leaves and soil at V8.
Weed control: 1.8 quarts/acre of Harness Xtra + 24 oz/acre of Roundup PowerMax on July 3; 24 oz/acre of Roundup PowerMax on August 8
Vigor results: Plant vigor was evaluated at the V2 stage on July 8, 2013. Values ranged from 5.8 to 6.3, and were not significantly different.
Harvest date: November 8, 2013
Yield results: The middle two rows of each plot were combined and weighed, and the moisture content was determined using an Almaco Grain Gauge.

Treatment	Grain yield[1]	Yield change[2]
	bu/acre	bu/acre
Control, 50% N	159.0 b	—
Vitazyme, 50% N	165.3 a	6.3 (+4%)
Control, 100% N	167.4 a	—
Vitazyme, 100% N	170.3 a	2.9 (+2%)
LSD (P = 0.10)	5.0	
CV	2.35%	
Replicate F	13.880	
Treatment F	6.138	

[1]Means followed by the same letter are not significantly different at P=0.10, according to the Student-Newman-Kuels Test.
[2]The Vitazyme means are compared with the control means at the same N level.

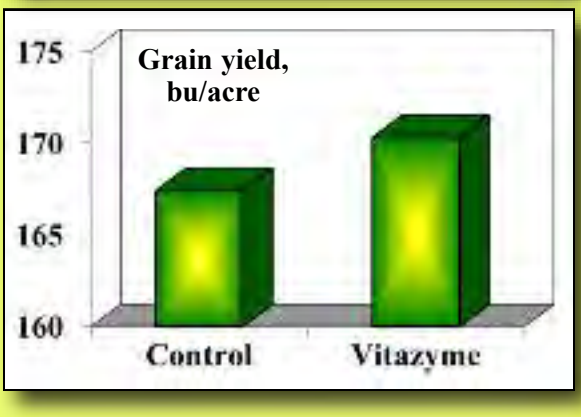
Grain Yield, 50% N



Increase in yield at 50% N: 4%

Increase in yield at 100% N: 2%

Grain Yield, 100% N



Vitazyme significantly increased grain yield at 50% N, boosting it by 6.3 bu/acre, while the 100% N application revealed that Vitazyme increased the yield by 2.9 bu/acre over the control, but not significantly. Vitazyme grain yield at 50% N was statistically the same as was the untreated grain yield at 100% N.

Test weight results: All values varied within a narrow range — 51.15 to 51.93 lb/bu — and none of the differences were significant. However, Vitazyme at both N levels slightly raised bushel weight.

Increase in test weight with Vitazyme

At 50% N ..... 0.78 lb/bu
At 100% N ..... 0.25 lb/bu

Grain moisture results: There were no significant differences in grain moisture among the four treatments.
Conclusions: This corn trial with Vitazyme at two nitrogen levels, near Brookings, South Dakota, revealed that Vitazyme significantly improved corn yield at the 50% N level. This yield was only 2.1 bu/acre less than the 100% N treatment without Vitazyme, and not significantly different from it. This reveals the improved nitrogen efficiency often noted with the use of this product. The 100% N level gave a 2% (2.9 bu/acre) yield increase for Vitazyme; the two were statistically the same. Grain moisture was not affected by the treatments, but there appeared to be a slight improvement in grain bushel weight with Vitazyme. These results show the excellent value of this program for corn growers in the northern Corn Belt.

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2013 Crop Results

Vitazyme on Corn

With Quantum Products at Two Nitrogen Rates

Researcher: Bertel Schou, Ph.D. *Research organization*: ACRES (Agricultural Research and Educational Services), Cedar Falls, Iowa
Location: Cedar Falls, Iowa *BBCH scale*: BCOR
Variety: Pioneer P9675 (Roundup Ready) *Planting Depth*: 1.5 inches *Maturity*: 96 days
Planting rate: 38,000 seeds/acre *Row spacing*: 30 inches *Slope of plot*: 4%
Tillage: field cultivated and harrowed *Planting date*: June 20, 2013 *Previous crop*: corn
Soil type: Maxfield silty clay loam (organic matter = 4.4%, pH = 6.3, cation exchange capacity = 17 meq/100 g of soil, drainage = excellent, fertility = excellent)
Experimental design: A small plot corn experiment was established in east-central Iowa to evaluate the effect of Vitazyme and two Quantum products on the yield of corn, at two nitrogen levels. Six replications were used, with a randomized complete block design. Individual plots were 15 x 30 feet, or 450 ft^2 per plot (0.01033 acre). This experiment had been put in earlier but was mistakenly fertilized incorrectly, so was redone and planted later with a short-season variety, so yielded less than the original study would have.

Treatment	Nitrogen	Vitazyme	Quantum Light	Quantum VSC
1. Control	50%	0	0	0
2. Vitazyme	50%	In-furrow,Foliar	0	0
3. Quantum	50%	0	In-furrow, Foliar	In-furrow, Foliar
4. Vitazyme + Quantum	50%	In-furrow, Foliar	In-furrow, Foliar	In-furrow, Foliar
5. Control	100%	0	0	0
6. Vitazyme	100%	In-furrow, Foliar	0	0
7. Quantum	100%	0	In-furrow, Foliar	In-furrow, Foliar
8. Vitazyme + Quantum	100%	In-furrow, Foliar	In-furrow, Foliar	In-furrow, Foliar

Fertilization: 18-46-0% N-P_2O_5-K_2O applied per acre the fall of 2012; 50% N, 80 lb/acre urea-NH_4NO_3; 100% N, 160 lb/acre urea NH_4NO_3, all sidedressed

Vitazyme application: 13 oz/acre (1 liter/ha) in-row at planting; 13 oz/acre (1 liter/ha) on the leaves and soil at V8, August 9, 2013

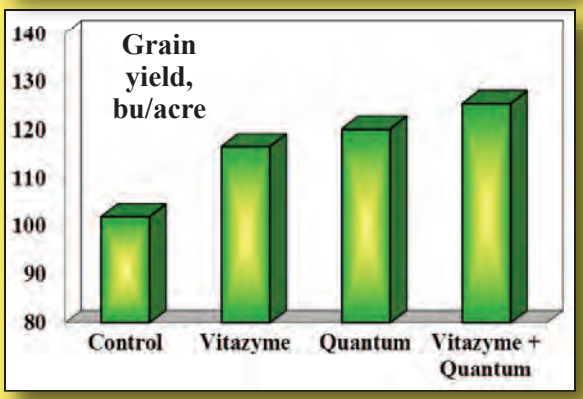
Quantum application: Both Quantum products are produced by Applied and Experimental Biology, Jacksonville, Florida. Quantum Light is a proprietary blend of beneficial cultures and photosynthetic microbes that increase plant photosynthesis and growth. Quantum VSC contains photosynthetic microbes, hypercellulose, symbiotic microbes, and humic substances. These were applied at 1 gallon/acre each for both in-furrow and foliar applications, at the same times as Vitazyme. The two were applied together.

Weed control: post-emergence herbicides
Weather during the growing season: Temperatures were about average after a cool early season; spring was wet, but July and August were dry.
Harvest date: October 28, 2013
Yield results: The two center rows of each plot were harvested for yield results. Weights are corrected to 15.5% moisture.

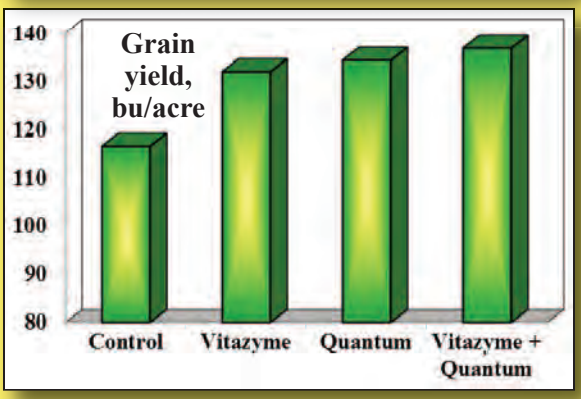
Treatment	Grain yield[1]	Yield change[2]
	bu/acre	bu/acre
---------- 50% Nitrogen ----------		
1. Control	101.9 d	—
2. Vitazyme	116.4 c	14.5 (+14%)
3. Quantum	120.0 c	18.1 (+18%)
4. Vitazyme + Quantum	125.3 bc	23.4 (+23%)
---------- 100% Nitrogen ----------		
1. Control	116.4 c	—
2. Vitazyme	131.8 ab	15.4 (+13%)
3. Quantum	134.2 ab	17.8 (+15%)
4. Vitazyme + Quantum	136.7 a	20.3 (+17%)
LSD (P = 0.05)	10.4	
CV (P = 0.05)	7.21%	
Replicate F	4.051	
Treatment F	10.244	

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

Yield at 50% Nitrogen



Yield at 100% Nitrogen



Vitazyme consistently boosted yield by 13 to 14% above the control at both nitrogen levels, while the Quantum products improved the yield by 15 to 18%. The two products together further boosted corn yield, to 17 to 23% above the control. In every cases the greatest increases were at the 50% notrogen level. There appears to be a synergism between Vitazyme and Quantum materials, with additional boosts in yield of 2% at the 100% N level, and 5% at the 50% N level.

Increase in Yield With Vitazyme

	50% N	100% N
Vitazyme	14%	13%
Quantum Only	18%	15%
Vitazyme + Quantum	23%	17%

Grain moisture results: Grain moisture was determined by a device on the plot combine.

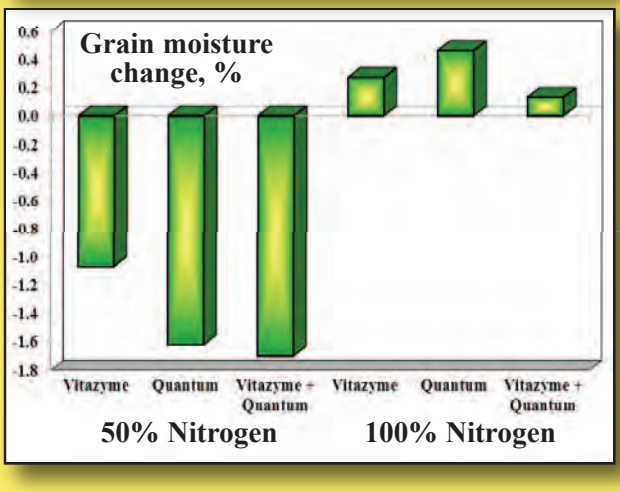
Treatment	Grain moisture[1]	Change[2]
	%	%e
---------- 50% Nitrogen ----------		
1. Control	25.00 a	—
2. Vitazyme	23.93 ab	-1.07
3. Quantum	23.38 ab	-1.62
4. Vitazyme + Quantum	23.30 b	-1.70
---------- 100% Nitrogen ----------		
1. Control	23.89 ab	—
2. Vitazyme	24.16 ab	+0.27
3. Quantum	24.35 ab	+0.46
4. Vitazyme + Quantum	24.02 ab	+0.13
LSD (P = 0.05)	1.67	
CV	5.90%	
Replicate F	0.940	
Treatment F	0.869	

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

There was only one significant grain moisture change: a reduction of 1.70 percentage points with Vitazyme + Quantum at 50% N. Both Vitazyme and Quantum and Quantum alone also reduced grain moisture, but not significantly at 50% N. On the other hand, all treatments at 100% N slightly increased grain moisture.

Reduction in grain moisture with Vitazyme + Quantum at 50% N: 1.70%-point

Change in Grain Moisture



Plant population results: All treatments had statistically the same population (23,980 to 22,092 plants/acre) except the control at 50% N, and Quantum products at 50% N, and Quantum products at 50% N, which had significantly lower populations. The good yield response of the Quantum treatment showed that these slightly reduced populations had little effect on the resultant yield.

Conclusions: A small plot corn study in east-central Iowa revealed that a late-planted Roundup Ready variety responded well to both two nitrogen levels, and also Vitazyme and Quantum products, alone or in combination. Vitazyme boosted the grain yield by 14% at 50% N, and by 13% at 100% N; Quantum Light + Quantum VSC increased the yields by 18% and 15% at 50 and 100% N, respectively. The products applied together in-row and foliar brought a synergistic improvement in yield above either product alone, the increases being 23% at 50% N and 17% at 100% N. Grain moisture was significantly reduced by the combined products at the 50% N level, but this reduction was not achieved at the 100% N level. Both products, and especially the products applied together, showed fine grain yield responses in this trial, and should be evaluated further as to their potential as excellent synergists for farmers in the Corn Belt.

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2012 Crop Results

Vitazyme on Corn

Researcher: James Anderson
Farmer: David Bergeson
Location: Dawson, Minnesota
Varieties: Pioneer 38A56, Garst 88B37
Planting date: April 25, 2012
Row width: 30 inches
Planting rate: 32,000 seeds/acre
Previous crop: soybeans
Tillage: conservation

Experimental design: A field was divided into plots of field length to determine the effects of Vitazyme on corn yield and test weight for various varieties.

1. Control **2. Vitazyme**

Fertilization: (1) starter in-furrow at 8 gal/acre (a 20-14-12% N-P_2O_5-K_2O formulation with sulfur and zinc, dry mixed at 1.5 lb/gal of water); (2) 120 lb/acre of anhydrous NH_3 (82% N)

Vitazyme application: 13 oz/acre in the starter, on the seed row at planting

Weather: very dry all season

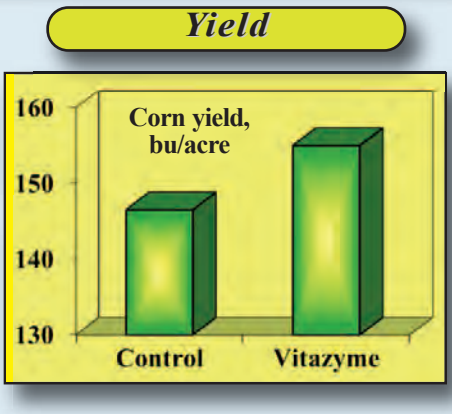
Yield and test weight results: A weigh wagon was used to weigh the corn for a measured area, from which yield calculations were made. Harvest date was September 29, 2012.

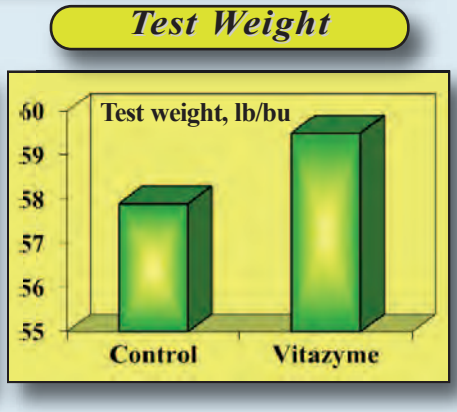
Variety: Pioneer 38A56

Treatment	Yield	Yield change	Test weight	Test weight change
	bu/acre	bu/acre	lb/bu	lb/bu
Control	146.5	—	57.9	—
Vitazyme	155.0	8.5 (+6%)	59.5	+1.6

Increase in yield with Vitazyme: 6%

Increase in test weight with Vitazyme: 1.6 lb/bu





Pioneer 38A56 responded with a yield increase of 6% (8.5 bu/acre), and with heavier grain that weighed 1.6 bu/acre more with Vitazyme.

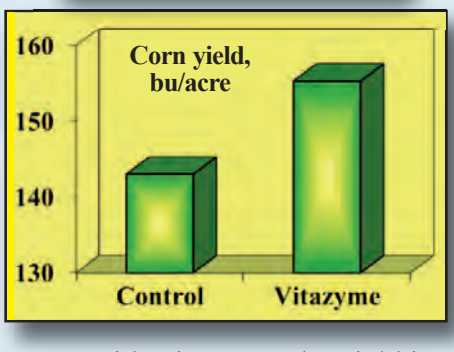
Variety: Garst 88B37

Treatment	Yield	Yield change	Test weight	Test weight change
	bu/acre	bu/acre	lb/bu	lb/bu
Control	143.0	—	51.9	—
Vitazyme	155.3	12.3 (+9%)	53.8	+1.9

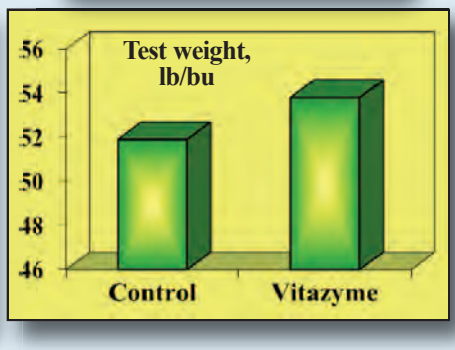
Increase in yield with Vitazyme: 9%

Increase in test weight with Vitazyme: 1.9 lb/bu

Yield



Test Weight

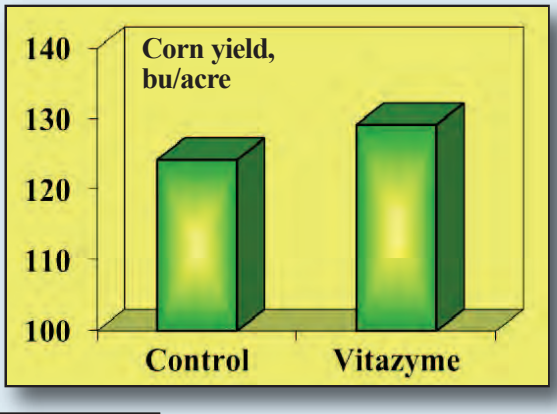


Garst 88B37 produced excellent responses with Vitazyme, the yield increasing by 9% (12.3 bu/acre), and the test weight by 1.9 lb/bu.

Variety: Pioneer 36152

Treatment	Yield	Yield change
	bu/acre	bu/acre
Control	124.2	—
Vitazyme	129.2	5.0 (+4%)

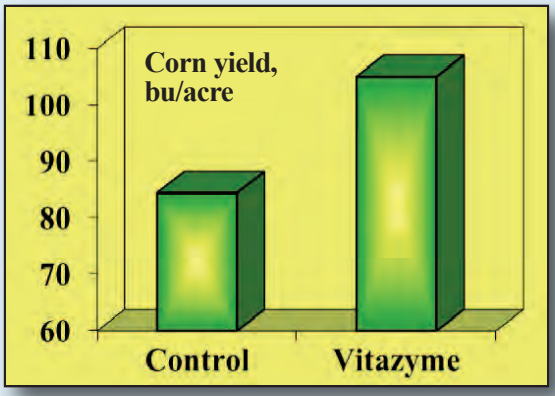
Increase in yield with Vitazyme: 4%



Variety: Federal 5100

Treatment	Yield	Yield change
	bu/acre	bu/acre
Control	84.4	—
Vitazyme	105.0	20.6 (+24%)

Increase in yield with Vitazyme: 24%



The great increase in yield with Vitazyme was due in part to the fact that the harvest was postponed because of equipment problems. As a result, high winds blew down some of the corn, preferentially downing the untreated control corn because the stalks and ear shanks were weaker

Conclusions: Four comparisons of Vitazyme treated and untreated corn varieties in this west central Minnesota study produced excellent yield increases for Vitazyme: 6% for Pioneer 38A56, 9% for Garst 88B37, 4% for Pioneer 36152. and 24% for Federal 5100. The 24% increase for the Federal variety was due in part to better standibility and stronger stalks and shanks of the great value in using Vitazyme to increase corn yields, grain weight, and profits in western Minnesota. Since only 13 oz/acre was used at planting, at a cost of about $5.00/acre, then the smallest increase (5.0 bu/acre) netted an added $32.50/acre — using $7.50/bu of corn — while the highest increase (20.6 bu/acre) netted $149.50/acre more with a single Vitazyme application. The recommended two applications would likely have given addition returns on investment.

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2012 Crop Results

Vitazyme on Corn

Free Amino Acid Levels - University of Missouri

Researcher: Manjula Nathan, Ph. D. *Location*: University of Missouri, Columbia, Missouri
Variety: unknown *Planting date*: May 3, 2011 *Row spacing*: 30 inches
Seeding rate: 32,000 seeds/acre *Soil type*: unknown
Experimental design: A plot area of 12 rows — six rows for the control and six rows for the Vitazyme treatment (0.33 acre per treatment) — was selected; each row was 200 feet long. Corn was grown to determine yield responses (reported elsewhere), and also to evaluate the free amino acid levels in plant tissues.

1. Control **2. Vitazyme**

Fertilization: station standard for corn
Vitazyme application: The seeds for Treatment 2 were treated with 100% Vitazyme to give a coating of 13 oz on 32,000 seeds, or an equivalent of 13 oz/acre. The control received only water on the seeds. On June 28 (V10 stage), an additional 13 oz/acre was applied to the leaves and soil of Treatment 2.
Free amino acid analysis: Samples of leaves below and opposite the ear were collected on July 14, during silking. These leaves were quite ragged due to the hail damage of a severe storm that struck on July 3, 11 days before. These composite samples from each treatment were frozen and later analyzed at a university laboratory to determine levels of free amino acids.

Amino acid*	Control	Vitazyme	Change
	µg/100 mg	µg/100 mg	µg/100 mg
Aspartic acid	23.32	20.04	-3.28
Threonine	21.72	20.33	-1.39
Serine	16.13	15.52	-0.61
Glutamic acid	29.55	28.15	-1.40
α-amino adipic acid	0.78	1.45	+0.67
Proline	9.49	9.73	+0.24
Gycine	6.88	5.84	-1.04
Alanine	35.26	32.81	-2.45
Valnine	14.06	13.40	-0.66
Methionine	0.61	0.46	-0,15
Cystine	11.07	11.43	+0.36
Isoleucine	10.21	15.39	+5.18
Leucine	15.28	16.64	+1.36
Tyrosine	11.14	11.83	-0.69
Phenylalanine	12.37	10.11	-2.26
β-amino isobutyric acid	5.80	4.66	-1.14
alpha-amino butyric acid	6.63	6.12	-0.51
Ornithine	3.29	7.93	+4.64
Lysine	14.89	13.80	-1.09
Histidine	3.26	3.10	-0.16
Arginine	0.72	3.20	+2.48
Net change			-1.90

*Only those free amino acids that were discovered in the analysis are listed here.

Note that the net effect of Vitazyme is to decrease the free amino acid level of the leaf tissue slightly (1.90 µg/100mg) This occurred in spite of the fact that large increases occurred for isoleucine, ornithine, and arginine. Most amino acids decreased with Vitazyme treatment, which should help explain the observation that treated plants resist fungal, bacterial, nematode, and other infections.

Conclusions: This University of Missouri corn trial revealed that Vitazyme reduced the level of most free amino acids in leaf tissue when sampled at silking, but fairly large increases in isoleucine, ornithine, and arginine offset much of the reduction. Even so, the theory of trophobiosis -- where high levels of free amino acids in tissues encourage the growth of pathogenic fungi, bacteria, nematodes, and other pests -- is somewhat substantiated by these results. Vitazyme stimulates the metabolic activity of various cycles in leaves, so proteosynthesis is encouraged to reduce the free amino acid backlog in tissues, thus reducing pest feeding potential.

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2012 Crop Results

Vitazyme on Corn

Yield, Quality, and Hail Damage - University of Missouri

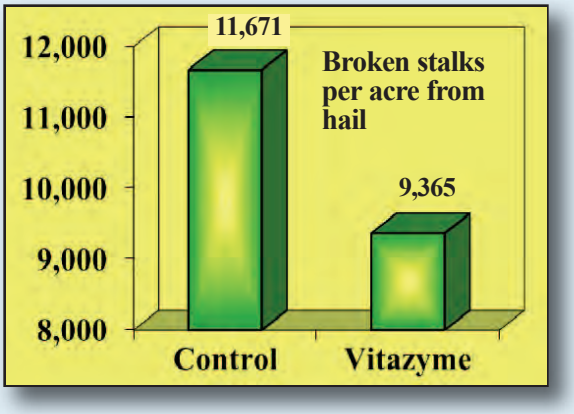
Researcher: Manjula Nathan, Ph. D., and Timothy Reinbott, research station supervisor
Location: University of Missouri Division of Plant Sciences, Columbia, Missouri, research farm
Variety: unknown hybrid *Planting date*: May 3, 2011 *Row spacing*: 30 inches
Seeding rate: 32,000 seeds/acre *Soil type*: unknown
Experimental design: A plot area of 12 rows – six rows for a control and six rows for the Vitazyme treatment, or 0.33 acre for each area – was selected; each row was 200 feet long. Corn was grown to determine the effects of Vitazyme on the yield and growth characteristics of corn.

1. Control **2. Vitazyme**

Fertilization: station standard for corn
Vitazyme application: The corn seeds of Treatment 2 were seed treated with straight Vitazyme to give a coating of 13 oz on 32,000 seeds, or an equivalent of 13 oz/acre. The control received water only on the seeds. On June 28 (V10 stage), a soil/foliar application of 13 oz/acre was made to Treatment 2.
Hail damage event: On July 2, a severe hail storm (stones of golf ball size) struck the plot area, resulting in considerable damage to the crop, with many partially or completely broken stalks. Since there appeared to be a difference in stalk damage between the two treatments, a count was made of broken stalks.

Treatment	Broken stalks	Difference
	stalks/acre	stalks/acre
Control	11,671	—
Vitazyme	9,365	(-) 2,306 (-20%)

Decrease in broken stalks with Vitazyme: -20%



It is clear that the Vitazyme treated corn had substantially stronger stalks due to greater deposition of lignin, cellulose, and hemicellulose in the stalk structures.
Plant analysis results: On July 14, at silking, some of the hail-damaged ear-leaf tissue was collected and analyzed at the University of Missouri Soil and Crop Testing Laboratory. Results are shown below. 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	2.126	—	0.290	—	1.323	—	13.3	—
Vitazyme	2.188	0.062 (+3%)	0.338	0.048 (+17%)	1.550	0.227 (+17%)	13.7	0.4 (+3%)

Increase in leaf N with Vitazyme: 3%
Increase in leaf P with Vitazyme: 17%
Increase in leaf K with Vitazyme: 17%
Increase in leaf crude protein with Vitazyme: 3% (0.4%-point)

All nutrients and protein were increased in leaf tissue harvested at silking.

Grain analysis results: At harvest, grain samples of the two treatments were analyzed at the University of Missouri Soil and Crop 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	1.20	0.35	0.36	0.01	0.06	16.8	13.2	3.9	2.6	28.2	1.0	0.007	171
Vitazyme	1.20	0.55	0.40	0.01	0.09	20.4	14.6	5.1	2.9	27.5	0.3	0.005	240

Increases with Vitazyme

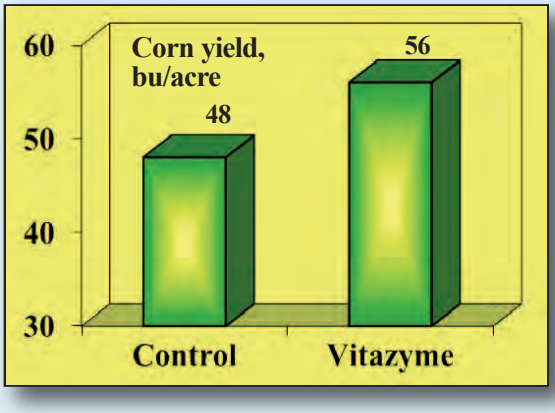
P ..... 0.20 %-point
K ..... 0.04 %-point
Mg ..... 0.03 %-point
Zn ..... 3.6 ppm
Fe ..... 1.4 ppm
Mn ..... 1.2 ppm
Cu ..... 0.3 ppm
N:S ..... 171 to 240

In most cases, nutrient uptake into the grain was increased with Vitazyme application.

Yield results: Due to the July 3 hail storm, yields were greatly reduced, and are given below.

Treatment	Grain yield	Yield change
	bu/acre	bu/acre
Control	48	—
Vitazyme	56	8 (+17%)

Yield increase with Vitazyme: 17%



Conclusions: In this side-by-side experimental farm demonstration at Columbia, Missouri, a seed plus foliar treatment of Vitazyme resulted in a substantial 8 bu/acre (17%) yield increase despite a severe hailstorm on July 3. Of considerable interest is the fact that the hail storm broke off 20% fewer stalks that had been treated with this product due to stronger connective tissues – cellulose, hemicellulose, and lignin – in the treated plants. Tissue levels of N, P, K, and protein were all increased, especially P, and K, and grain elemental levels at harvest was in most cases increased, especially for P. These results reveal the ability of Vitazyme's active agents to activate rhizosphere activity and the availability of nutrients, especially P, presumably because of a more active mycorrhizae population. An analysis of free amino acids in the plant tissues is discussed in a separate report.

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2012 Crop Results

Vitazyme on Corn

Researcher: Eddie Pearson
Location: Hooser Farm, Frost, Texas
Variety: Pioneer 2058
Planting date: February 27, 2012
Seeding rate: 26,500 seeds/acre
Row spacing: 30 inches
Experimental design: Two adjacent corn fields, both treated equally and of the same soil type, were selected to compare a single Vitazyme treatment with an untreated area. A 65-acre field served as the untreated control, and an adjacent 10-acre area was treated with Vitazyme.

1. Control **2. Vitazyme**

Fertilization: before planting, 150 lb/acre anhydrous ammonia (82-0-0 %N-$P_2O_5K_2O$), 150 lb/acre 18-46-0, and 150 lb/acre 32-0-0; during growth, 110 lb/acre 34-0-0 sidedressed
Vitazyme application: 13 oz/acre sprayed over the leaves and soil sometime between February 27 and May 10, 2012
Harvest date: July 19, 2012
Yield results: At harvest, three 30-foot typical sections of row for both treatments were picked and bagged, to make a composite 90-foot (225 ft.^{2}) row sample for each.

Treatment	Ear number	Ear weight	Estimated grain[1]	Yield[2]	Yield change
		lb	lb	bu/acre	bu/acre
Control	110	58.8	47.0	162.5	—
Vitazyme	123 (+12%)	65.8 (+12%)	52.6	181.8	19.3 (+12%)

[1]A shelling percentage of 80% grain on the ear is estimated. Moisture content is estimated at 14%.
[2]Area harvested for each treatment = 0.0051653 acre. 1 bushel = 56 lb.

Ear number increase with Vitazyme....12%

Ear weight increase with Vitazyme....12%

Yield increase with Vitazyme....12%

Income results: Based on corn valued at $8.30/bu, 13 oz/acre of Vitazyme increased the value of corn produced by $160.19/acre.
Aflatoxin levels: Samples of corn grain from each treatment were sent to A and L Laboratories in Lubbock, Texas. Both samples tested negative (<2 ppb) for aflatoxins.
Conclusions: By applying 13 oz/acre one time to this corn field in southern Texas, the yield was increased by 19.3 bu/acre, giving an increased income of about $160/acre. This shows the efficacy of even a single application of Vitazyme for corn, although the total program recommended a 13 oz/acre application on the seeds at planting, which likely would have increased the yield even more.

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2012 Crop Results

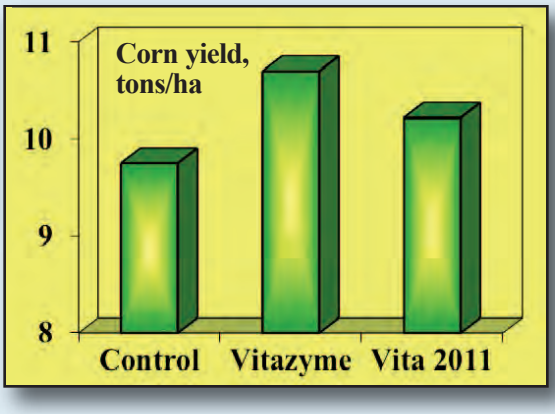
Vitazyme on Corn

Researcher: V. Plotnikov *Research organization*: National Academy of Agricultural Sciences
Location: Vinnytsia, Ukraine *Variety*: DKS 2960 (FAO 250) *Previous crop*: corn
Seedbed preparation: 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 14, 2012 *Seeding rate*: 80,000 seeds/ha
Experimental design: A small plot corn study was laid out on land previously grown to corn, using 1.1 ha plots and four replications. The purpose of the study was to determine the effect of Vitazyme biostimulant on corn growth and yield, with one treatment using soil on which a Vitazyme treated corn crop had been grown in 2011.

1. Control **2. Vitazyme** **3. Vitazyme in 2011**

Fertilization: 100 kg/ha N, 60 kg/ha P_2O_5, and 60 kg/ha K_2O applied before cultivation
Vitazyme application: 1 liter/ha sprayed on the leaves and soil at five to six mature leaves
Yield and income results:

Treatment	Grain yield	Yield change	Income increase
	tons/ha	tons/ha	hrn/ha
Control	9.75	—	—
Vitazyme	10.70	0.95 (+10%)	1,700
Vita in 2011	10.22	0.47 (+5%)	880



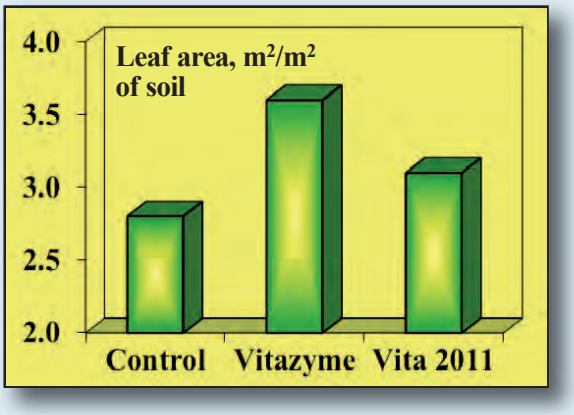
Yield increase with Vitazyme, 1 liter/ha: 10%

Yield increase with Vitazyme, applied in 2011: 5%

Vitazyme produced an excellent 10% yield increase with 1 liter/ha applied, and there was a significant 5% increase from residual effects from 2011 applications

Leaf area results:

Treatment	Leaf area	Leaf area change
	m^2/m^2 of soil	m^2/m^2 of soil
Control	2.8	—
Vitazyme	3.6	0.8 (+29%)
Vita in 2011	3.1	0.3 (+11%)



Increase in leaf area with Vitazyme, 1 liter/ha: 29%

Increase in leaf area with Vitazyme, applied in 2011: 11%

A great response in leaf area was noted with Vitazyme application, 29% more leaf area with the 1 liter/ha application, and 11% more with the 2011 treatment. The carryover effect was very apparent.

Conclusions: A replicated Ukrainian corn study, using Vitazyme at the 5 to 6 leaf stage, provided a yield increase of 10%, and a consequential income increase of 1,700 hrn/ha. Corn treated on the same plots in 2011 caused a respectable 5% yield increase. Corn leaf area was also increased by Vitazyme (by 29%) for the 1 liter/ha application, and by 11% with the 2011 treatments. These results show the strong carryover effect of the product, and the highly positive and profitable yield results, making it an excellent choice for farmers in Ukraine.

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2012 Crop Results

Vitazyme on Corn

Researcher: Bert Schou, Ph.D.
Research organization: Agricultural Custom Research and Education Services (ACRES)
Location: Cedar Falls, Iowa *Variety*: Pioneer PO 448 (non-GMO) *Previous crop*: soybeans
Soil type: Aredale Loam (36% sand, 42% silt, 22% clay), 3.6% organic matter, pH = 6.1, C.E.C. = 15.2 meq/100 g, fertility level = excellent, soil drainage = excellent *Planting depth*: 1.5 inches
Row spacing: 30 inches *Planting rate*: 38,000 seeds/acre *Seedbed at planting*: fine
Planting date: May 9, 2012 *Plot size*: 15 x 40 feet (600 ft^2) *Tillage*: conventional
Irrigation: 2 inches total in late July and early August
Experimental design: A small plot, replicated corn trial (four replicates) was established in eastern Iowa to evaluate the ability of two Vitazyme variations, plus an amino acid formulation, alone or in combination, to influence corn 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)

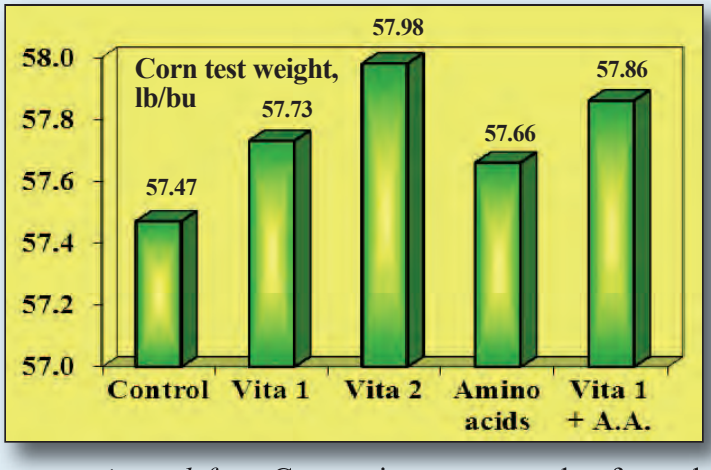
*All applications were on the seeds at planting, and on the leaves and soil later.

Fertilization: Fall of 2011, 60 lb/acre of 18-46-0% N-P_2O_5-K_2O; June 5, 2012, 110 lb/acre of N as urea ammonium nitrate, with a sprayer and drop nozzles
Vitazyme application: For Treatments 2, 3, and 5, 13 oz/acre on the seeds at planting (May 9), and again at 13 oz/acre on the leaves and soil at the V6 stage (June 16). 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 9, and to the leaves and soil at the V6 stage at 2 oz/acre on June 16. For Treatment 5, the amino acids were mixed with the Vitazyme before application.
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: preplant: Harness Xtra at 1.2 quarts/acre; additional post-emergence applications
Weather during the growing season: The season was hot and dry, with the July average high temperature being 92.3° F, and the August average high being 85.5° F. Rainfall for April through October 12 was 12 inches, whereas the normal is 26 inches.

Harvest date: October 20, 2012. A Massey-Ferguson 9 plot combine harvested the middle two rows of each plot, and the corn was weighed on an electronic scale.

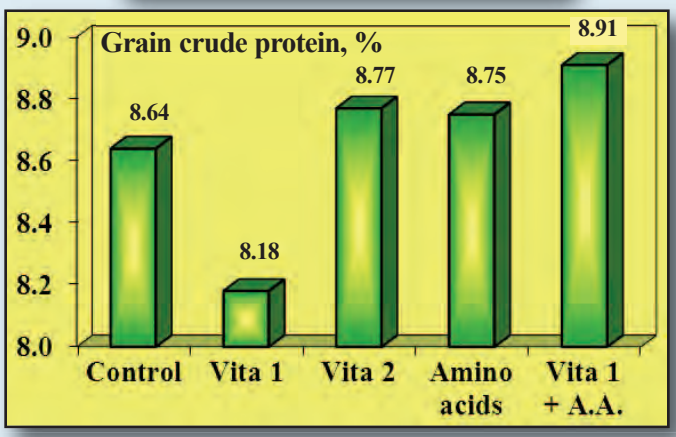
Plant population results: No significant differences were detected.

Corn test weight: Although differences among treatments were not significant, all four Vitazyme and amino acid treatments exceeded the control.



Corn protein and fat: Composite corn samples from the four replicates of each treatment were sent to Midwest Laboratories, Inc., Omaha, Nebraska, to evaluate the levels of protein and fat in the samples. Fat of the treated corn always exceeded the untreated control, and in all but one case the protein was also evaluated by the treatments.

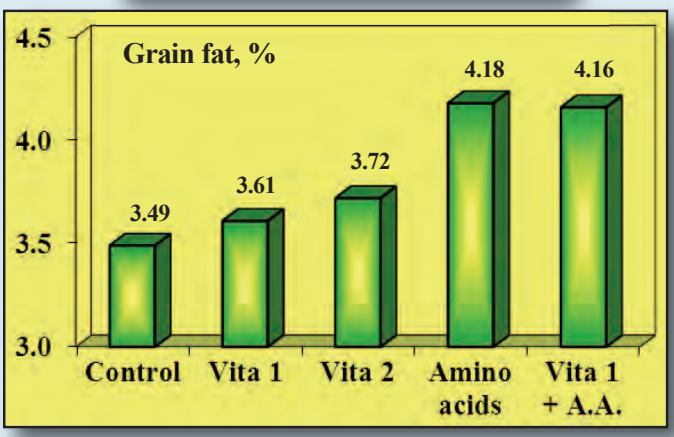
Protein (dry basis)



Increase grain protein with Vitazyme and amino acids

Vitazyme 2	+2%
Amino acids	+1%
Vitazyme 1 + Amino acids	+3%

Fat (dry basis)



Increase grain fat with Vitazyme and amino acids

Vitazyme 1	+3%
Vitazyme 2	+7%
Amino acids	+20%
Vitazyme 1 + Amino acids	+3%

Changes in grain composition are usually quit resistant to treatment, but there were small increases in grain protein with Vitazyme and amino acids. Fat composition was improved by all four treatments, and dramatically by the amino acid and Vitazyme 1 plus amino acid treatments (19 to 20%).

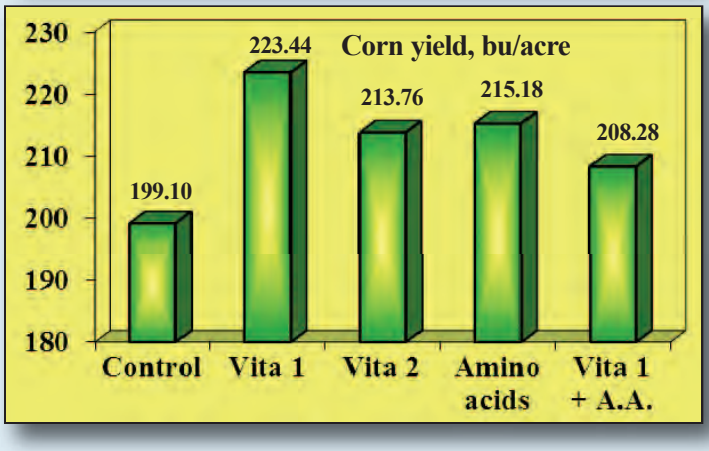
Yield results: The two inner rows of each plot were harvested.

Treatment	Yield[1]	Yield change
	bu/acre	bu/acre
1. Control	199.10 b	—
2. Vitazyme 1	223.44 a	24.34 (+12%)
3. Vitazyme 2	213.76 ab	14.66 (+7%)
4. Amino acids	215.18 ab	16.08 (+8%)
5. Vita 1 + A.A.	208.28 ab	9.18 (+5%)
$LSD_{0.05}$	15.21 bu/acre	
Standard deviation	11.35 bu/acre	
Replicate F	10.947	
Treatment F	3.150	
C.V.	5.35%	

[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 ..... +12%
Vitazyme 2 ..... +7%
Amino acids ..... +8%
Vitazyme + Amino acids ..... +5%



Notice that Vitazyme 1 increased the corn yield by 12% (24.34 bu/acre), while the other treatments boosted the yield by from 5 to 8% above the control. While these lower increases were not significant at P = 0.05, yet the 7 and 8% increases were very close to being significant.

Conclusions: A replicated corn study in east-central Iowa, during a very hot and dry year, revealed that two variations of Vitazyme both increased corn yield, one by 12% (24.34 bu/acre), and another by 7% (14.66 bu/acre). An amino acid product increased yield by 8% (16.08 bu/acre). With a corn price of $7.50/bu during the fall of 2012, these yield increases translate to $182.55, $109.95, and $120.60/acre. The combined Vitazyme plus amino acid treatment increased yield a very respectable 5% (9.18 bu/acre), but did not display a synergism. Grain quality was also improved by both Vitazyme and amino acids. Per bushel weight was increased by up to 0.51 lb/bu (Vitazyme 2), and grain protein was improved by 1 to 3%. Grain fat was especially enhanced by both products, increasing by 3 to 7% with Vitazyme alone, and by 20% with amino acids alone, and by 19% with the two products combined. These results show the great value of utilizing Vitazyme, and to a lesser extent the amino acids, to improve corn grain yield and quality in the central Corn Belt. There appears to be no synergism between Vitazyme and the amino acid formulation used in this study.

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2012 Crop Results

Vitazyme on Corn

A Greenhouse Study

Researcher: Paul W. Syltie, Ph.D.
Location: Vital Earth Resources Research Greenhouse, Gladewater, Texas
Variety: yellow dent *Planting date*: January 19, 2012 *Pot size*: 1 gallon
Planting rate: 8 seeds/pot, thinned to 3 plants/pot *Soil type*: silt loam
Experimental design: A greenhouse pot trial using 12 replicates was set up to evaluate the effect of Vitazyme, applied once at a standard field rate, on corn growth.

1. Control **2. Vitazyme**

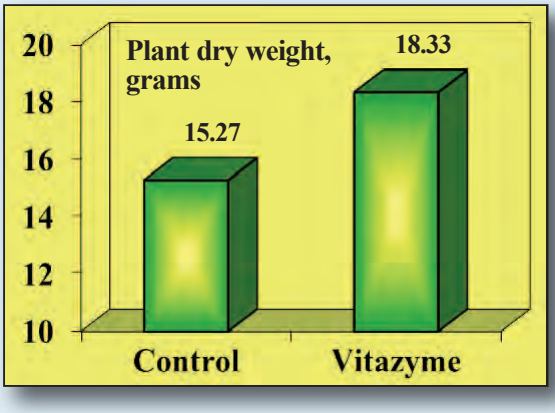
Fertilization: none
Vitazyme application: 100 ml of a 0.1% solution for each pot, immediately after planting
Harvest date: March 5, 2012, 46 days after planting
Plant height results: All plants were measured to the nearest cm, and the three plants for each pot were averaged.

Treatment	Plant height	Height change
	cm	cm
Control	95.7 a	—
Vitazyme	99.3 a	3.6 (+4%)
Block P	0.382	
Treatment P	0.153	
Model P	0.336	
$CV_{0.10}$	5.85%	
$LSD_{0.10}$	4.2 cm	

Vitazyme increased corn height by 4% at 46 days after planting, but this increase was not significant at P = 0.10.

Dry weight results: The plants were placed in a drying oven for 24 hours at 115°F, and then weighed to the nearest 0.01 gram.

Treatment	Dry Weight	Weight change
	grams	grams
Control	15.27	—
Vitazyme seed trt.	18.33	3.06 (+20%)
Block P	0.7148	
Treatment P	0.0029**	
Model P	0.1589	
$CV_{0.10}$	11.74%	
$LSD_{0.10}$	1.45 grams	



Increase in dry weight with Vitzyme: 20%

Vitazyme dramatically and significantly increased the dry matter accumulation of the corn with only one application, by 20%.

Conclusions: In this greenhouse trial, Vitazyme greatly increased the fixation of dry matter in the plants with 100 ml/pot of a 0.1% solution applied at planting. The increase was highly significant, and 20% greater than the control. Plant height was increased by 4% with Vitazyme, but this increase was not significant. These results verify the utility of this product, with its natural vitamins and growth regulators, to improve plant growth and yield.

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2012 Crop Results

Vitazyme on Corn

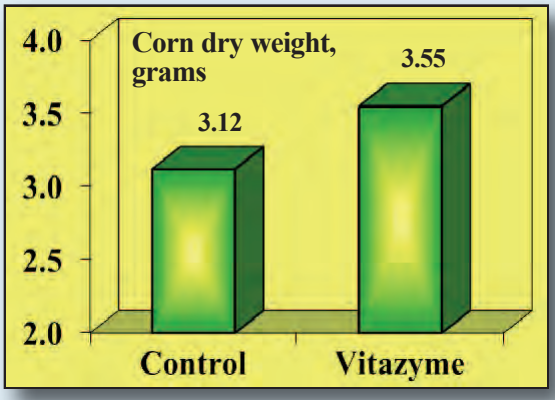
Seed Treatment Results in the Greenhouse

Researcher: Paul W. Syltie, Ph.D.
Location: Vital Earth Resources Research Greenhouse, Gladewater, Texas
Variety: yellow dent *Planting date*: March 14, 2012 *Pot size*: 1 gallon
Soil type: silt loam *Seeding rate*: 8 seeds/pot, thinned to 3 plants/pot
Experimental design: A four replicated greenhouse trial, using corn seeds pre-treated with Vitazyme on January 17, 2012, was planted on March 14, 2012, 57 days after treatment, to determine residual effects of the seed treatment on plant growth. A randomized complete block design was used.

1. Control **2. Vitazyme seed treatment**

Fertilization: none
Vitazyme treatment: On January 17, corn seeds were soaked in a 10% Vitazyme solution for 6 minutes, then dried on paper towels with a fan blowing accross them for rapid drying. The seeds were stored in closed jars at room temperature along with untreated seeds, which served as the control.
Harvest date: April 5, 2012, 21 days after planting
Dry weight results: Roots of the corn plants were washed free of soil, and the plants were placed in a drying oven at 115 °F for 24 hours. Weights of the dried plants for each pot were recorded to the nearest 0.01 gram.

Treatment	Dry Weight	Weight change
	g	g
Control	3.12	—
Vitazyme seed trt.	3.55	0.43 (+14%)
Block P	0.339*	
Treatment P	0.0978*	
Model P	0.0403*	
$CV_{0.10}$	7.581%	
$LSD_{0.10}$	0.42 gram	



Increase in dry weight with Vitzyme: 14%

A seed treatment on these corn seeds 57 days before planting caused a significance 14% increase in dry weight at harvest.

Conclusions: A greenhouse pot study, using corn seeds treated with a 10% Vitazyme solution and dried 57 days earlier, produced a 14% increase in dry weight after 21 days of growth. This significant increase at P = 0.10 shows the effectiveness of a seed treatment to improve corn growth, and the long-term efficacy of the practice.

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2012 Crop Results

Vitazyme on Corn

A Greenhouse Trial -- Synergism With Amino Acids

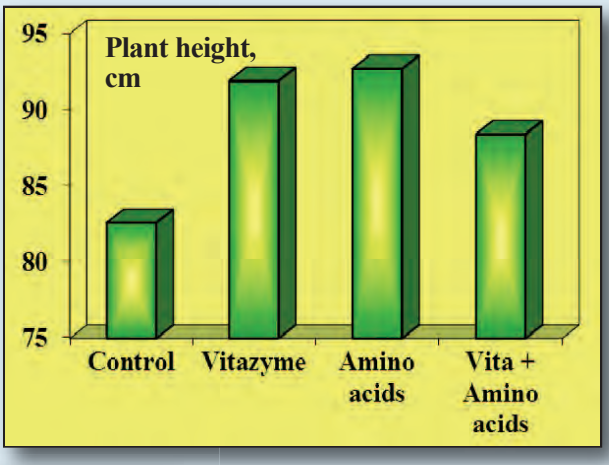
Researcher: Paul W. Syltie, Ph.D.
Location: Vital Earth Resources Research Greenhouse, Gladewater, Texas
Variety: yellow dent *Planting date*: January 19, 2012 *Pot size*: 1 gallon
Planting rate: 8 seeds/pot, thinned to 3 plants/pot *Soil type*: silt loam
Experimental design: A replicated greenhouse pot study (four reps) use set up to evaluate the effects of Vitazyme and certain amino acids — alone and together — on corn growth.

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 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 three plants from each pot were measured to the nearest cm, and averaged. A statistical analysis was then performed on these averages.

Plant Height

Treatment	Plant height	Height change
	cm	cm
Control	82.6 b	—
Vitazyme	91.9 a	9.3 (+11%)
Amino acids	92.7 a	10.1 (+12%)
Vita + A.A.	88.4 a	5.8 (+7%)
Block F	0.0096*	
Main effects F	0.0262*	
Model F	0.0088*	
$LSD_{0.10}$	5.3 cm	
$CV_{0.10}$	4.63%	

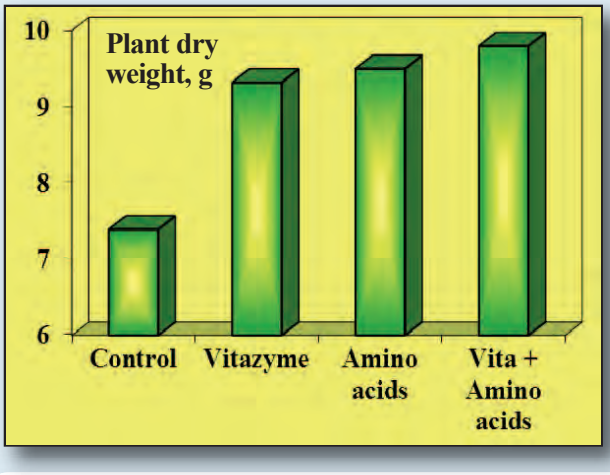


Increase in height with Vitazyme: 11%
Increase in height with Amino Acids: 12%

All three treatments significantly increased plant height at P = 0.10.

Dry weight results: The harvested plants were dried in a drying oven for 24 hours at 115°F, before weighing to the nearest 0.01 gram.

Plant Dry Weight



Treatment	Dry weight	Weight change
	g	g
Control	7.39 b	—
Vitazyme	9.32 a	1.93 (+26%)
Amino acids	9.50 a	2.11 (+29%)
Vita + A.A.	9.80 a	2.41 (+33%)
Block F	0.184	
Main effects F	0.068*	
Model F	0.088*	
$LSD_{0.10}$	1.54 gram	
$CV_{0.10}$	13.2%	

Increase in dry weight

Vitazyme 26%
Amino acids 29%
Vitazyme + Amino Acids 33%

All three treatments increased plant dry weight at P = 0.10, especially the combined Vitazyme + Amino Acid treatment.

Conclusions: In this greenhouse study with corn, Vitazyme, Amino Acids, and the combined products all significantly increased both plant height and dry weight. Dry weight was especially

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2012 Crop Results

Vitazyme on Baby Corn

Researcher: Richard Stonewigg
Research organization: Lachlan Kenya Limited.
Location: Mboga Tuu, Isinya, Kenya
Soil type: unknown
Variety: "Baby" corn
Planting date: November, 2011
Irrigation: drip

Experimental design: A field of baby corn was divided into five treatments of 1,800 m^2 each to evaluate the effect of Vitazyme (two formulations) and Rizobacter, alone and in combination, on the health, growth parameters, and the yield of the crop.

1. Control **2. Vitazyme, regular** **3. Rizobacter**
4. Vitazyme, regular + Rizobacter **5. Vitazyme, from concentrate + Rizobacter**

Fertilization: unknown

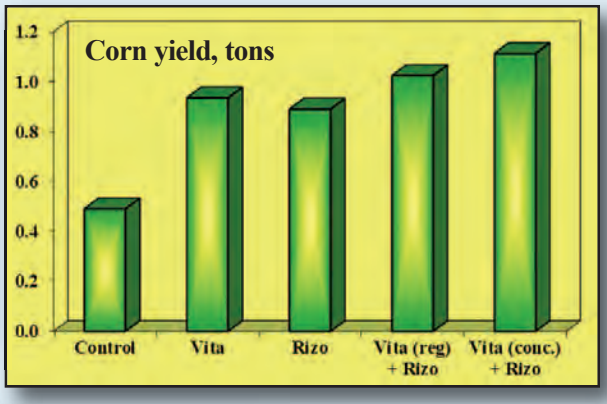
Vitazyme treatment: The Vitazyme from concentrate was diluted with water (1 part concentrate to 9 parts water). Treatments for either product alone, or combined with Rizobacter, were as follows:

Time	Rate
Seeding	5 ml/kg of seed
Drench, pre-plant	200 ml/20 liters of water
Two weeks post-plant	foliar 50 ml/20 liters of water
Before tasseling	foliar 50 ml/20 liters of water
At tasseling	foliar 50 ml/20 liters of water
At ear filling	foliar 50 ml/20 liters of water

Rizobacter application: The Rizobacter products are bacterial preparations from Argentina.

Yield results: The crop was harvested in January of 2012.

Treatment	Yield	Yield increase
	tons	tons
1. Control	0.490	—
2. Vitazyme, regular	0.935	0.445 (+91%)
3. Rizobacter	0.890	0.400 (+82%)
4. Vita (regular) + Rizobacter	1.024	0.534 (+109%)
5. Vita (from conc.) + Rizobacter	1.113	0.623 (+127%)



Yield increase with Vitazyme

Vitazyme regular ..... +91%
Vitazyme regular + Rizobacter ..... +109%
Vitazyme concentrate + Rizobacter ..... +127%

Conclusions: This baby corn study in Kenya proved that both Vitazyme and Rizobacter inoculant gave excellent yield increases, especially when the two products were combined. Regular Vitazyme gave a 91% yield increase, while Rizobacter alone provided an 82% increase. When regular Vitazyme was combined with Rizobacter, a 109% yield increase resulted, showing the synergism between the bacterial product and Vitazyme. Both the regular and the diluted concentrate (10:1) provided excellent yield increases (109% and

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2011 Crop Results

Vitazyme on Corn

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 the 10 to 12-leaf stage
Yield results: No yield results are available, but the increase in yield is given.

Increase in corn yield with Vitazyme:
1.72 tons/ha (27.4 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 Corn

Researcher/Farmer: Nong Van Duc
Nong Province, Viet Nam
Location: Village 7, Eapo Hamlet, Cu Jut District, Dak
Variety: NK 7328
Planting season: Summer – Fall, 2011
Experimental design: A corn field was divided into a Vitazyme treated area of 1.0 ha, and an untreated control area of 0.5 ha, to determine the effect of this product on the yield and profitability of the crop.

1. Control **2. Vitazyme**

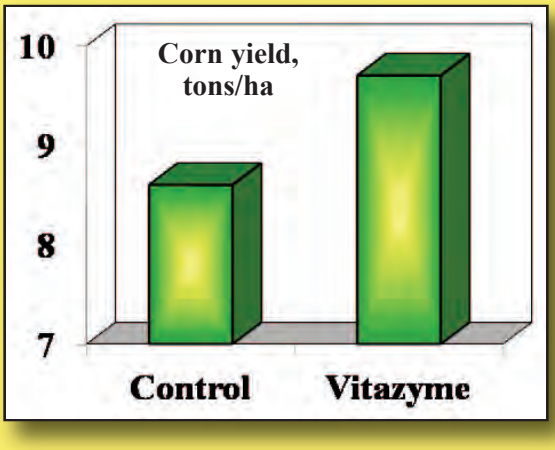
Vitazyme application: (1) a 5% Vitazyme seed spray on the seeds before planting; (2) 1 liter/ha sprayed on the leaves and soil 35 days after planting
Growth results: With Vitazyme the following effects were noted:

- Taller plants
- Stronger root systems
- Darker green leaves
- Excellent disease resistance from steaked leaf and stem rot
- During a drought period, plants showed no leaf rolling
- Seed color was brighter

Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
Control	8.6	—
Vitazyme	9.7	1.1 (+13%)

Increase in corn yield with Vitazyme: 13%



Income results:

Treatment	Vitazyme[1]	Total costs	Total income[2]	Net income	Extra profit
	VND/ha	VND/ha	VND/ha	VND/ha	VND/ha
Control	0	11,250,000	38,700,000	26,700,000	—
Vitazyme	500,000	11,500,000	43,650,000	31,150,000	4,450,000

[1]VND = Vietnamese dollar; 1 USD = 20,000 VND.
[2]Corn price = 4,500 VND/kg.

Increase in income with Vitazyme:
4,450,000 VND, or $222.50/ha

Conclusion: This Vietnamese corn trial revealed that Vitazyme, applied on the seeds as well as 35 days after planting, increased yield by 13%, while boosting profit by $222.50/ha. These results prove the great utility of the Vitazyme program to grow corn in Viet Nam.

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2011 Crop Results

Vitazyme on Corn

Researcher/Farmer: Dinh Thi Ngan
Location: Village 2, Dak Will, Cu Jut District, Dak Nong Province, Viet Nam
Variety: NK 72
Planting season: Summer – Fall, 2011
Experimental design: A corn field was divided into a Vitazyme treated area of 0.9 ha, and an untreated control area of 0.5 ha, to determine the effect of this product on the yield and profitability of the crop.

1. Control **2. Vitazyme**

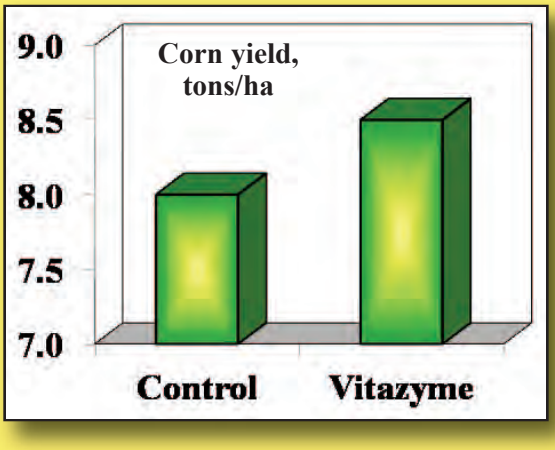
Vitazyme application: a 5% Vitazyme seed spray on the seeds before planting
Growth results: With Vitazyme the following effects were noted:

- Taller plants
- Stronger root systems
- Darker green leaves
- Excellent disease resistance from steaked leaf and stem rot
- During a drought period, plants showed no leaf rolling
- Seed color was brighter

Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
Control	8.0	—
Vitazyme	9.0	1.0 (+13%)

Increase in corn yield with Vitazyme: 6%



Income results:

Treatment	Vitazyme[1]	Total costs	Total income[2]	Net income	Extra profit
	VND/ha	VND/ha	VND/ha	VND/ha	VND/ha
Control	0	12,000,000	36,000,000	24,750,000	—
Vitazyme	250,000	12,250,000	38,250,000	27,000,000	2,250,000

[1]VND = Vietnamese dollar; 1 USD = 20,000 VND.
[2]Corn price = 4,500 VND/kg.

Increase in income with Vitazyme:
2,250,000 VND, or $112.75/ha

Conclusion: This Vietnamese corn trial revealed that Vitazyme, applied as a 5% seed treatment at planting, increased yield by 6%, while boosting profit by $112.75/ha. Had an additional foliar treatment been applied, yields and profits would likely have improved even more.

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2011 Crop Results

Vitazyme on Corn

Researcher/Farmer: Tran Van Nhuong *Location*: Village Tan Thanh, Eapo, Cu Jut District, Dak Nong Province, Viet Nam
Variety: SSC 557
Planting season: Summer – Fall, 2011
Experimental design: A corn field was divided into a Vitazyme treated area of 0.5 ha, and an untreated control area of 0.2 ha, to determine the effect of this product on the yield and profitability of the crop.

1. Control **2. Vitazyme**

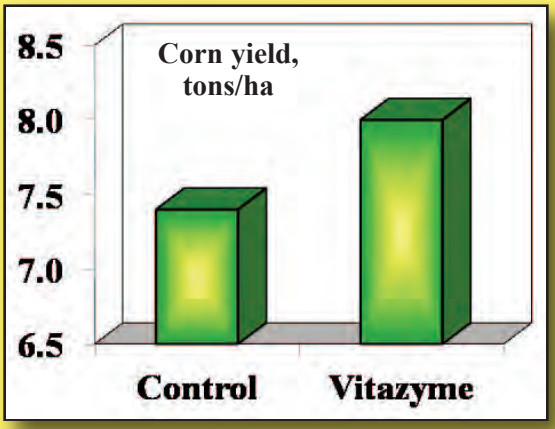
Vitazyme application: 1.5 liters/ha sprayed on the leaves and soil 30 days after planting
Growth results: With Vitazyme the following effects were noted:

- Taller plants
- Stronger root systems
- Darker green leaves
- Excellent disease resistance from steaked leaf and stem rot
- During a drought period, plants showed no leaf rolling
- Seed color was brighter

Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
Control	7.4	—
Vitazyme	8.0	0.6 (+8%)

Increase in corn yield with Vitazyme: 8%



Income results:

Treatment	Vitazyme[1]	Total costs	Total income[2]	Net income	Extra profit
	VND/ha	VND/ha	VND/ha	VND/ha	VND/ha
Control	0	11,125,000	31,080,000	19,955,000	—
Vitazyme	575,000	11,700,000	33,600,000	21,900,000	1,945,000

[1]VND = Vietnamese dollar; 1 USD = 20,000 VND.
[2]Corn price = 4,200 VND/kg.

Increase in income with Vitazyme:
1,945,000 VND, or $97.25/ha

Conclusion: This Vietnamese corn trial revealed that Vitazyme, applied once at 1.5 liters/ha at 30 days after planting, increased yield by 8%, while boosting profit by $97.25/ha. Had a seed treatment been applied, yields and profits would likely have improved even more.

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Average Values for 2009 to 2011 in Ukraine

Vitazyme on Corn

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

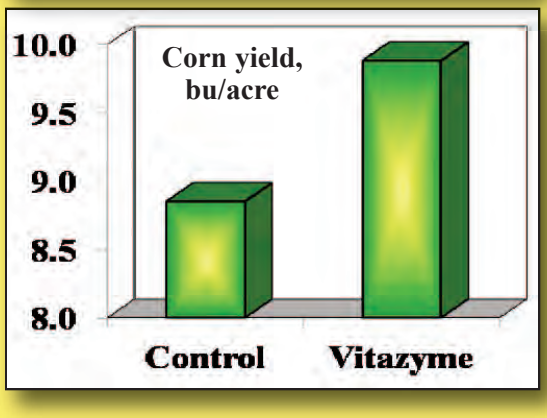
Demonstration plot values averaged over three years, 2009 to 2011:

Treatment	Yield	Yield change
	tons/ha	tons/ha
1. Control	8.85	—
2. Vitazyme on leaves[1]	9.88	1.03 (+12%)

[1]1 liter/ton on the leaves + soil at the 7 to 8-leaf stage.

Three-Year Average Increase With Vitazyme: +12%

Three-Year Average



Conclusion: Over three years of demonstrations, Vitazyme is shown to be an excellent adjunct to corn production in Ukraine.

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2011 Crop Results

Vitazyme on Corn

Researcher: Michael Rethwisch
Extension, David City, Nebraska
Variety: Kruger K-4510
Research organization: University of Nebraska-Lincoln
Location: Aurora, Nebraska
Soil type: unknown

Experimental design: A corn field was divided into replicated strips with four different products, with Vitazyme applied to the side of the seeds, to evaluate the yield and test weight responses. All treatments received starter fertilizer under conventional tillage.

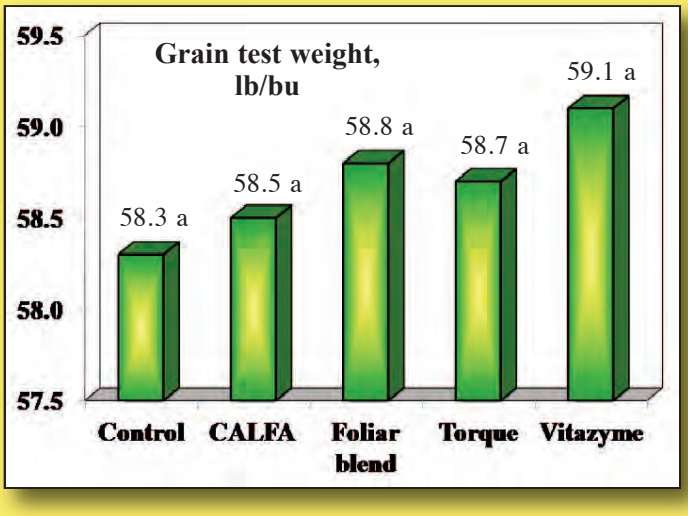
Treatment	Starter fertilizer	Product rate
		amount/acre
1. Control	X	—
2. CALFA	X	10 oz
3. Foliar Blend	X	16 oz
4. Torque	X	8 oz
5. Vitazyme	X	13 oz

Fertilization: Besides typical N-P_2O_5-K_2O fertilizer, all products and the control received 5 gallons/acre of NaChurs 6-24-6 Starter fertilizer applied to the side of the seeds with a "splitter."

Vitazyme and other product applications: At planting, all four products were applied at the rates shown in the above table, using the "splitter."

Weather for the growing season: Rains were ample to excessive, and temperatures were somewhat below normal.

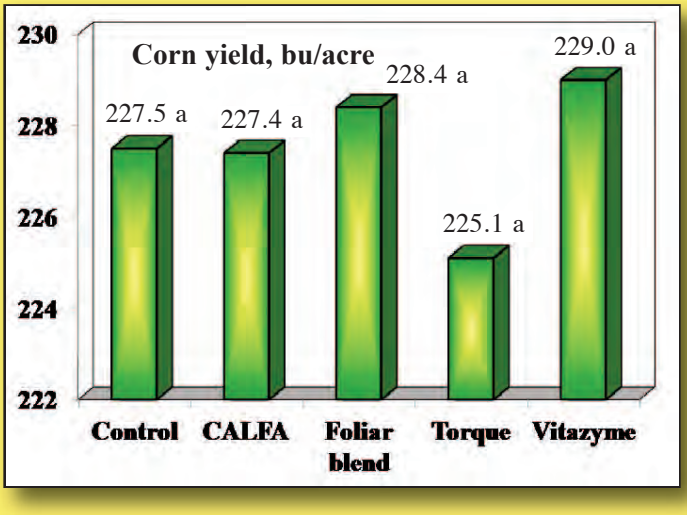
Test weight results: Grain volume weights were determined corrected to 15.5% moisture.



While none of the test weight values were significantly different, Vitazyme had the highest test weight, which was 0.3 lb/bu greater than the closest other product value.

Increase in test weight with Vitazyme: 0.8 lb/bu

Yield results:



Yield values were not significantly different among the five treatments, but Vitazyme produced the greatest yield, of 1.5 bu/acre above the control.

Increase in yield with Vitazyme: 1.5 bu/acre

Conclusion: In this eastern Nebraska corn study using four products applied at planting, using a "splitter", Vitazyme produced the highest yield and the heaviest test weight, although the values did not differ significantly. The reason for a less than significant response with Vitazyme may have been because the product was applied to the side of the seeds, not directly on them.

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2011 Crop Results

Vitazyme on Corn

A Nematode Evaluation

Researcher: Michael Rethwisch, David City, Nebraska
Research organization: University of Nebraska - Lincoln Extension,
Location: Silver Creek, Nebraska
Variety: Mycogen 2T832
Soil type: Darr sandy loam

Experimental design: A replicated corn trial having Vitazyme applied twice, plus the normal farming program, was evaluated for nematodes and statistically analyzed.

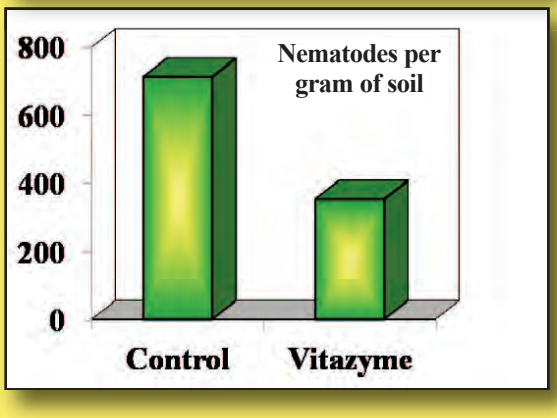
1. Control **2. Vitazyme**

Fertilization: normal farming program
Vitazyme application: 13 oz/acre (1 liter/ha) in the seed row with starter fertilizer at planting
Growing season weather: excessive rain and normal temperatures
Nematode results: After harvest in the fall of 2010, soil samples were taken in the vicinity of the roots of each plot and analyzed at the nematode testing facilities of the University of Nebraska at Lincoln.

	Nematode species[1]		
Treatment	Stunt[2]	Lesion[3]	Dagger[4]
Control	119.5	119	711.8
Vitazyme	133.0	93	352.3 (-149%)
p-value (0.05)	0.61	0.36	0.0016**

[1]All data from each plot was subjected to statistical analyses to arrive at probabilities, as shown here.
[2]*Tylenchorhynchus* spp. They can possibly cause stunting of corn, and feed externally on the roots.
[3]*Pratylenchus* spp. These can be important root pathogens causing stunting of corn plants. They feed inside roots.
[4]*Xiphinema* spp. This nematode feeds externally on roots, and can survive sandy soils but is sensitive to tillage.

Dagger Nematodes



Reduction in dagger nematodes with Vitazyme: 149%

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2011 Crop Results

Vitazyme on Corn

An Evaluation of Soil Phosphorus Levels and Two Formulations

Researcher: Bert Schou, Ph.D. *Research organization*: Agricultural Custom Research and Education Services (ACRES) *Location*: Cedar Falls, Iowa *Variety*: Pioneer P0528 (non-GMO)
Soil type: Kenyon loam (34% sand, 46% silt, 20% clay, 3.6% organic matter, pH = 7.2, C.E.C. = 15 meq/100 g, fertility level = excellent, drainage = excellent) *Planting depth*: 2 inches
Row spacing: 30 inches *Planting rate*: 35,000 seeds/acre *Seedbed at planting*: fine
Planting date: May 16, 2011 *Tillage*: conventional *Plot size*: 15 x 40 feet (600 ft.^{2})
Experimental design: A small plot, six replicate study with corn, using three phosphorus levels in a phosphorus-deficient soil, received nine treatments, with two Vitazyme formulations. The trial was conducted to determine effects on corn yield and grain quality.

Treatment	Phosphorous	Vitazyme A[1]	Vitazyme B[1]
	lb/acre	oz/acre	oz/acre
1	0	0	0
2	0	13 (2X)	0
3	0	0	13 (2X)
4	65	0	0
5	65	13 (2X)	0
6	65	0	13 (2X)
7	130	0	0
8	130	13 (2X)	0
9	130	0	13 (2X)

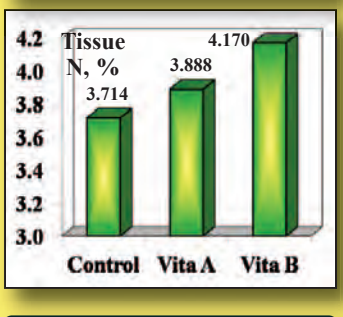
[1]2X = two applications.

Fertilization: All plots received 100 lb/acre of nitrogen and 75 lb/acre of K_2O preplant, plus the P_2O_5 applications of 0, 65, or 130 lb/acre as shown in the table above
Weed control: Harness at 1.2 qt/acre preemergence, giving excellent weed control
Vitazyme application: (1) 13 oz/acre (1 liter/ha) in the seed row at planting on May 16, 2011; (2) 13 oz/acre (1 liter/ha) on the leaves and soil at V7 on June 30, 2011. Vitazyme A ad B are different formulations of Vitazyme.
Weather during the growing season: The season was favorable to the corn growth in terms of temperature and rainfall, although early July was quite dry.
Harvest date: October 15, 2011. A Massey-Ferguson 9 plot combine harvested the middle two rows of each plot, and the corn was weighed using an electronic scale.
Plant Population: There were no significant differences among the nine treatments, so these data are not

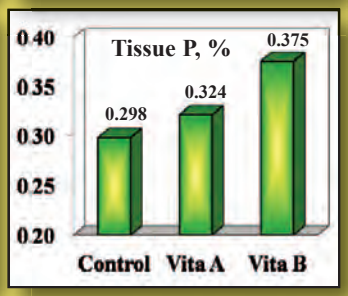
included here.

Tissue test results: On July 12, 2011, tissue analyses were conducted on composite samples for each treatment at Perry Agricultural Laboratory, Bowling Green, Missouri. The results for the first three treatments (no added phosphorus) are presented here, to reveal effects of Vitazyme A and Vitazyme B on tissue element levels.

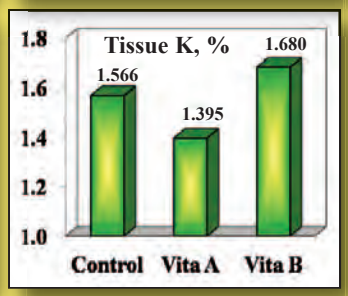
Nitrogen



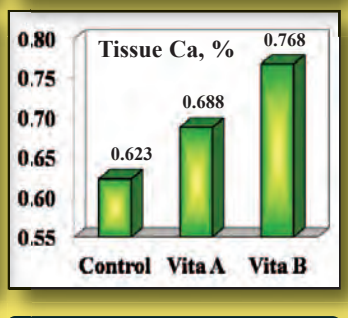
Phosphorus



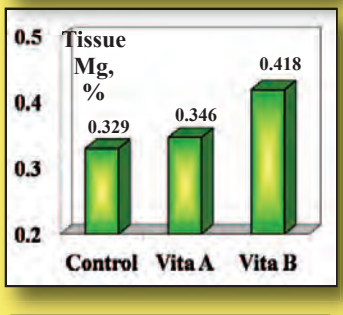
Potassium



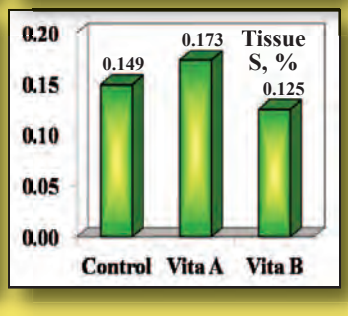
Calcium



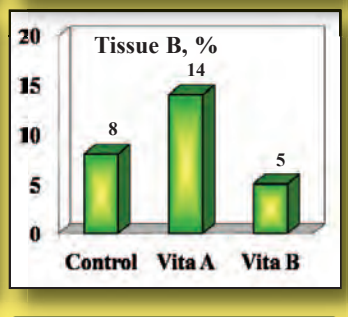
Magnesium



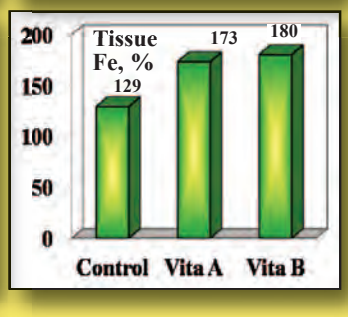
Sulfur



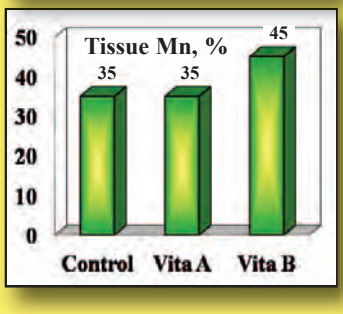
Boron



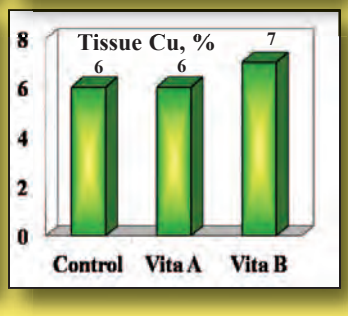
Iron



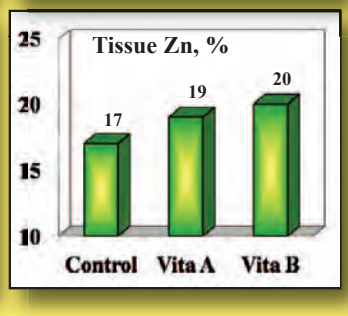
Manganese



Copper



Zinc



Notice that in most cases Vitazyme A and Vitazyme B increased the elemental composition of the corn tissue. For potassium, sulfur, boron, manganese, and copper there were either equal contents or a lower content of the element for one product or the other.

Test weight results: There were some differences in grain test weight.

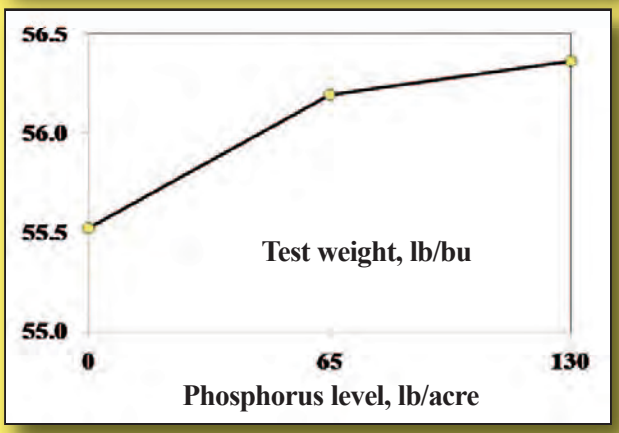
Treatment	Test weight[1]	Test weight change[2]
	lb/bu	lb/bu
1 (O P)	55.17 b	—
2 (O P, Vita A)	55.82 ab	0.65 (+1%)
3 (O P, Vita B)	55.57 ab	0.40 (+1%)
4 (Low P)	56.39 a	—
5 (Low P, Vita A)	55.94 ab	(-) 0.45 (-1%)
6 (Low P, Vita B)	56.25 ab	(-) 0.14 (0%)
7 (High P)	56.04 ab	—
8 (High P, Vita A)	56.48 a	0.44 (+1%)
9 (High P, Vita B)	56.55 a	0.51 (+1%)
$LSD_{0.05}$	0.77 lb/bu	
Standard deviation	0.66 lb/bu	
Replicate F	4.21	
Treatment F	2.86	
CV	1.18%	

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

[2]Comparisons are made with the control at the same phosphorus level.

Combined Phosphorus Test Weight for All Treatments

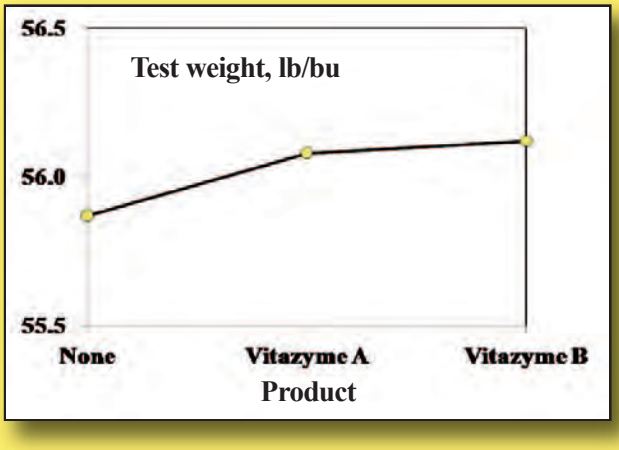
P level	Test weight	Test weight change
lb/acre	lb/bu	lb/bu
0	55.52	—
65	56.19	+0.67
130	56.36	+0.84



Note the trend towards higher test weight with higher P levels.

Combined Product Test Weight for All Treatments

Product	Test weight	Test weight change
	lb/bu	lb/bu
None	55.52	—
Vitazyme A	56.08	+0.21
Vitazyme B	56.12	+0.25



Both Vitazyme A and Vitazyme B show increased test weights versus the untreated controls. This result is likely due to the products' enhanced rhizosphere activation so more nutrients were available for uptake.

Yield results:

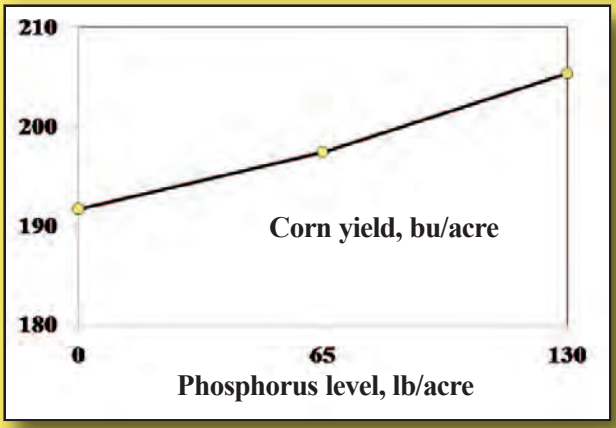
Treatment	Yield[1]	Yield change[2]
	bu/acre	bu/acre
1 (O P)	187.1 c	—
2 (O P, Vita A)	190.3 bc	3.2 (+2%)
3 (O P, Vita B)	197.7 abc	10.6 (+6%)
4 (Low P)	196.7 abc	—
5 (Low P, Vita A)	195.8 abc	(-) 0.9 (0%)
6 (Low P, Vita B)	199.8 abc	3.1 (+2%)
7 (High P)	202.6 ab	—
8 (High P, Vita A)	203.3 ab	0.7 (0%)
9 (High P, Vita B)	209.9 a	6.6 (+3%)
$LSD_{0.05}$	9.7 bu/acre	
Standard deviation	8.3 bu/acre	
Replicate F	3.27	
Treatment F	4.13	
CV	4.19	

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

[2]Comparisons are made with the control at the same phosphorus level.

Combined Phosphorus Yield for All Treatments

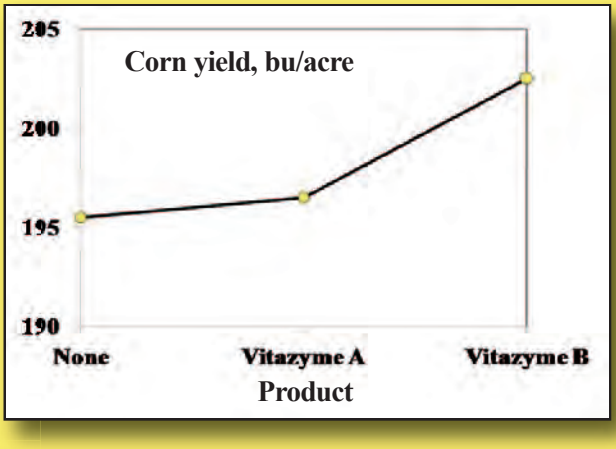
P level	Yield	Yield change
lb/acre	lb/bu	lb/bu
0	191.7	—
65	197.4	+5.7 (+3%)
130	205.3	+13.6 (+7%)



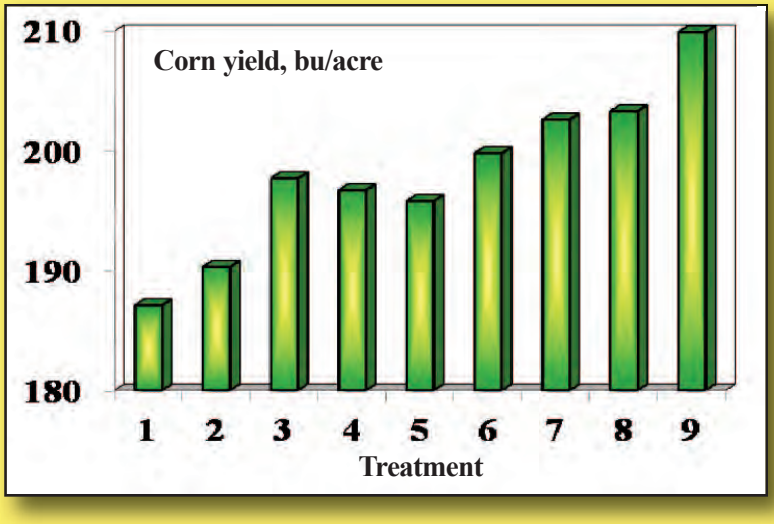
With increasing phosphorus levels the yield of corn grain increased almost in a linear fashion, to 3 and 7% above the control at 65 and 130 lb/acre of phosphorus, respectively.

Combined Product Test Weight for All Treatments

Product	Yield	Yield change
	lb/bu	lb/bu
None	195.5	—
Vitazyme A	196.5	+1.0 (+1%)
Vitazyme B	202.5	+7.0 (+4%)



Vitazyme A, accross all phosphorus levels, slightly increased corn yields, but Vitazyme B increased yields by 4%, or 7.0 bu/acre.



There was a trend accross the treatments for higher yields due to higher fertilizer phosphorus applications and Vitazyme B. The highest overall treatment was combined high phosphorus plus Vitazyme B (Treatment 9), which increased yield by 22.8 bu/acre (+12%) above the untreated, low phosphorus control (Treatment 1).

Grain protein: A composite grain sample from each of the six replicates for the nine treatments was sent to Midwest Laboratories in Omaha, Nebraska, for the analysis of protein and elements. The various elements showed no trends among the treatments, but protein displayed interesting results.

Treatment	Crude protein[1]
	%
1 (O P)	6.42
2 (O P, Vita A)	6.80
3 (O P, Vita B)	6.66
4 (Low P)	6.80
5 (Low P, Vita A)	6.90
6 (Low P, Vita B)	6.60
7 (High P)	6.22
8 (High P, Vita A)	7.21
9 (High P, Vita B)	6.28

[1]Dry weight basis

Combined Phosphorus Protein for All Treatments

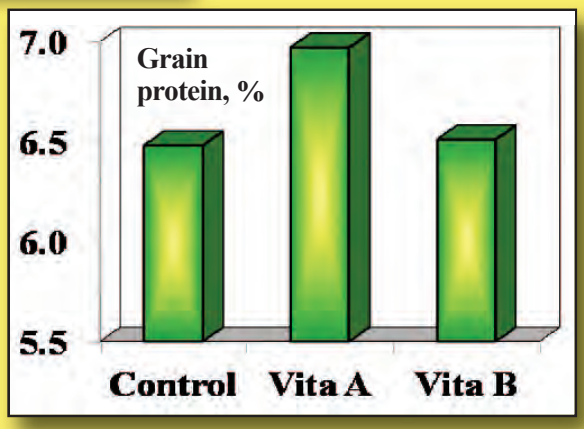
P level	Protein	Protein change
lb/acre	%	%
0	6.63	—
65	6.77	+0.14
130	6.57	-0.06

There was no clear relationship between fertilizer and soil phosphorus and grain protein.

Combined Product Protein for All Treatments

Product	Protein	Protein change
	%	%
None	6.48	—
Vitazyme A	6.97	+0.49
Vitazyme B	6.51	+0.02

Note that Vitazyme A improved grain protein by near 0.5%, although Vitazyme B had little effect.



Conclusion: A replicated small-plot study in east-central Iowa, using two Vitazyme versions with treatments at planting and V-7, and three phosphorous fertilizer levels, revealed several significant effects of phosphorous and Vitazyme on test weight, yield, and grain protein. The year was favorable for high yields, so yields varied from 187.1 to 209.9 bu/acre. The tissue element levels for the first three treatments, analyzed mid-season, revealed that both Vitazyme A and Vitazyme B increased element levels, with few exceptions.

Test weight showed a positive impact from fertilizer phosphorous, increasing by 0.67 lb/bu for 65 lb/acre of P_2O_5, and by 0.84 lb/bu for 130 lb/acre of P_2O_5. Both Vitazyme A and Vitrazyme B gave increases in the test weight, of 0.21 and 0.25 lb/bu, respectively. It is interesting that the highest test weights were for Treatments 8 and 9 (high P_2O_5, Vitazyme A and Vitazyme B, respectively), which produced significantly heavier grain than the low-P_2O_5, no-Vitazyme control (Treatment 1). This result reveals that higher phosphorous levels plus Vitazyme increase mineral uptake the most due to rhizosphere activation – especially phosphorous-extracting mycorrhizae – and increased availability of soil nutrients.

Yield results showed significant increases in corn grain with the high P_2O_5 + Vitazyme B treatment, which exceeded the no P_2O_5 and no P_2O_5 + Vitazyme A treatments. Of particular interest is the trend for increasing grain yield with both increasing phosphorous fertility and Vitazyme A and B, especially with Vitazyme B, which boosted corn yield by 7.0 bu/acre (4%) above the combined average of the no-Vitazyme phosphorous treatments at all P_2O_5 levels. The highest yield was for Treatment 9 – high P_2O_5 + Vitazyme – which boosted grain yield by 22.8 bu/acre over the no P_2O_5 + no Vitazyme control.

Grain protein responded with no pattern to added P_2O_5 fertilizer, but Vitazyme A increased protein by 0.49%-point across all three P_2O_5 fertilizer levels. This study reveals that, of the two Vitazyme formulations, Vitazyme B is the best in terms of test weight and yield enhancement, but Vitazyme A increased grain protein the most. Both products, however, improved yield, protein, and test weight of corn.

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2011 Crop Results

Vitazyme on Corn

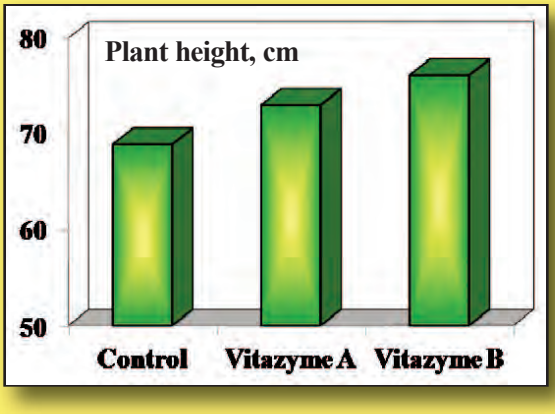
Researcher: Paul W. Syltie, Ph.D. *Location*: Vital Earth Resources Research Greenhouse, Gladewater, Texas
Variety: yellow dent *Pot size*: 1 gallon *Soil type*: silt loam
Planting rate: 10 seeds/pot, thinned to 3 plants/pot *Planting date*: November 12, 2010
Experimental design: A replicated greenhouse 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
Plant height results: The plants were measured on December 15, 2010, and averaged for each pot.

Treatment	Plant height[1]	Height change
	cm	cm
Control	68.9 b	—
Vitazyme A	73.0 a	4.1 (+6%)
Vitazyme B	76.1 a	7.2 (+10%)
Treatment P	0.0023**	
Model P	0.0023***	
CV	4.45%	
$LSD_{0.05}$	3.6 cm	

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



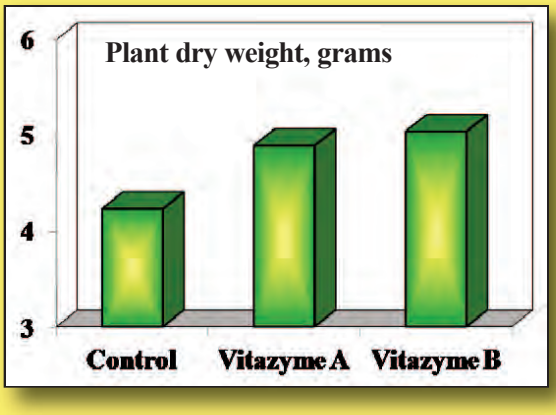
Increase in height with Vitazyme A: 6%

Increase in height with Vitazyme B: 10%

Dry weight results: On December 15, 2010, the roots were washed free of soil, and dried in a drying oven at 120º F for 24 hours.

Treatment	Dry Weight[1]	Weight change
	grams	grams
Control	4.23 b	—
Vitazyme A	4.89 a	0.66 (+16%)
Vitazyme B	5.04 a	0.81 (+19%)
Treatment P	0.0006***	
Model P	0.0006***	
CV	7.06%	
$LSD_{0.10}$	0.37 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 A: 16%

Increase in dry weight with Vitazyme B: 19%

Conclusion: A replicated pot trial in the greenhouse, using two variations of Vitazyme, proved that both corn height and dry weight responded significantly to both products. Height increased by 6% and 10%, respectively, for Vitazyme A and Vitazyme B, while dry weight increased by 16% and 19% for the two products. These results prove that both products are very effective for improving corn growth, especially Vitazyme B, the product made directly from concentrate.

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2011 Crop Results

Vitazyme on Corn

A Greenhouse Study

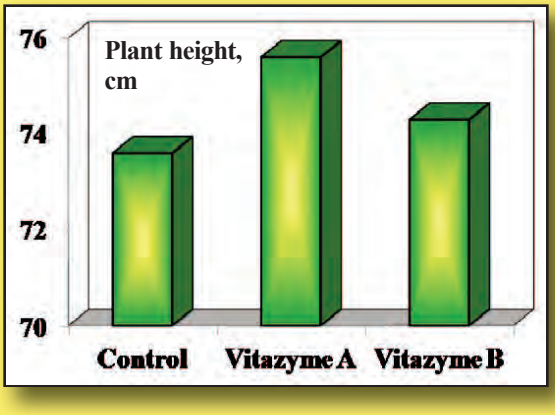
Researcher: Paul W. Syltie, Ph.D. *Location*: Vital Earth Resources Research Greenhouse, Gladewater, Texas
Variety: yellow dent *Pot size*: 1 gallon *Soil type*: silt loam
Planting rate: 10 seeds/pot, thinned to 3 plants/pot *Planting date*: February 14, 2011
Experimental design: A replicated greenhouse pot study was conducted to evaluate the relative effectiveness of two Vitazyme formulations to increase plant growth. Eight replications 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, from regular product; Vitazyme B: 100 ml/pot at planting of a 0.1% solution, diluted directly from concentrate
Plant height results: On March 22 at harvest, 36 days after planting, the plants were measured for height, and averaged for the three plants in each pot.

Treatment	Plant height[1]	Height change
	cm	cm
Control	73.6 a	—
Vitazyme A	75.6 a	2.0 (+3%)
Vitazyme B	74.3 a	0.7 (+1%)
Block P	0.605	
Treatment P	0.463	
Model P	0.624	
$CV_{0.10}$	4.07%	
$LSD_{0.10}$	2.9 cm	

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



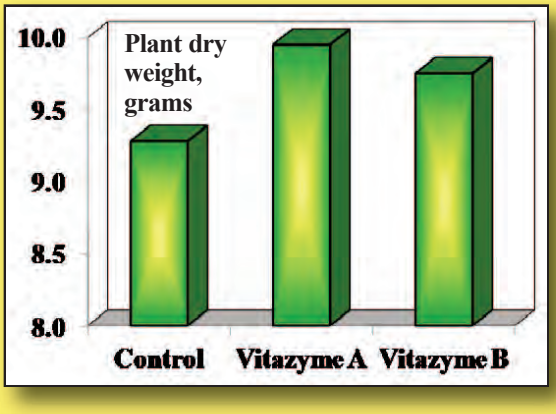
Increase in plant height with Vitazyme

Vitazyme A 3%
Vitazyme B 1%

Dry weight results: On March 22 the roots were washed of all soil, and then dried in a drying oven at 120º F for 24 hours. Weights were recorded to the nearest 0.01 gram for the combined three plants of each pot.

Treatment	Dry weight[1]	Weight change
	grams	grams
Control	9.28 b	—
Vitazyme A	9.95 a	0.67 (+7%)
Vitazyme B	9.75 a	0.47 (+5%)
Block P	0.018*	
Treatment P	0.011*	
Model P	0.008**	
$CV_{0.10}$	3.64%	
$LSD_{0.10}$	0.34 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 7%
Vitazyme B 5%

Conclusion: This replicated greenhouse study with corn proved that both Vitazyme A (regular product) and Vitazyme B (direct dilution from concentrate) increased dry matter production significantly above the untreated control.

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2011 Crop Results

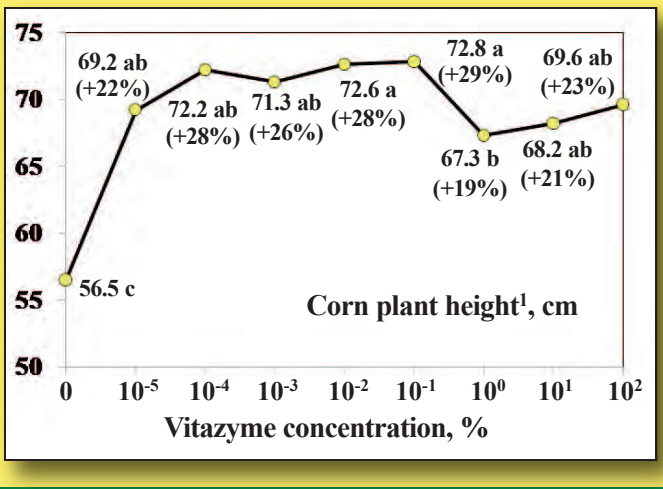
Vitazyme on Corn

A Concentration Series Study

Researcher: Paul W. Syltie, Ph.D. *Location*: Vital Earth Resources Research Greenhouse, Gladewater, Texas
Variety: yellow dent *Pot size*: 1 gallon *Soil type*: silt loam
Planting rate: 10 seeds/pot, thinned to 3 plants/pot *Planting date*: November 15, 2010
Experimental design: A dilution series of Vitazyme was prepared and applied to pots in a replicated greenhouse setting, the purpose of which was to determine relative degrees of response to the active agents at varying conentrations. A completely randomized design was used, with eight replications.

Treatment	Vitazyme concentration
	%
1	0
2	0.00001 (10^{-5})
3	0.0001 (10^{-4})
4	0.001 (10^{-3})
5	0.01 (10^{-2})
6	0.1 (10^{-1})
7	1 (10^{0})
8	10 (10^{1})
9	100 (10^{2})

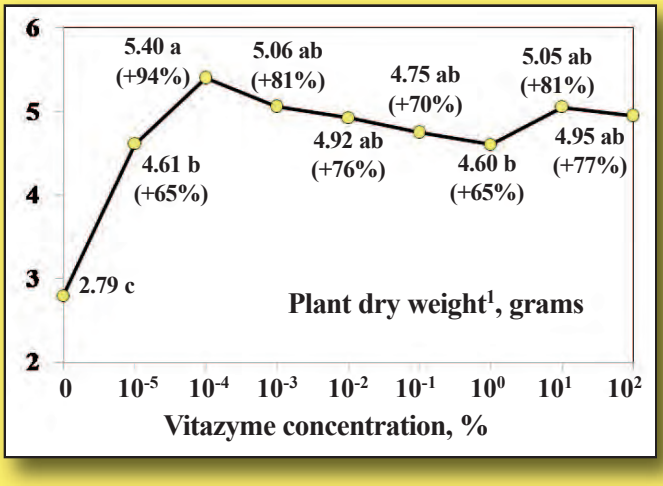
Fertilization: none
Vitazyme application: At planting, 100 ml of the eight dilutions were added to the soil surface of the appropriate pots, directly after seeding.
Plant height results: Plant heights were measured for the three plants of each pot at harvest, on December 15, 2010, and averaged.



Treatment P	**0.0000*** **
Model P	**0.0000*** **
CV	**7.55%**
$LSD_{0.05}$	**5.2 cm**

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

Dry weight results:



Treatment P	**0.0000*** **
Model P	**0.0000*** **
CV	**7.55%**
$LSD_{0.05}$	**5.2 cm**

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

Conclusions: Vitazyme at all concentrations improved the growth of corn above the control in terms of plant height and dry weight. All concentrations, from 10^{-5} to 10^{2}, gave significant responses for plant height, with the 10^{-2} and 10^{-1} dilutions giving the strongest responses (28% and 29%, respectively). Plant weight increases were statistically equal across the entire range of concentrations except for 10^{-5} and 10^{0} %, the highest values appearing at 10^{-4}, 10^{-3}, and 10^{1} %; the reason for this bimodal response is not known, The field application rates are typically represented by 10^{-2} to 10^{-3} % Vitazyme.

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2011 Crop Results

Vitazyme on Corn

Researcher/Farmer: Nguyen Ngoc Tuan *Location*: Easling Town, Cu Jut District, Dak Nong Province, Viet Nam *Variety*: 30 D55
Planting season: Summer – Fall, 2011
Experimental design: A corn field was divided into a Vitazyme treated area of 0.5 ha, and an untreated control area of 0.3 ha, to determine the effect of this product on the yield and profitability of the crop.

1. Control **2. Vitazyme**

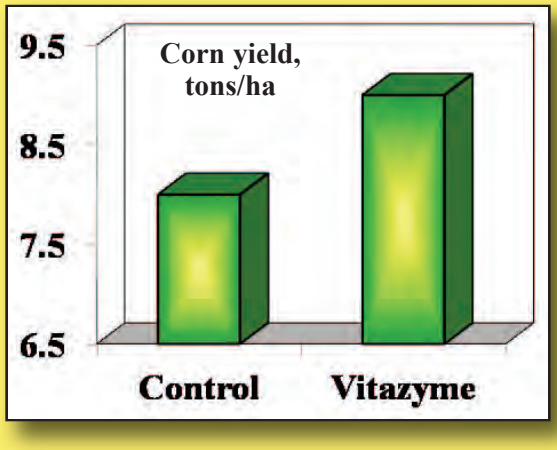
Vitazyme application: (1) 5% Vitazyme seed spray just before planting; (2) 1 liter/ha sprayed on the leaves and soil 35 days after planting
Growth results: With Vitazyme the following effects were noted:

- Taller plants
- Stronger root systems
- Darker green leaves
- Excellent disease resistance from steaked leaf and stem rot
- During a drought period, plants showed no leaf rolling
- Seed color was brighter

Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
Control	8.0	—
Vitazyme	9.0	1.0 (+13%)

Increase in corn yield with Vitazyme: 13%



Income results:

Treatment	Vitazyme[1]	Total costs	Total income[2]	Net income	Extra profit
	VND/ha	VND/ha	VND/ha	VND/ha	VND/ha
Control	0	13,500,000	36,000,000	22,500,000	—
Vitazyme	500,000	14,000,000	38,250,000	26,500,000	4,000,000

[1]VND = Vietnamese dollar; 1 USD = 20,000 VND.
[2]Corn price = 4,500 VND/kg.

Increase in income with Vitazyme:
4,000,000 VND, or $200.00/ha

Conclusion: This Vietnamese corn trial revealed that Vitazyme, applied on the seeds and also 30 days after planting, increased yield by 13%, while boosting profit by $200.00/ha. This program is highly effective for corn production in Viet Nam.

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2011 Crop Results

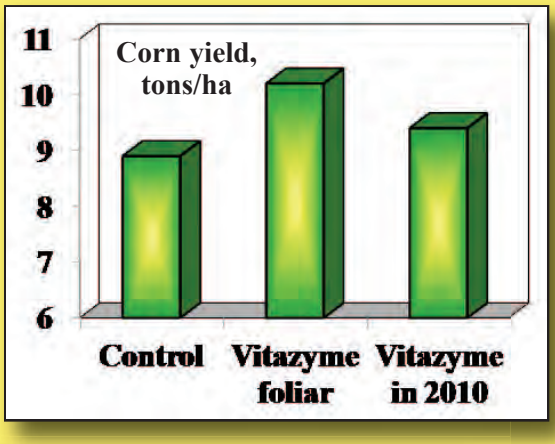
Vitazyme on Corn

Researcher: Unknown *Research organization*: National Academy of Agrarian Sciences, Vinnytsia State Agricultural Research Station *Location*: Vinnytsia, Ukraine (Central Forest and Steppe Region)
Variety: Sangriya *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: Replicated corn plots were prepared and treated with a Vitazyme treatment, and plots treated with Vitazyme were also used to evaluate a carryover effect, to evaluate the effect of the product on corn yield and profitability.

1. Control **2. Vitazyme on leaves and soil** **3. Vitazyme on leaves and soil in 2010**

Vitazyme applications: 1 liter/ha at the 7 to 8-leaf stage (June 16, 2011) for Treatment 2
Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
Control	8.9	—
Vitazyme foliar	10.2	1.3 (+15%)
Vitazyme in 2010	9.4	0.5 (+6%)



Yield increase with a Vitazyme foliar treatment: 15%
Yield increase with a Vitazyme in 2010: 6%

Income results:

- Income increase with a Vitazyme treatment: 2,050 hrn/ha
- Income increase with Vitazyme in 2010: 850 hrn/ha

Conclusion: This replicated corn trial in Vinnytsia, Ukraine, reveals what previous years' trials have shown ... that Vitazyme increases yield (+15% in 2011) and profitability (+2,050 hrn/ha in 2011) consistently. It is a product that powerfully improves agricultural productivity in Ukraine.

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2009 Crop Results

Vitazyme on Corn

Researcher: Nathan Temples *Farm cooperator*: Parker Brothers *Location*: Sikeston, Missouri
Variety: Pioneer 33N58 *Soil type*: sandy loam *Planting rate*: 31,500 seeds /acre
Row-spacing: 38 inches *Irrigation*: unknown *Planting date*: April 23, 2009

Experimental design: A corn field received Vitazyme on the seeds of 24 rows within the field, to determine the effects of this product on corn yield.

1. Control **2. Vitazyme**

Fertilization: 200-60-90 lb/acre N-P_2O_5-K_2O

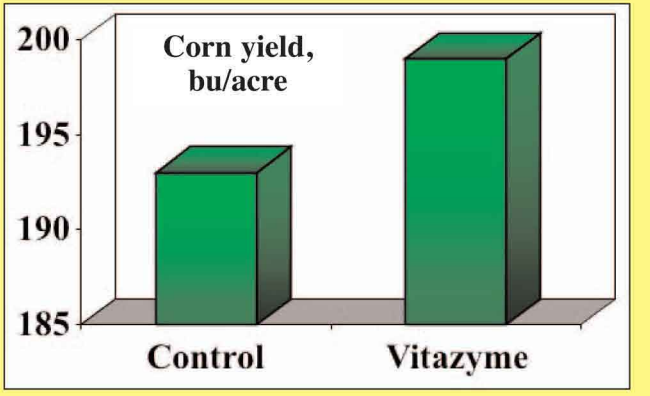
Vitazyme application: 8 oz/acre on the seeds at planting

Harvest date: September 23, 2009

Yield results:

Treatment	Yield	Yield change
	bu/acre	
Control	193	—
Vitazyme	199	6 (3%)

Increase in corn yield with Vitazyme: 3%



Conclusions: This high yielding corn study in Missouri revealed that Vitazyme, applied at 8 oz/acre to the seeds at planting, increased yield by 6 bu/acre (+3%). This is a highly profitable additional yield, to reveal the potential of Vitazyme to improve corn yields in the Corn Belt of Missouri.

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2009 Crop Results

Vitazyme on Corn

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 22, 2009 *Variety*: Ronaldinio *Seeding rate*: 22 kg/ha
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 two 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 corn grain.

1. Control **2. Vitazyme, once foliar**

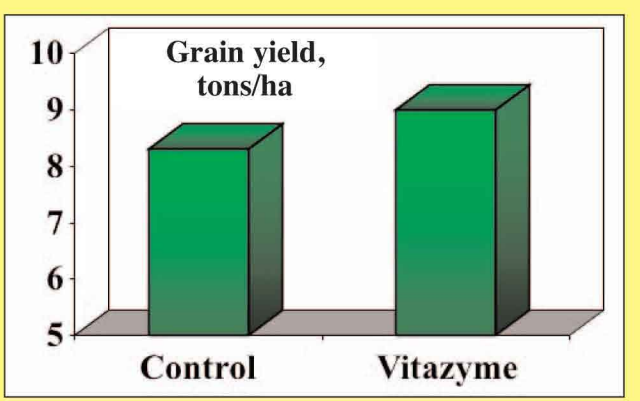
Fertilization: 60 kg/ha, 30 kg/ha P_2O_5, and 60 kg/ha K_2O

Vitazyme application: Treatment 2 received 1.0 liter applied to the leaves and soil on June 25, 2009, at the 7 to 8 leaf stage

Yield results:

Treatment	Grain yield	Change
	tons/ha	tons/ha
Control	8.3	—
Vitazyme	9.0	0.7 (+8%)

Increase in corn yield with Vitazyme: 8%



Income results:

Income increase with Vitazyme foliar: 479 hrn/ha

Conclusions: Corn grain with and without Vitazyme (1 liter/ha, foliar) in this Ukraine study showed an 8% yield increase. Moreover, the return to the farmer was improved substantially.

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2009 Crop Results

Vitazyme on Corn

Researcher: Nathan Temples
Farm cooperator: Schlosser Farms
Location: Perkins, Missouri
Variety: Pioneer 33 N 58
Soil type: silt loam
Planting date: April 20, 2009
Planting rate: 25,000 seeds /acre
Irrigation: none

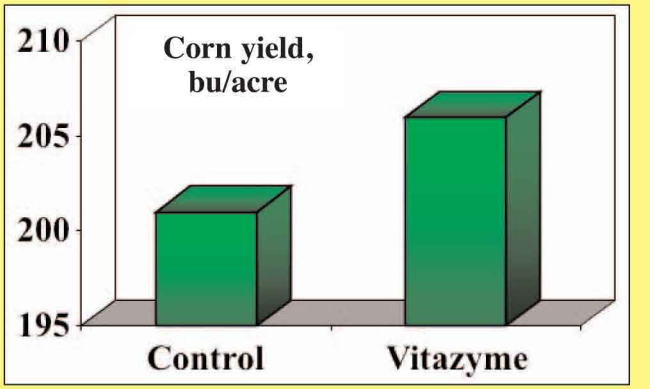
Experimental design: Five acres of a 90-acre corn field were treated with Vitazyme, applied with the herbicide, to determine the product's ability to improve crop yields.

1. Control **2. Vitazyme**

Fertilization: 160-50-90 lb/acre N-P_2O_5-K_2O preplant
Vitazyme application: 13 oz/acre with the herbicide, 42 days after planting
Harvest date: October 3, 2009
Yield results:

Treatment	Yield	Yield change
	---------bu/acre	----------
Control	201	—
Vitazyme	206	5 (2.5%)

Increase in yield with Vitazyme: 2.5%



Conclusions: A Misourri corn study showed that Vitazyme, applied along with a herbicide at 13 oz/acre, increased yield by 5 bu/acre (+2.5%)

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2009 Crop Results

Vitazyme on Corn

Researcher: Nathan Temples
Farm cooperator: Seyer Farms
Location: Oran, Missourri
Variety: Dekalb
Soil type: sandy
Planting rate: 29,000 seeds /acre
Row-spacing: 30 inches
Irrigation: furrow, six times
Planting date: April 22, 2009

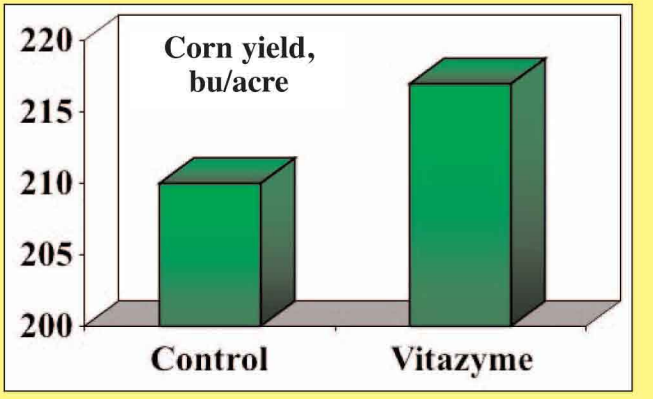
Experimental design: An 80-acre irrigated corn field was divided into 60 acres treated with Vitazyme, and 20 acres left untreated, to determine the product's effect on crop yield.

1. Control **2. Vitazyme**

Fertilization: unknown
Vitazyme application: 13 oz/acre along with a herbicide
Harvest date: September 14, 2009
Yield results:

Treatment	Yield	Yield change
	---------- bu/acre ----------	
Control	210	—
Vitazyme	217	7 (3.3%)

Increase in corn yield with Vitazyme: 3.3%



Conclusions: In this high yielding Missouri irrigated corn trial, Vitazyme increased corn yield by 7 bu/acre (3.3%), showing the utility of this product to improve production even at high yield levels.

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2009 Crop Results

Vitazyme on Corn

Researcher: Nathan Temples
Farm cooperator: Donnie and Chris Wondel, D and C Farms
Location: Arbor, Missouri
Variety: 32 D 78
Soil type: silt loam
Planting rate: 29,000 seeds /acre
Row-spacing: 30 inches
Irrigation: furrow, six times
Planting date: May 7, 2009

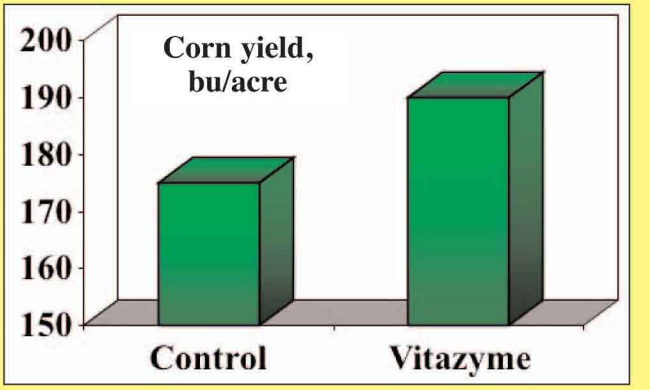
Experimental design: A 55-acre field was treated with Vitazyme on 40 acres, using seed and foliar treatments, to determine if this product would increase the yield of grain.

1. Control **2. Vitazyme**

Fertilization: unknown
Vitazyme application: (1) 8 oz/acre on the seeds at planting; (2) 13 oz/acre on the leaves and soil at 7 inches height, with a herbicide
Harvest date: October 6, 2009
Yield results:

Treatment	Yield	Yield change
	bu/acre	
Control	175	—
Vitazyme	190	15 (9%)

Increase in yield with Vitazyme: 9%



Conclusions: In this Missouri corn trial, using seed and foliar/soil applications, the Vitazyme treatments increased grain yield by 9% (15 bu/acre) in this high-yielding field, showing the program's great effectiveness in corn programs, even when yields are high.

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2008 Crop Results

Vitazyme on Corn

A Long-Term study: Year 1

Researcher: Bertel Schou, Ph.D. *Research organization*: ACRES (Agricultural Custom Research and Environmental Services), Cedar Falls, Iowa
Planting rate: 29,900 seeds/acre
Variety: Pioneer 34R67 (BBCH Scale:BCOR)
Planting date: May 21, 2008
Tillage: conventional (cultivated and harrowed on May 21)
Row spacing: 30 inches
Planting depth: 2 inches *Previous crop*: corn
Soil type: Kenyon loam (34% sand, 46% silt, 20% clay, 3.6% organic matter, 15.0 meq/100 grams cation exchange capacity, pH 7.2, good fertility)
Soil test results, initial for all plots (analyzed May 15, 2008): pH, 7.2; organic matter, 3.90%; N, 89 lb/acre; SO_4-S, 6 lb/acre; P_2O_5, 1,076 lb/acre; Ca, 5,407 lb/acre; Mg, 916 lb/acre; K, 298 lb/acre; Na, 52 lb/acre; B, 1.76 lb/acre; Fe, 460 lb/acre; Mn, 176 lb/acre; Cu, 3.4 lb/acre; Zn, 12.6 lb/acre; base saturations: Ca, 72.6%, Mg, 20.5%, K, 2.1%, Na, 0.6%, others, 4.2%
Experimental design: A field was selected to place plots (15 x 40 feet) in a randomized complete block design (five replicates), using two treatments for a long-term field study. These plots are designed to assess the long-term effects of Vitazyme on the yield and growth of corn and soybeans in rotation, but moreover the effects on the physical, chemical, and microbial characteristics of the soil.

1. Control **2. Vitazyme**

Fertilization: 120 lb/acre of N as 28% N applied postemergence in 20-inch spaced bands, using drop nozzles from a shielded sprayer
Vitazyme application: 13 oz/acre (1 liter/ha) in the seed furrow at planting (May 21), and 13 oz/acre sprayed over the leaves and soil on July 6, 2008, at the V6 stage
Weed control: Harness Extra preemergent, and Accent postemergent
Microorganism analyses: Soil biological activity was evaluated in the spring and fall to determine product effects on a number of parameters. Soil samples were collected from the root zones of plants from each of the five replicates, and then combined for each treatment and sent to the Soilfoodweb Laboratory in Corvallis, Oregon, for analysis.

May 29 analysis (baseline values for future comparisons)

Treatment	Organism biomass	Active bacteria	Total bacteria	Active fungi	Total fungi	Protozoa			Total nematodes
						Flagellates	Amoebae	Ciliates	
		ug/g	ug/g	ug/g	ug/g	no./g	no./g	no./g	no./g
Control	0.81	28.4	1,853	20.4	244	5,718	17,211	34	2.33
Vitazyme	0.80	24.7	2,324	13.3	282	3,454	5,738	72	1.84

Treatment	Total fungi to bacteria	Active fungi to total fungi	Active bacteria to total bacteria	Active fungi to active bacteria	Plant-available nitrogen
					lb/acre
Control	0.13	0.08	0.02	0.72	75 to 100
Vitazyme	0.12	0.05	0.01	0.54	50 to 75

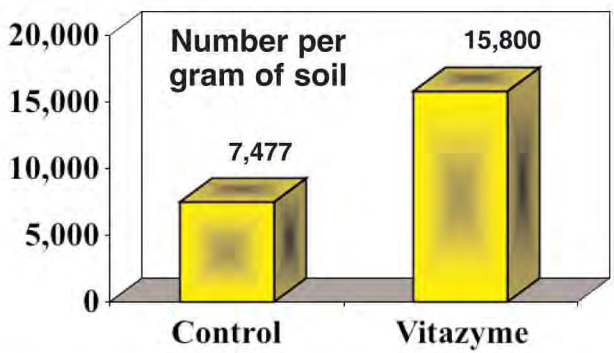
September 10 analysis

Treatment	Organism biomass	Active bacteria	Total bacteria	Active fungi	Total fungi	Protozoa			Total nematodes
						Flagellates	Amoebae	Ciliates	
		ug/g	ug/g	ug/g	ug/g	no./g	no./g	no./g	no./g
Control	0.82	41.6	929	18.7	352	1,690	5,618	169	2.73
Vitazyme	0.81	3.4	1,033	13.4	240	8,594	7,103	103	0.57

Treatment	VA mycorrhizae	Total fungi to bacteria	Active fungi to total fungi	Active bacteria to total bacteria	Active fungi to active bacteria	Plant-available nitrogen
	% infection				lb/acre	
Control	0	0.38	0.05	0.04	0.45	50 to 75
Vitazyme	0	0.23	0.06	0.03	0.41	75 to 100

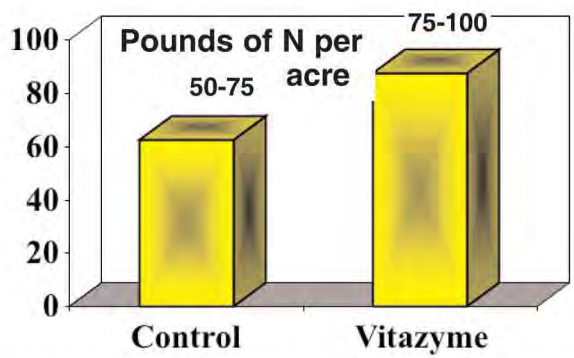
Differences in microbes between the two treatments are not pronounced, although there was a distinctly greater number of protozoa with the Vitazyme treatment, especially flagellates. There was no VAM mycorrhizal root infection for either treatment. Fungal and bacterial ratios were not very different, but plant-available nitrogen was decideably greater with the Vitazyme treatment.

Total Protozoa



Increase in protozoa with Vitazyme: 111%

Plant-Available Nitrogen



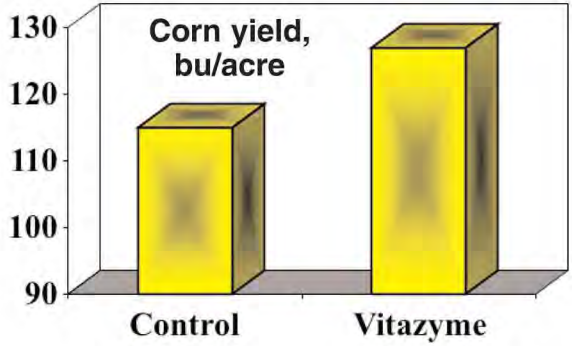
Increase in N availability with Vitazyme: 25 lb/acre

Harvest date: The crop was harvested on November 1, 2008, using a Massy-Ferguson 8 plot combine. Two rows 40 feet long were harvested from each plot.

Plant populations: The populations of the two treatments were very similar: 21,414 plants/acre for the control, and 21,235 plants/acre for the Vitazyme treatment. This difference was not significant (P=0.871).

Yield results:

Treatment	Grain yield	Yield increase
	bu/acre	bu/acre
Control	114.96 b	—
Vitazyme	127.02 a	12.06 (+10%)
LSD (0.05)	8.53	
Standard deviation	4.86	
Coeff. of variation	4.02	
Replicate F	4.4	
Replicate probability	0.090	
Treatment F	15.4	
Treatment probability	0.017	



Vitazyme significantly increased the yield of corn, by 12.06 bu/acre, a full 10% above the control yield.

Conclusions: In this first year of a long-term trial to evaluate the effects of Vitazyme on the physical, chemical, and microbiological effects of the soil, and on crop response, Vitazyme greatly boosted grain yield (12.06 bu/acre, or 10%) above the control. Baseline soil chemical analyses were completed, as were baseline microbiological analyses. A September 10 microbial analysis revealed that, while both treatments showed minimal differences in most parameters measured, there was a marked 111% increase in total protozoa with Vitazyme. In addition, the supply of plant-available nitrogen was improved by about 25 lb/acre with Vitazyme, a significant factor in the current climate of high and volatile fertilizer prices. Work will continue during the coming years on monitoring the changes brought about by Vitazyme on an array of soil and plant characteristics.

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2008 Crop Results

Vitazyme on Corn

Researcher/Farmer: Rick Nichols
Variety: Pioneer 34Y88 (non-GMO)
Row spacing: 30 inches
Planting date: May 4, 2008
Location: Hebron, Indiana
Soil type: silty clay "gumbo"
Population: 34,000 seeds/acre
Previous crop: soybeans

Experimental design: A field was divided into a control area receiving no sidedressed nitrogen or Vitazyme, and a treated area receiving both. The objective of the test was to evaluate the effect of combined sidedressed nitrogen plus Vitazyme on crop yield.

1. Control **2. Vitazyme + sidedressed nitrogen**

Fertilization: Before planting: 140 lb/acre nitrogen, as urea. At planting: 300 lb/acre 18-46-60% N-P_2O_5-K_2O placed 4 inches to the side of the seeds. At sidedressing, in June (corn about 2 feet tall): 40 lb/acre nitrogen as a 28% solution

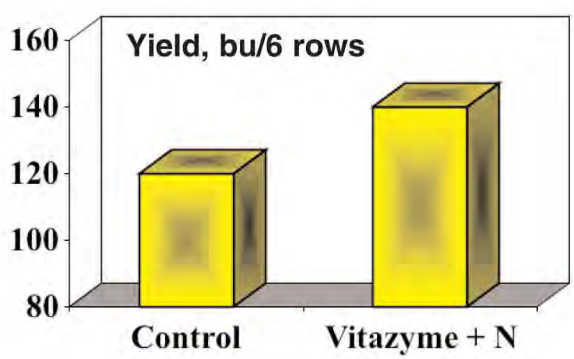
Vitazyme application: 13 oz/acre with sidedressed nitrogen on the treated area, applied in June at the 2-foot height

Harvest date: October 7, 2008

Yield results: Six rows of field length were harvested and weighed from each treatment in passes near one another. However, no row length was measured, so per acre yields were not obtained.

Treatment	Yield	Increase
	bu/6 rows	bu/6 rows
1. Control	120	—
2. Vitazyme + Sidedressed N	140	20 (+17%)

Increase in corn yield: 17%



Conclusions: In this northern Indiana corn trial, Vitazyme side-dressed with 40 lb/acre of nitrogen as a 28% solution increased the yield by 17% above the control. It was not possible to separate the effects of the nitrogen and the Vitazyme, but it is well documented that Vitazyme enhances the utilization of soil and fertilizer applied nutrients, especially nitrogen.

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2008 Crop Results

Vitazyme on Corn

Researcher/Farmer: Gary Burkey
Variety: Flexseed 4918 non-GMO
Row spacing: 30 inches
Planting date: May 6, 2008
Location: Couts, Indiana
Soil type: silty clay loam "gumbo"
Population: 29,500 seeds/acre

Soil test: pH, 6.6; cation exchange capacity, 24.6 meq/100g; organic matter, 3.6%; base saturations, Ca = 65.6%, Mg = 21.8%, K = 1.4%, Na = 0.3%, other bases = 4.8%, H = 6.0%; estimated N release, 86 lb/acre; S, 9 ppm; P_2O_5, 175 lb/acre; Ca, 6,468 lb/acre; Mg, 1,290 lb/acre; K. 274 lb/acre; Na, 38 lb/acre; B, 0.9 ppm; Fe, 1,842 ppm; Mn, 77 ppm; Cu, 1.1 ppm; Zn, 26.7 ppm

Experimental design: A corn field was treated entirely on the seeds with Vitazyme, and part of the field received a foliar Vitazyme treatment as well, along with two other products in the sprayer tank. The objective of the study was to evaluate the effect of an additional Vitazyme application and these other foliar products on corn yield.

1. Vitazyme on the seeds
2. Vitazyme on the seeds, plus Vitazyme and two other products on the leaves

Fertilization: _Before planting_: 150 lb/acre potassium chloride (0-0-60% N-P_2O_5-K_2O); 100 lb/acre diammonium phosphate (18-46-0% N-P_2O_5-K_2O); 70 lb/acre N from dry urea. _At planting_: 4 gallons/acre 3-18-18% N-P_2O_5-K_2O on the seeds. _At knee-height_: 70 lb/acre N (28% N) side-dressed with a row-crop cultivator. _Foliar spray on July 6_: Tricert K (1 quart/acre of a 50-0-20 N-P_2O_5-K_2O material), manganese (1.5 lb/acre). with Vitazyme.

Vitazyme application: (1) 13 oz/acre on the seeds at planting, along with 3-18-18 fertilizer; (2) 13 oz/acre sprayed foliar with Tricert K and manganese on July 6

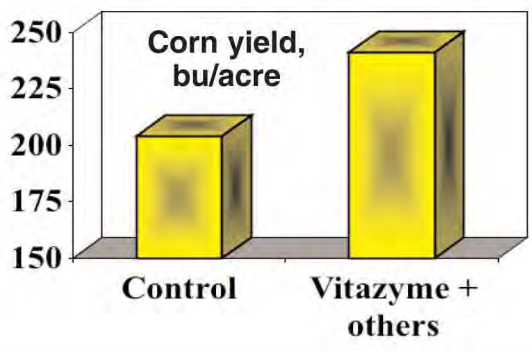
Weather results: a wet spring and late planting, few rains in July, and a very dry late July and August, followed by a 12-inch flooding rain in mid-October

Harvest date: November 10, 2008

Yield results: Eight -row swatchs were combined and weighed for both treatments. Due to an extreme rain event in mid-October, water rose so high in the field that the ears were covered for two to three days. In spite of that problem the corn grade was not affected, although untreated corn from neighbors' fields suffered water damage to their grain.

Treatment	Yield	Change
	bu/acre	bu/acre
1. Vitazyme on seeds	204	—
2. Vitazyme on seeds + foliar with Tricert K + Mn	241	37 (+18%)

Increase in corn yield: 18%



Conclusions: In this Indiana in-field corn trial, Vitazyme plus Tricert K and manganese boosted the yield by 18% (37 bu/acre), though it was not possible to separate the individual effects of these products. Vitazyme works in synergism with native soil and applied nutrients to boost utilization, so this great yield increase is not uncommon. **Of great interest is the fact that submersion of the ears before harvest for up to three days did not reduce the grain quality, indicating that cell wall integrity and anti-pathogen properties of the grain were likely enhanced by Vitazyme throughout the field.**

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2008 Crop Results

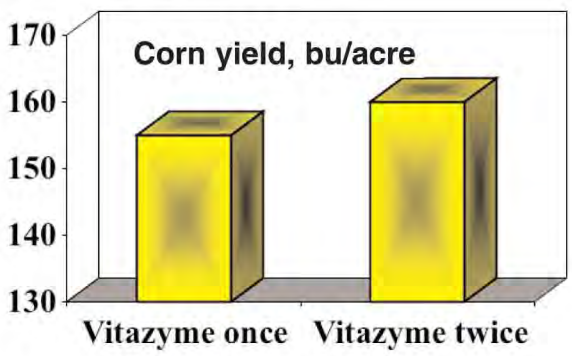
Vitazyme on Corn

Researcher/Farmer: Gary Burkey
Variety: Flexseed 303 Triple-Stack
Row spacing: 30 inches
Planting date: May 18, 2008
Location: Couts, Indiana
Soil type: mucky sand
Population: 31,000 seeds/acre
Soil test: pH, 7.2; cation exchange capacity, 22.53 meq/100g; organic matter, 6.0%; base saturations, Ca = 70.8%, Mg = 20.5%, K = 4.2%, Na = 0.3%, others = 4.2%, H = 0%; estimated N release, 105 lb/acre; S, 10 ppm; P_2O_5, 468 lb/acre; Ca, 6,376 lb/acre; Mg, 1,110 lb/acre; K. 739 lb/acre; Na, 31 lb/acre; B, 0.9 ppm; Fe, 277 ppm; Mn, 29 ppm;Cu, 0.4 ppm; Zn, 6.6 ppm
Experimental design: A field was treated entirely with Vitazyme on the seeds at planting, and a portion of the field was foliar treated to determine the effect of this later application on crop yield.

1. Vitazyme on the seeds **2. Vitazyme on the seeds + leaves**

Fertilization: Before planting: 150 lb/acre potassium chloride (0-0-60% N-P_2O_5-K_2O); 100 lb/acre diammonium phosphate (18-46-0% N-P_2O_5-K_2O). At planting: 4 gallons/acre 3-18-18% N-P_2O5-K_2O on the seeds at planting. Sidedressed on June 18, at 5-feet plant height: 40 gallons/acre 28% N.
Vitazyme application: (1) 13 oz/acre on the seeds at planting, with 3-18-18% N-P_2O_5-K_2O over all areas; (2) 13 oz/acre foliar over one portion of the field, on June 18
Weather results: a wet spring and late planting, few rains in July, and very dry in late July and August, with a flooding rain (12 inches) in mid-October
Harvest date: December 12, 2008
Yield results: Eight-row swaths were combined and weighed for both treatments.

Treatment	Yield	Change
	bu/acre	bu/acre
1. Vitazyme on seeds	155	—
2. Vitazyme on seeds + leaves	160	5 (+3%)



Conclusions: Vitazyme applied foliar in this northern Indiana corn trial resulted in a substantial 5 bu/acre increase in yield above the treatment receiving only a seed treatment.

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2008 Crop Results

Vitazyme on Corn

A Greenhouse Study

Researcher: Paul W. Syltie, Ph.D. *Location*: Vital Earth Resources Research Greenhouse, Gladewater, Texas *Variety*: yellow dent *Planting date*: January 31, 2008
Soil type: silt loam *Pot size*: 1 gallon
Planting rate: 10 seeds/pot, thinned to three plants *Watering*: on-demand
Temperature: 55 to 85°F *Planting depth*: 0.5 inch

Experimental design: A replicated greenhouse pot study was designed to evaluate the effect of various rates of Vitazyme on the growth of corn. six replicates were included with six treatments, and the data were analyzed using Analysis of Variance with CoHort software.

1. **Control**
2. **Vitazyme at 7.5 oz/acre**
3. **Vitazyme at 13 .0 oz/acre**
4. **Vitazyme at 26.0 oz/acre**
5. **Vitazyme at 39.0 oz/acre**
6. **Vitazyme at 52.0 oz/acre**

Vitazyme applications: The 13.0 oz/acre application was made immediately after planting to the soil surface of the pot, using 100 ml of a 0.0016% solution. Other treatments were multiples of this rate.

Harvest date: On March 5, 35 days after planting, the soil was washed from the roots of the plants, and measurements were made of the height of each plant. The plants were then placed in a drying oven at about 50°C for 48 hours.

Plant height results:

Treatment	Plant height	Height change*
	cm	cm
5 (Vitazyme, 3x)	85.3 a	5.5 (+7%)
3 Vitazyme, 1x)	84.6 a	4.8 (+6%)
4 (Vitazyme, 2x)	83.8 a	4.0 (+5%)
2 (Vitazyme, 0.5x)	83.4 a	3.6 (+5%)
6 (Vitazyme, 4x)	80.0 b	0.2 (+0%)
1 (Control)	79.8 b	—
	Statistical analysis	
Replicate P	0.0245	
Treatment P	0.0040	
Model P	0.0029	
Coefficient of variation	3.24%	
$LSD_{0.10}$	2.6 cm	

*Compared to the untreated control, Treatment 1.

The highest (4 times normal) rate, as well as the untreated control, gave significantly shorter plants than all of the other Vitazyme treatments. There was no statistical difference among the 0.5 to 3 times normal treatments, but the greatest heights were for the 3 times normal and normal treatments.

Increase in plant height	
3x Vitazyme	**7%**
1x Vitazyme	**6%**
2x Vitazyme	**5%**
0.5x Vitazyme	**5%**

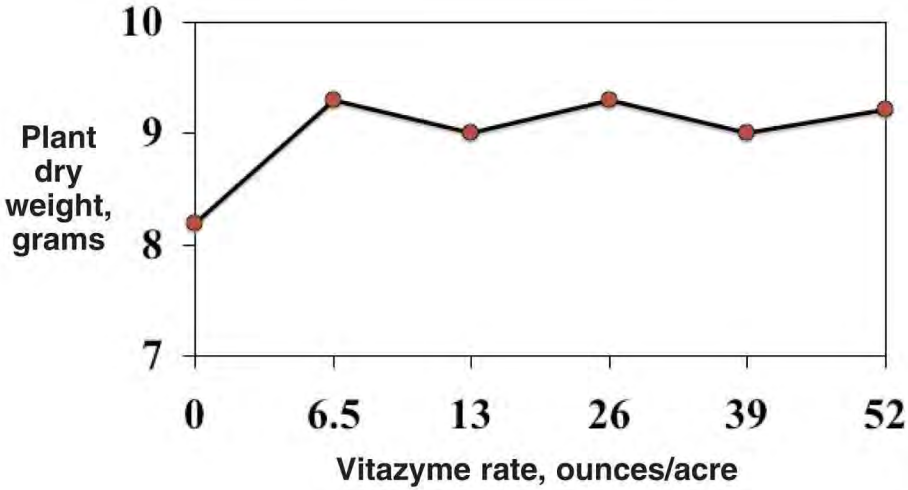
Dry weight results:

Treatment	Dry weight	Dry weight change*
	cm	cm
2 (Vitazyme, 0.5x)	9.30 a	1.11 (+14%)
4 Vitazyme, 2x)	9.30 a	1.11 (+14%)
6 (Vitazyme, 4x)	9.22 a	1.03 (+13%)
5 (Vitazyme, 3x)	9.01 a	0.82 (+10%)
3 (Vitazyme, 1x)	9.00 a	0.81 (+10%)
1 (Control)	8.19 b	—
	Statistical analysis	
Replicate P	0.0092	
Treatment P	0.0192	
Model P	0.0043	
Coefficient of variation	6.23%	
$LSD_{0.10}$	0.55 gram	

*Compared to the untreated control, Treatment 1.

All of the Vitazyme applications gave increases in dry plant weight of from 10 to 14%, the highest increases being with the 0.5x, 2x, and 4x rates. None of these differences were statistically significant, and all exceeded the control.

Increase in plant dry weight	
0.5x Vitazyme	**14%**
2x Vitazyme	**14%**
4x Vitazyme	**13%**
3x Vitazyme	**10%**
1x Vitazyme	**10%**



Conclusions: In this greenhouse study to evaluate the effects of progressively higher rates of Vitazyme to stimulate corn height and dry weight accumulation, the product proved to significantly increase plant height by 5 to 7% at all but the 4x (52 oz/acre) rate, whereas dry weight significantly increased from 10 to 14% for all of the Vitazyme rates. These data prove that more than just the standard 13 oz/acre rate can be effective in stimulating crop growth, but higher rates do not produce a linear yield or growth increase.

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2007 Crop Results

Vitazyme on Corn

Researchers: Fred Vaughn and Greg Wilson *Organization*: Vaughn Agricultural Research Services
Location: Branchton, Ontario, Canada *BBCH Scale*: BCOR *Variety*: Pioneer 38P03
Planting rate: 76,000 seeds/ha *Planting depth*: 5cm
Row spacing: 76 cm *Planting Date*: May 14, 2007 *Seedbed conditions*: dry, fine
Soil temperature at planting: 13.3C *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 crop: 2004, winter wheat (with Cobutox); 2005, potatoes (with Dual + Sencor); 2006, corn (Dual + Marksman)
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	At 8 leaves	Nitrogen
	liters/ha		Kg/ha
1. No Vitazyme	0	0	60
2. No Vitazyme	0	0	60
3. Vitazyme	1	1	120
4. Vitazyme	1	1	120

Fertilization: All areas received 200 kg/ha of dry 6-24-24% N-P_2O_5-K_2O before planting. 100 liters/ha of liquid 6-24-6% N-P_2O_5-K_2O was applied in the seed furrow at planting (May 14). A 28% nitrogen solution was applied to the plots on June 8 so that the appropriate plots would receive either 60 or 120 kg/ha of nitrogen.
Vitazyme application: To Treatments 3 and 4, 1 liter/ha was applied to the seeds at planting (May 14), as a spray on the seeds just behind the disc openers, and 1 liter/ha was applied to the leaves and soil at the eight-leaf stage (June 20).
Crop emergence date: May 18, four days after planting
Weed control: unknown
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 grain moisture content and test weight, nor were any differences discovered in stalk lodging. Thus, those data are not included below.

Grain Yield

Treatment	Grain yield	Change*
	bu/acre	bu/acre
1. No Vitazyme, 60 N	118.6 c	—
2. No Vitazyme, 120 N	144.3 b	25.7 (+22%)
3. Vitazyme, 60 N	137.7 b	19.1 (+16%)
4. Vitazyme, 120 N	166.8 a	48.2 (+41%)
LSD	16.3	
CV	11.37	
Bartlett's X2	3	
P (Bartlett's X2)	0.392	
Replicate F	4.315	
Replicate Prob (F)	0.0124	
Treatment F	9.158	
Treatment Prob (F)	0.0011	

.Vitazyme Effect at 60 kg/ha N

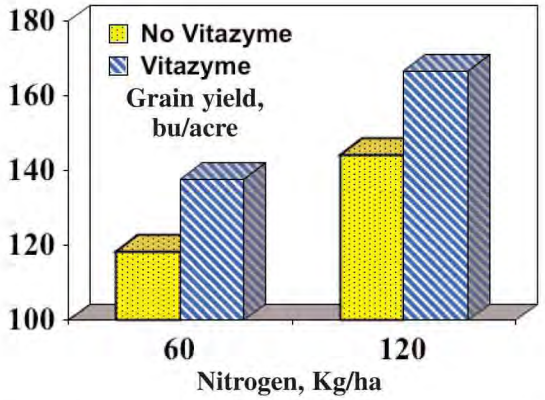
Treatment	Yield	Change
	bu/acre	bu/acre
No Vitazyme	118.6 b	—
Vitazyme	137.7 a	19.1 (+16%)

Yield increase with Vitazyme at 60 kg/ha N: 16%

Vitazyme Effect at 120 kg/ha N

Treatment	Yield	Change
	bu/acre	bu/acre
No Vitazyme	144.3 b	—
Vitazyme	166.8 a	22.5 (+16%)

Yield increase with Vitazyme at 120 kg/ha N: 16%



At both nitrogen levels, Vitazyme significantly increased grain yield at P=0.10. This increase was 16% above the control at both nitrogen levels. What is especially interesting to note is that the 60 kg/ha N yield (137.7 bu/acre) with Vitazyme was statistically equal to the 120 kg/ha N yield (144.3 bu/acre) without Vitazyme. This reveals a benefit of Vitazyme to improve the utilization of fertilizer nitrogen.

Income results: At $4.00/bu, the increased incomes for the grain produced in this study are as follows:

At 60 kg/ha N. No Vitazyme: 118.6 bu/acre x $4.00/bu = $474.40
Vitazyme: 137.7 bu/acre x $4.00/bu = $550.80
Increase with Vitazyme: $74.40/acre

At 120 kg/ha N. No Vitazyme: 144.3 bu/acre x $4.00/bu = $577.20
Vitazyme: 166.8 bu/acre x $4.00/bu = 667.20
Increase with Vitazyme: $90.00/acre

Conclusions: In this southern Ontario, Canada, study of Vitazyme on corn at two nitrogen levels, Vitazyme was shown to significantly increase grain yield, by 16% above the respective control (no Vitazyme) levels. Moreover, the yield of the Vitazyme + 60 kg/ha N rate was statistically equal to the 120 kg/ha N rate without Vitazyme, demonstrating the ability of the product to improve the utilization of nitrogen. Two applications of 1 l/ha, at planting and again at the eight-leaf stage, brought about this yield improvement. The yield increases gave significant income increases: $74.40/acre at 60 kg/ha nitrogen, and $90.00/acre at 120 kg/ha nitrogen.

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2006 Crop Results

Vitazyme on Corn

Ministry of Sugar, Cuban Ministry of Agriculture

Researchers: Wilberto G. Marrero and Jorge G. Acosta
Location: Juan Abrahantes Farm, Madruga, Havana Province, Cuba *Variety*: unknown
Soil type: red ferralitic of low fertility *Planting rate*: unknown *Row spacing*: unknown
Planting date: July 23, 2006 *Watering*: rain-fed
Experimental design: An area of 1.5 acres in a production corn field was treated with Vitazyme twice, each time at 1 liter/ha, to determine the effect of the product on corn yield.

1. Control **2. Vitazyme**

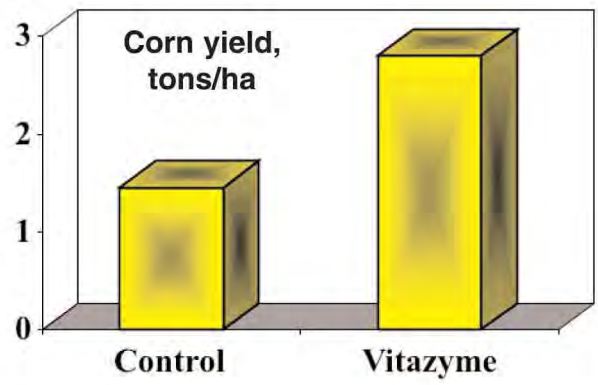
Fertilization: unknown
Vitazyme application: 1 liter/ha on the leaves and soil on August 7, 15 days after planting, and again 39 days later on September 15
Harvest date: October 14, 2006, 83 days after planting
Growth results:

Parameter	Control	Vitazyme
Rows of kernels	Averaging <12 rows/ear	Averaging>12 rows/each
Ear size	Average size	Larger than average
Stalk diameter	Average diameter	Greater than average diameter
Plant vigor	Average vigor	More vigorous
Plant height	2.00 meters average	1.55 meters average
Root development	Moderate	Extensive

Yield results:

Treatment	Yield	Increase
	tons/ha	tons/ha
Control	1.45	—
Vitazyme	2.80	1.35 (+93%)
Historical yield	0.70	

Increase in corn yield: 93%



Conclusions: This Cuban corn study showed that Vitazyme greatly increased corn yield (by 93%) with two applications at 1 liter/ha each time, separated by 39 days. **This yield was four times the normal historical yield experienced in that area under the management system used.** The treated corn plants expressed superior vigor and growth throughout the growth cycle.

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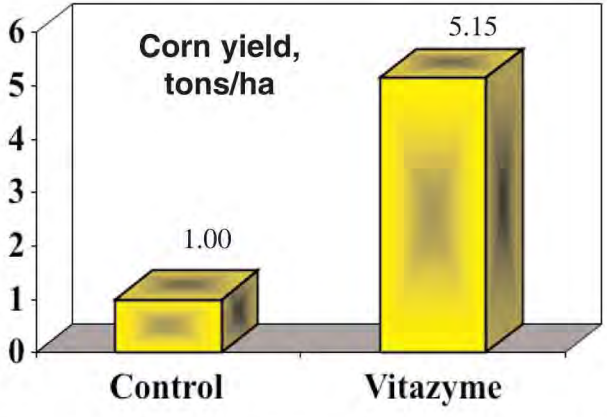
2006 Crop Results

Vitazyme on Corn

Researchers: Eng. Wilberto Gonzalez, and Eng. Jorge Gonzalez, Camilo Cienfuegos, Agricultural Enterprise
Location: Armistad Farm of Camilo Cienfuegos Agricultural Enterprise, Havana Province, Cuba
Variety: unknown
Soil type: red ferralitic
Planting date: late 2005 to early 2006
Experimental design: A commercial production trial involved a split field area of 1.0 ha treated and 1.0 ha untreated with Vitazyme at Armistad Farm.

1. Control **2. Vitazyme**

Fertilization: unknown
Vitazyme applications: 1.0 liter/ha on the leaves twice, separated by 30 days



Increase in corn yield: 415%

Conclusions: This commercial corn trial in Cuba revealed the remarkable ability of Vitazyme to increase corn production, with a very large 415% yield increase.

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2006 Crop Results

Vitazyme on Corn

USDA/National Soil Tilth Laboratory

Researcher: Jerry Hatfield, Ph.D.
Location: Ames, Iowa
Variety: Pioneer 35P17
Planting rate: 36,000 seeds/acre in double rows
Planting date: April 18, 2006
Tillage: chisel plowing on November 26, 2005, and field cultivation on April 4 and April 18, 2006
Experimental design: A field area was treated with Vitazyme to determine if corn planted in a double-row fashion would respond to the product under conventional tillage. The trial was non-replicated.

1. Control **2. Vitazyme**

Fertilization: 50 lb/acre of N as 32% UAN on October 18, 2005; 30-80-120 lb/acre of N-P_2O_5-K_2O dry spread on November 23, 2005; 300 lb/acre of SuperCal 98 pelleted lime on February 8, 2006; 300 lb/acre of SuperCal SO_4 pelleted gypsum on February 9, 2006; sidedressed 180 lb/acre of N as 32% UAN on May 29, 2006

Vitazyme application: 13 oz/acre foliar, hand applied, on June 5, 2006; 13 oz/acre foliar, hand applied, on June 27, 2006

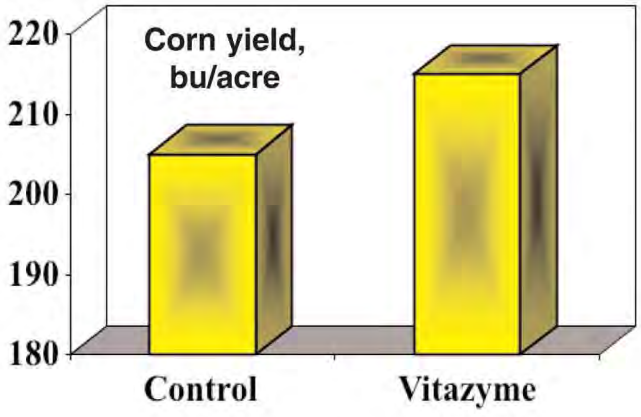
Herbicide application: 3 qt/acre of Lumax, pre-emergent, on April 24, 2006

Harvest date: October 19, 2006

Yield results:

Treatment	Yield	Increase
	tons/ha	tons/ha
Control	205	—
Vitazyme	215	10 (+5%)

Yield increase with Vitazyme: 5%



Conclusions: On this non-replicated corn-yield study in central Iowa, using a double row system, two foliar Vitazyme applications utilizing 13 oz/acre each time increased the grain yield by 10 bu/acre (5%). Had a seed application been made it is likely that the response would have been greater.

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2006 Crop Results

Vitazyme on Corn (Organic)

Research location: Ontario County, New York
Planting date: May 24
Row spacing: 30 inches
Variety: Blue River 42A32 (96-day)
Soil type: silty clay loam
Seeding rate: 28,400/acre

Experimental design: A field of organically grown corn was divided into Vitazyme treated and untreated areas in an effort to determine the product's effects on the yield of high-moisture corn. This corn was placed in an air-tight silo to be ground and used for cattle feed later.

1. Control **2. Vitazyme**

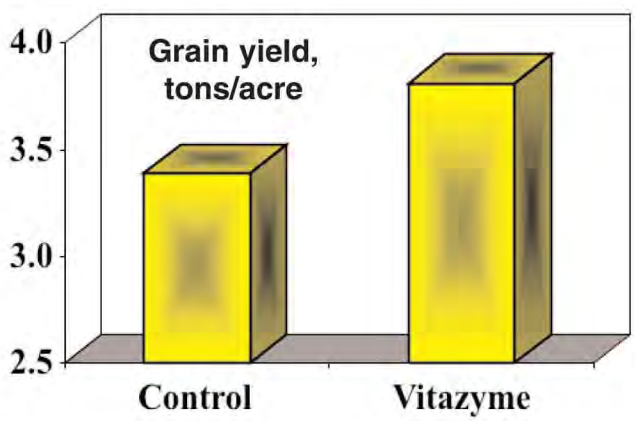
Fertilization: Liquid cow manure, 8,500 gal/acre in November of 2005, and 7,300 gal/acre on May 8, 2006; 300 lb/acre of a 5-5-5% N-P_2O_5-K_2O dry Fertrell organic mix, in a 2 x 2-inch placement

Vitazyme treatment: 13 oz/acre on the seed in-furrow at planting
Weather for 2006: adequate moisture until August, then excessive afterwords
Harvest date: October 13

Yield results: Each parcel was harvested for a certain area, and the grain was dumped into a bin where a measurement of volume was taken. From the difference of these values the value of each treatment was calculated based upon the average field yield.

Treatment	Grain yield	Yield increase
	tons/acre	tons/acre
Control	3.39	—
Vitazyme	3.81	0.42 (+12%)

Grain increase with Vitazyme: 12%



Income results: The value of high moisture corn (25%) is about $175/ton.

Value of control corn $593.25/acre
Value of Vitazyme corn $666.75/acre
Income increase with Vitazyme $73.50/acre

Conclusions: In this New York split-field study on organically grown corn, only one 13 oz/acre treatment of Vitazyme, on the seeds, produced a marked 12% increase in the yield of high moisture corn. This yield increase translated into an additional $73.50/acre income, or about an $18 return for each dollar invested in Vitazyme.

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2005 Crop Results

Vitazyme on Corn

North Carolina State University

Researcher: Ron Heiniger, Ph.D.
Variety: De Kalb Dk 69-71 RR/YG
Soil type: Roanoke silt loam
Row width: 30 inches
Location: Hertford, North Carolina
Planting date: April 21, 2005
Previous crop: soybeans
Population: 27,000 and 38,000 seeds/acre

Experimental design: A split-plot randomized complete block design (four replicates) was placed on a uniform soil area with the main plots containing the two seeding rates. Plots were 10 x 40 feet. Subplots contained starter fertilizer, starter fertilizer + Vitazyme, Vitazyme only, and a control. Evaluations were made on stalk diameter, root parameters, and yield to discover the effects of all variables on these parameters.

Main Plots
1. 27,000 seeds/acre
2. 38,000 seeds/acre

Subplots
1. Control
2. Vitazyme
3. Starter
4. Vitazyme + Starter

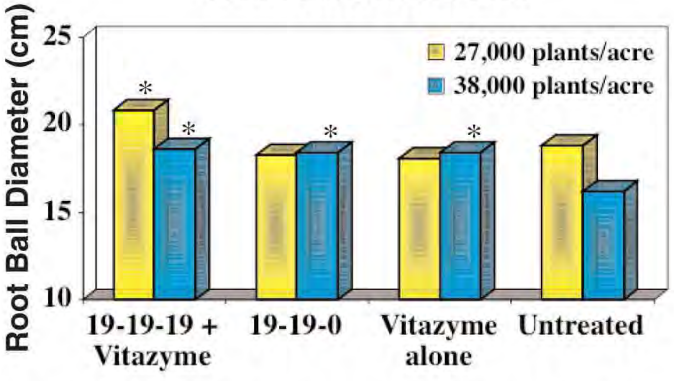
Fertilization: A 19-19-0% N-P_2O_5-K_2O fertilizer was applied to the subplots 3 and 4 at a 10 gal/acre rate in a 2 x 2 inch band below and beside the seeds at planting. On June 7, 60 gal/acre of 30% UAN (urea ammonium nitrate) was applied.

Vitazyme application: 13 oz/acre on the seeds at planting for subplots 2 and 4

Weed control: excellent control with Bicep, Roundup, and atrazine herbicides

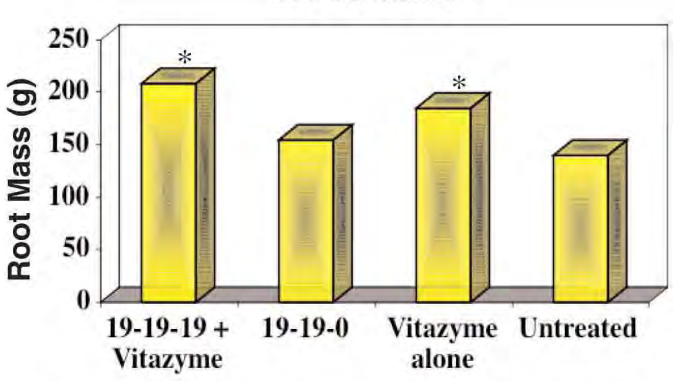
Root and stalk results: In early July five plants in consecutive order in rows of each treatment were dug, and the soil was washed from the root balls. Roots were pruned and dried, and the stalk diameter at the first internode below each ear was measured. Root ball depth and diameter were also measured.

Root Ball Diameter

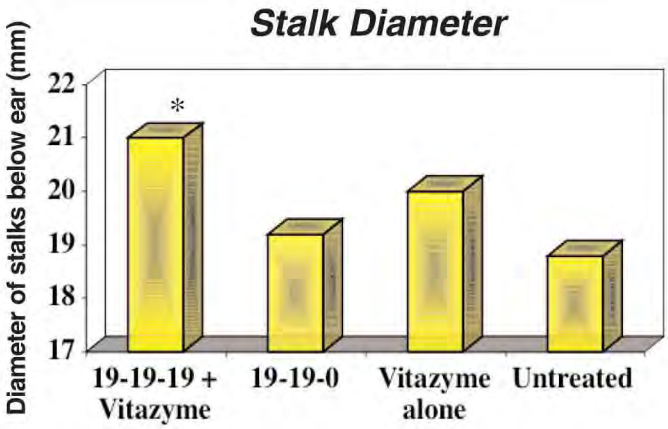


*Significantly greater than the control. $LSD_{0.05}$= 1.32 cm. (Comparisons are made within the same plant population.)

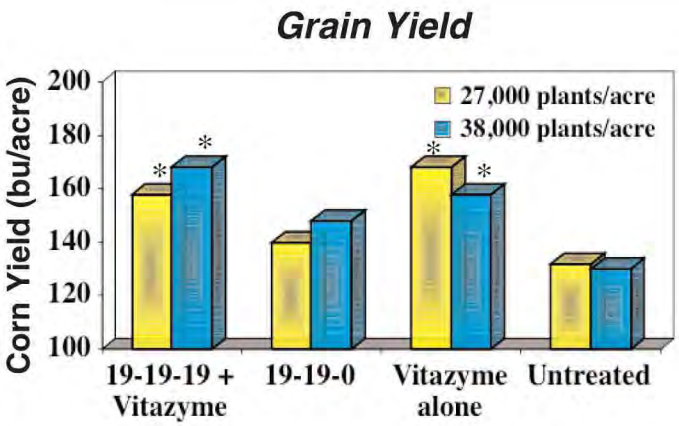
Root Mass



*Significantly greater than the control. $LSD_{0.05}$= 43.5 g



*Significantly greater than the control. $LSD_{0.05}$= 0.93 mm.



*Significantly greater than the control. $LSD_{0.05}$= 22.9 bu/acre (Comparisons are made within the same plant population.)

Conclusions (by the researcher): Significant treatment effects or interactions involving Vitazyme were found for the diameter of the root ball, root mass, stalk diameter and grain yield. In the case of the diameter of the root ball there was a significant plant population by treatment interaction. At the lower plant population of 28 000 plants/acre the combination of 19-19-0 and Vitazyme significantly increased the diameter of the root ball compared to either product used alone or when compared to the untreated check. Neither the 19-19-0 nor Vitazyme when used alone increased the diameter of the root ball compared to the untreated check. In contrast, at the higher plant population, Vitazyme, 19-19-0, or the combination of the two significantly increased the diameter of the root ball compared to the untreated check. Although none of these three treatments were significantly different from each other the combination of Vitazyme and 19-19-0 again tended to have the higher yield. There were no significant interactions for root mass. However, there was a significant treatment effect. Vitazyme when used alone or in combination with 19-19-0 resulted in greater root mass compared to the untreated check. Again, the combination of Vitazyme and 19-19-0 produced the greatest root mass when compared with either treatment used alone. There was also a treatment effect on stalk diameter. The combination of Vitazyme and 19-19-0 increased stalk diameter at the first internode below the ear when compared with the untreated check or with a treatment of only 19-19-0. There was not a significant difference in stalk diameter between a treatment with only Vitazyme and the combination of Vitazyme and 19-19-0. However, the combination did have the largest stalk diameter.

For grain yield there was a significant plant population and treatment interaction. At the lower plant population, Vitazyme alone significantly increased yield compared to either the starter fertilizer or the untreated check; while the combination of starter and Vitazyme resulted in a yield similar to that obtained by Vitazyme alone. In comparison, at the higher plant population, the starter treatment, Vitazyme, or the combination of the two resulted in statistically similar yields but only the Vitazyme or Vitazyme-starter combination had significantly higher yields than the untreated check.

In summary, Vitazyme or Vitazyme in combination with 19-19-0 increased root ball diameter, root mass, stalk diameter, and grain yield compared to an untreated check. While plant disease ratings were not taken in this study, it is unlikely that the Vitazyme effect was related to better disease resistance. It appears that Vitazyme applied to the seeds at planting improves early root development resulting in a larger root mass, greater stalk diameter, and increased yield.

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2004 Crop Results

Vitazyme on Corn
North Carolina State University

Researcher: Ron Heiniger, Ph.D *Location*: Clarkton, North Carolina
Variety: DKC69-71 RRH62 *Tillage*: conventional *Population*: 33,000 seeds/acre
Row width: 30 inches *Planting date*: April 24, 2004 *Previous crop*: soybeans

Experimental design: A plot area of 18,000 ft^2 (180 x 100 ft) was divided into individual plots of 400 ft^2 (40 x 10 ft), with four replicates. The objective of the study was to evaluate the potential of Vitazyme biostimulant to improve grain yield at five nitrogen rates.

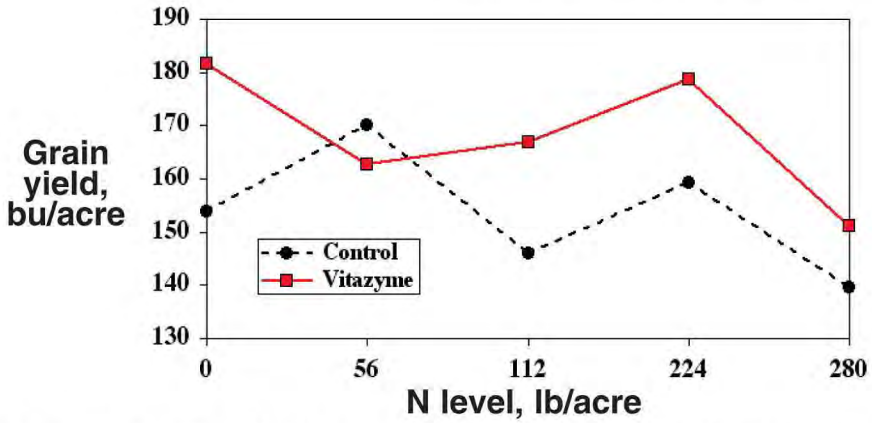
Control	Vitazyme
1. No N	6. No N
2. 56 lb/acre	7. 56 lb/acre
3. 112 lb/acre N	8. 112 lb/acre N
4. 224 lb/acre N	9. 224 lb/acre N
5. 280 lb/acre N	10. 280 lb/acre N

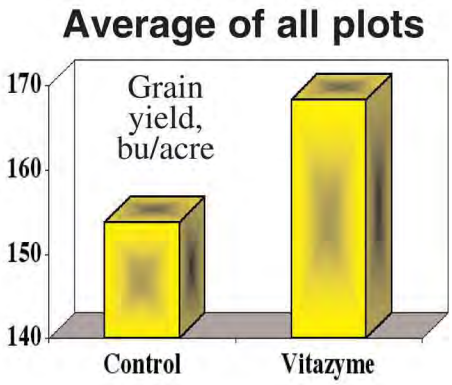
Fertilization: 10 gal/acre of 19-19-0 %N-P_2O_5-K_2O in a 2x2 band on April 24 after broadcasting 30% UAN and a 10-34-0 fertilizer on April 19
Herbicide application: Lariat (3 qt/acre) on April 19, broadcast pre-plant
Insecticide application: Counter 20CR (7 lb/acre) on April 21, T-banded on April 21
Vitazyme application: 13 oz/acre on the seeds at planting, and 13 oz/acre broadcast at knee height
Harvest date: September 23, 2004
Yield Results:

Treatment	N-level	Yield	Change[1]	NCLB rating[2]	Change[1]	GLS rating[3]	Change[1]
	lb/acre	bu/acre	bu/acre				
Control	0	153.9	—	9.25	—	8.88	—
	56	170.2	—	9.38	—	8.88	—
	112	145.9	—	9.63	—	9.00	—
	224	159.3	—	9.75	—	9.38	—
	280	139.7	—	10.00	—	9.50	—
	Average	153.8	—	9.60	—	9.13	—
Vitazyme	0	181.6	27.7* (+18%)	9.38	0.13 (+1%)	8.88	0 (0%)
	56	162.6	(-) 7.6 (-4%)	9.75	0.37* (+4%)	9.25	0.37* (+4%)
	112	166.8	20.9* (+14%)	9.88	0.25* (+3%)	9.50	0.50*(+6%)
	224	178.6	19.3* (+12%)	9.88	0.13 (+1%)	9.63	0.25* (+3%)
	280	151.2	11.5 (+8%)	10.00	0 (0%)	9.50	0 (0%)
	Average	168.2	14.4* (+9%)	9.78	0.18 (+2%)	9.35	0.22* (+2%)
	$LSD_{0.05}$	14.3		0.19		0.15	

[1] Differences are compared with the same N level for control and Vitazyme
[2]NCLB = Northern Corn Leaf Blight: 1 = leaves covered with lesions, 10 = no disease.
[3]GLS = Gray Leaf Spot: 1 = leaves covered with lesions, 10 = no disease.
*Significant difference vs. the control at P=0.05.

Corn Grain Yield

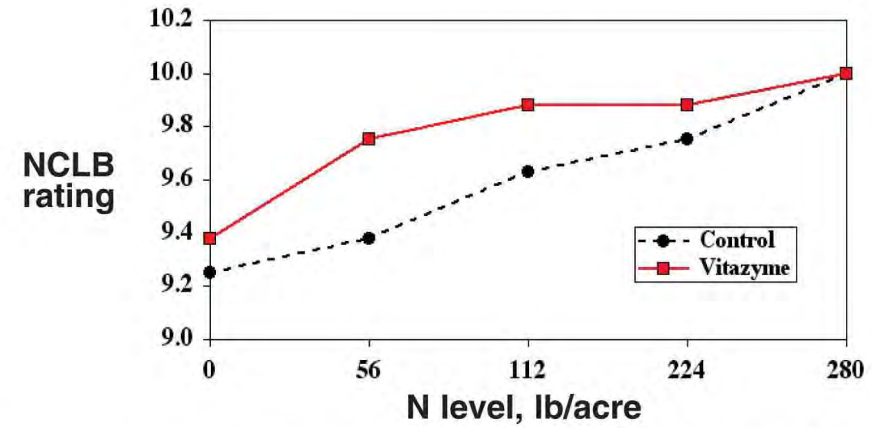


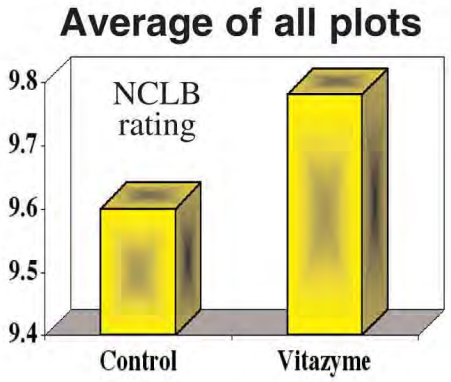


Vitazyme significantly boosted grain yield across all N levels, by 14.4 bu/acre (9%), and especially at the 0 N level (+18%), the 112 lb/acre N level (+14%), and the 224 lb/acre N level (+12%). Residual N levels and seasonal N release were apparently quite high, since the highest yield was with no added N plus Vitazyme (181.6 bu/acre), and yields in general tapered off as N levels increased, the lowest yields being at the 280 lb/acre N rate for both treatments. The yield response thus exhibited some N excess at the higher N rates.

Leaf pathogen results:

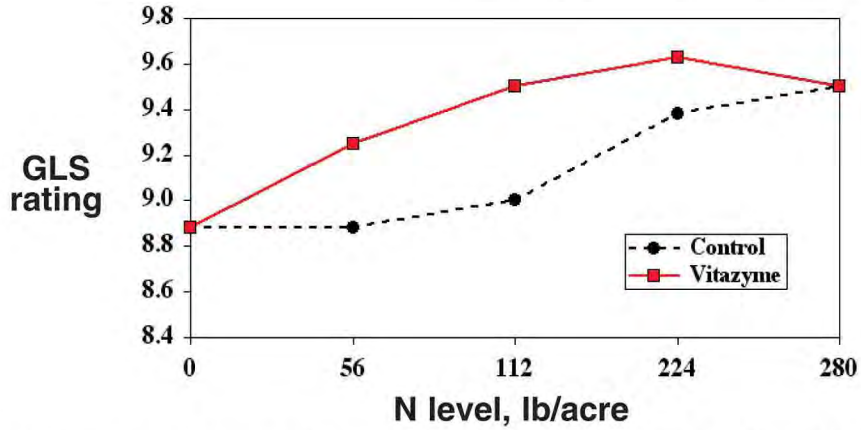
Northern Corn Leaf Blight Rating

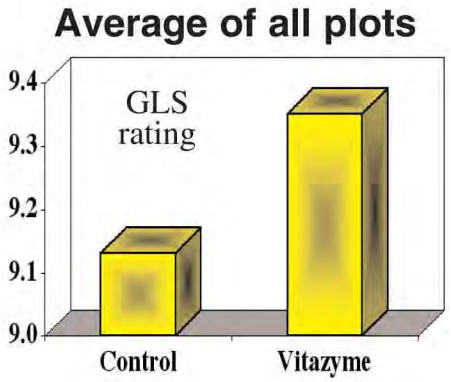




Vitazyme reduced the Northern Corn Leaf Blight rating significantly across nearly all plots, and did so at the 56 and 112 lb/acre N rates. At all N rates, Vitazyme treated corn reduced NCLB incidence compared to the control.

Grey Leaf Spot Rating





At all levels of N except at 0 and 280 lb/acre, Vitazyme reduced the incidence of grey leaf spot. This reduction was significant at 56, 112, and 224 lb/acre of N, and also for the overall average of all plots.

Conclusions: In this North Carolina State University replicated corn study, Vitazyme increased corn grain yields at all N levels except at 56 lb/acre N. the average overall yield was increased by Vitazyme by 9%, which was significant at P=0.05. Resistance to both Northern Corn Leaf Blight and Grey leaf Spot were also significantly (P=0.05) increased over several N levels, and was significantly greater for Vitazyme over all N levels for Grey Leaf Spot, and nearly so for NCLB. This product shows excellent promise in promoting higher yields with greater disease resistance under North Carolina conditions.

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2004 Crop Results

Vitazyme on Corn

Farmer: James Glass *Location*: Austin, Texas *Variety*: Golden Acre 2850RR
Soil type: silty clay loam *Row spacing*: 30 inches *Population*: 24,000 plants/acre
Planting date: March 28, 2204

Experimental design: A 110-acre field was divided into two parts, 30 acres treated with Vitazyme and the rest of the field left untreated. All other treatments were the same across the entire field.

1. Control **2. Vitazyme**

Fertilization: anhydrous ammonia and a mixed N-P-K fertilizer

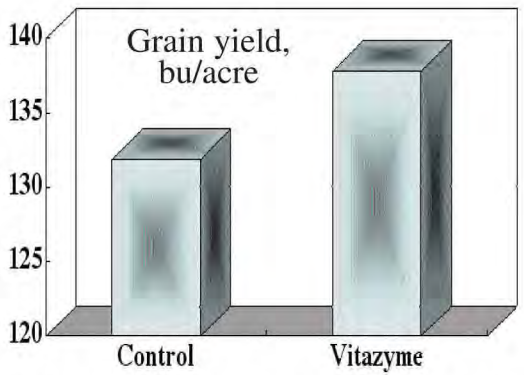
Vitazyme application: 13 oz/acre added to the seeds with a liquid starter fertilizer at planting

Growth observations: An examination of corn plants from each treatment at midseason revealed a noticeable size advantage for the treated plants.

Yield results: On August 27, 2004, one-acre areas of each treatment located close to each other were measured and blocked off. The one-acre areas were harvested and unloaded into a truck, and weighed individually.

Treatment	Grain weight		Change
	lb/acre	bu/acre	bu/acre
Control	7,385	131.9	—
Vitazyme	7,715	137.8	5.9 (+4.5%)

Increase in grain yield: 4.5%



Conclusions: This south Texas corn study revealed that Vitazyme applied in the seed row at planting increased the yield by 4.5% (5.9 bu/acre). There was little change in grain quality due to Vitazyme application. If a $3.00/bushel corn price is used, this yield increase is profitable $17.70/acre.

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2004 Crop Results

Vitazyme on Corn
North Carolina State University

Researcher: Ron Heiniger, Ph.D *Location*: Elizabeth City, North Carolina
Variety: DKC69-71 RRH62 *Tillage*: conventional *Population*: 33,000 seeds/acre
Row width: 30 inches *Planting date*: April 21, 2004 *Previous crop*: soybeans

Experimental design: A plot area of 15,400 ft^2 (220 x 70 ft) was divided into individual plots of 400 ft^2 (40 x 10 ft), with four replicates. The objective of the study was to evaluate the potential of Vitazyme biostimulant to improve grain yield and reduce disease incidence at five nitrogen rates.

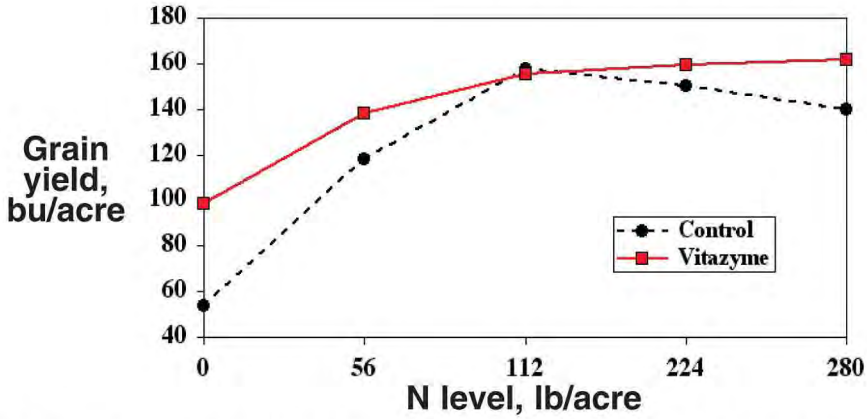
Control	Vitazyme
1. No N	6. No N
2. 56 lb/acre	7. 56 lb/acre
3. 112 lb/acre N	8. 112 lb/acre N
4. 224 lb/acre N	9. 224 lb/acre N
5. 280 lb/acre N	10. 280 lb/acre N

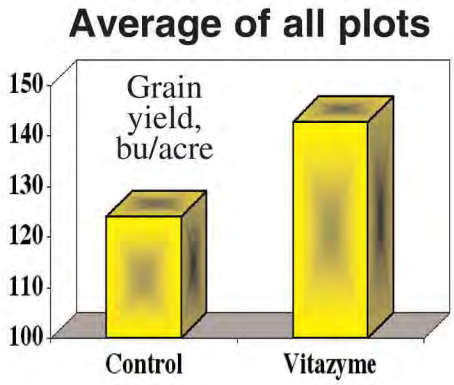
Fertilization: 10 gal/acre of 19-19-0 %N-P_2O_5-K_2O in a 2x2 band on April 21 after broadcasting 30% UAN and a 10-34-0 fertilizer before planting
Herbicide application: Atrazine (2 qt/acre) with Banvel (0.5 pt/acre) plus Accent on May 27
Insecticide application: Counter 20CR (15 lb/acre), T-banded on April 21
Vitazyme application: 13 oz/acre on the seeds at planting, and 13 oz/acre broadcast at knee height
Harvest date: unknown
Yield Results:

Treatment	N-level	Yield	Change[1]	NCLB rating[2]	Change[1]	GLS rating[3]	Change[1]
	lb/acre	bu/acre	bu/acre				
Control	0	54.0	—	3.25	—	6.13	—
	56	118.3	—	3.75	—	6.13	—
	112	157.8	—	3.88	—	6.38	—
	224	150.0	—	4.25	—	6.63	—
	280	139.9	—	4.13	—	6.75	—
	Average	124.0	—	3.85	—	6.40	—
Vitazyme	0	98.5	44.5* (+82%)	4.88	1.63* (+50%)	6.50	0.37 (+6%)
	56	138.4	20.4* (+17%)	5.13	1.38* (+37%)	6.88	0.75* (+12%)
	112	155.6	(-)2.2 (-1%)	5.13	1.25* (+32%)	7.25	0.87* (+14%)
	224	159.4	9.4 (+6%)	5.88	1.63* (+38%)	7.38	0.75*(+11%)
	280	161.5	21.6*(+15%)	5.75	1.62* (+39%)	7.88	1.13* (+17%)
	Average	142.7	18.7*(+15%)	5.35	1.50* (+39%)	7.18	0.78* (+12%)
	$LSD_{0.05}$	15.0		0.40		0.38	

[1] Differences are compared with the same N level for control and Vitazyme
[2]NCLB = Northern Corn Leaf Blight: 1 = leaves covered with lesions, 10 = no disease.
[3]GLS = Gray Leaf Spot: 1 = leaves covered with lesions, 10 = no disease.
*Significant difference vs. the control at P=0.05.

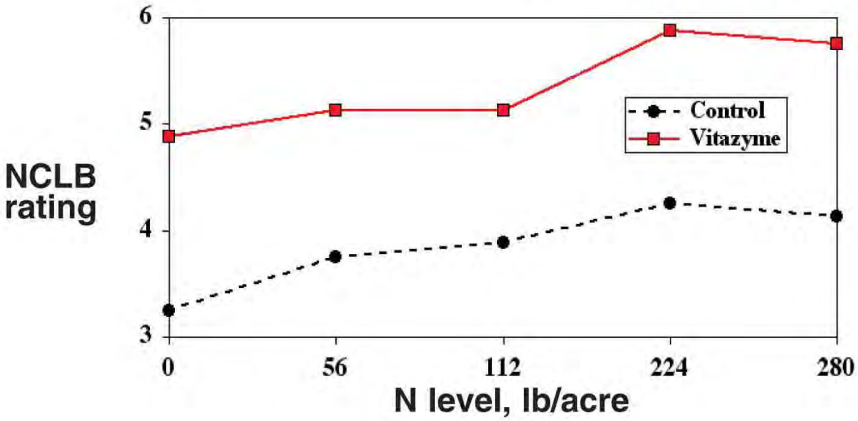
Corn Grain Yield

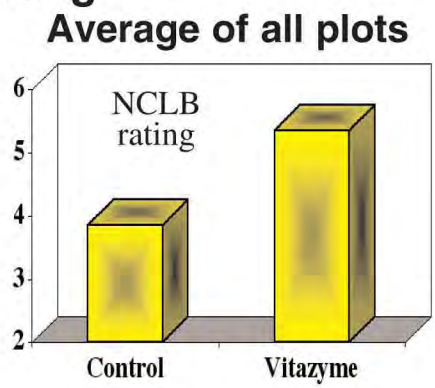




Vitazyme caused a substantial increase in yield over the untreated control at all N levels except at 112 lb/acre N; most of these yield differences were significant. The average yield difference was 18.7 bu/acre in favor of Vitazyme, a significant increase over the control of 15%.

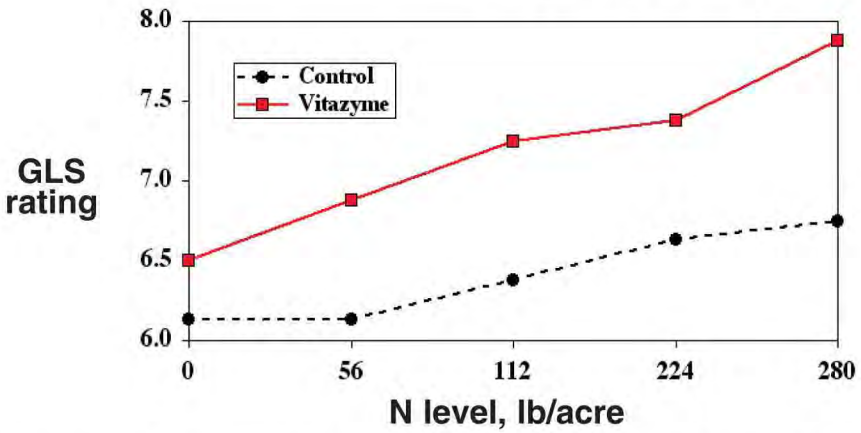
Northern Corn Leaf Blight Rating

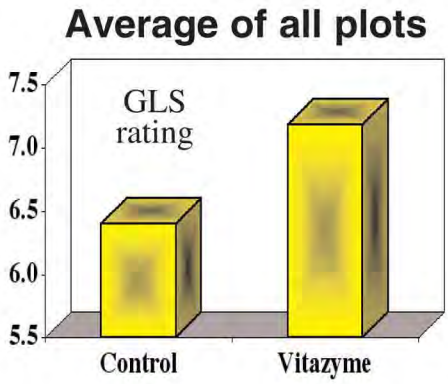




At all N levels the Vitazyme treatment produced significantly reduced NCLB infection than did the control. This led to an average 39% reduction in NCLB lesions over all treatments.

Grey Leaf Spot Rating





As for Northern Corn Leaf Blight ratings, Grey Leaf Spot ratings were significantly better for Vitazyme at all N levels than for the control. This differences led to a significant average difference of 12% over all plots for each treatment.

Conclusions: This corn study in North Carolina revealed that Vitazyme increased grain yield significantly, by an average of 18.7 bu/acre (+15%) over all plots ... and especially at the 0 N level, where yield was improved by 44.5 bu/acre (+82%) above the control. Both Northern Corn leaf Blight and Grey Leaf Spot were also significantly reduced by Vitazyme at all N levels, the average reduction being 39% for NCLB and 12% for GLS. These data show that Vitazyme apparently improves plant immunity to common corn pathogens, and concurrently boosts the yield potential of the crop, especially when N is limiting. The optimum N application in this study was 112 lb/acre; corn yields increased only slightly with Vitazyme with higher N rates, although without Vitazyme the yields fell somewhat.

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2003 Crop Results

Vitazyme on Corn *(Surfactant vs. None)*

Researcher: Paul W. Syltie, Ph.D.
Location: Vital Earth Resources Research Greenhouse, Gladewater, Texas
Variety: yellow dent *Soil type*: Bowie very fine sandy loam
Pot size: 1 gallon *Planting date*: December 30, 2002
Experimental design: A greenhouse study was established to discover the relative effectiveness of a foliar application on corn using either diluted product in the leaf whorl or diluted product in the whorl and on leaf surfaces using a surfactant. Five replicates were used for each treatment in a complete block design. Temperatures were maintained at 55° to 80°F during the study, with no artificial light.

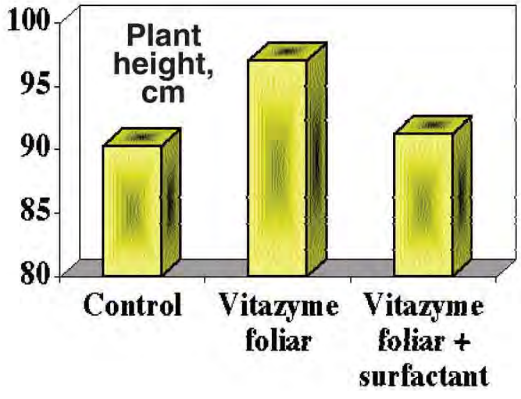
1. **Control**
2. **Vitazyme in the whorl, no surfactant**
3. **Vitazyme on the leaves, plus a surfactant**

Fertilization: All plants received 0.88 g/pot at planting of a 13-13-13% N-P_2O_5-K_2O pelleted fertilizer with 0.65% Mg, 6.0% S, 0.02% B, 0.0006% Co, 0.0006% Cu, 1.40% Fe, 0.06% Mn, 0.0006% Mo, and 0.06 % Zn. This fertilizer, giving 50 lb/acre of N, was applied to the soil surface.
Vitazyme application: On January 24, 2003, Vitazyme at 1% was sprayed from a small spray bottle into the leaf whorl of all plants in Treatment 2, being careful not to apply to the soil surface. Paper towels were used to prevent any spray from contacting the soil of the pots. Vitazyme was also sprayed the same day on the leaves and whorl of Treatment 3, with a 1% Vitazyme solution plus 5 tablespoons/gallon of Sunspray Ultra-Fine Oil, a fine agricultural oil containing 98.8% paraffinic oil.
Harvest date: February 14, 2003, 47 days after planting
Harvest results: The corn plants were washed free of soil, the leaves were measured, and then all plants were dried at about 115°F for two days. They were then weighed to the nearest 0.01 gram.

Plant Height

Treatment	Plant height*	Height change
	cm	cm
1. Control	90.3 b	—
2. Vitazyme on leaves, no surfactant	97.0 a	6.7 (+7%)
3. Vitazyme on leaves, with a surfactant	91.2 b	0.9 (+1%)

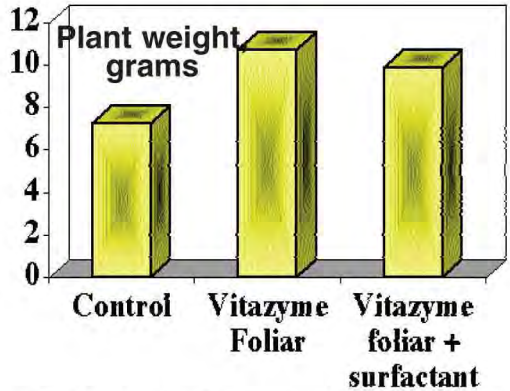
*Means followed by the same letter are not significantly different at P=0.10 according to the Tukey-Kramer Test. $LSD_{0.1}$=5.0 cm.



Plant Dry Weight

Treatment	Dry weight*	Weight change
	grams	grams
1. Control	7.25 b	—
2. Vitazyme on leaves, no surfactant	10.71 a	3.46 (+48%)
3. Vitazyme on leaves, with a surfactant	9.88 a	2.63 (+36%)

*Means followed by the same letter are not significantly different at P=0.10 according to the Tukey-Kramer Test. $LSD_{0.1}$=1.58 grams.



Conclusions: **This experiment showed that corn responded almost equally well with Vitazyme applied to the leaves only, with or without a surfactant, in terms of dry weight gain during the growth period.** Vitazyme in the leaf whorl only caused a highly significantly 48% weight gain versus the control, while the surfactant plus Vitazyme increased dry weight by 36%. Both treatments received the product in the leaf whorl, but Treatment 3 — with the surfactant — also had product clinging to other leaf surfaces. Both Treatments 2 and 3 had no Vitazyme applied to the soil surface.

Plant height was significantly increased by Vitazyme applied to the leaves without a surfactant, but the failure of Treatment 3 (with the surfactant) to increase significantly in height did not prevent the plants of Treatment 3 from increasing dry matter accumulation nearly as much as Treatment 2.

It is concluded from this study that, **as long as sufficient active agents are present on the plant — such as in the leaf whorl for corn — the plant will react properly to the biostimulants.** Additional amounts of product clinging to leaf surfaces as produced by a surfactant may be important in encouraging plant growth if enough droplets cling to leaf surfaces during application. However, droplets falling to the soil surface will normally contribute to product activity through root stimulation by active agents, so there may be only certain instances in which the use of a surfactant with Vitazyme may be advantageous.

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2003 Crop Results

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

Researcher: Paul W. Syltie, Ph.D.
Location: Vital Earth Resources Research Greenhouse, Gladewater, Texas
Variety: yellow dent *Planting rate*: 10 seeds/pot thinned to 3 plants/pot
Soil type: Bowie very fine sandy loam *Planting date*: December 30, 2002 *Pot size*: 1 gallon

Experimental design: A greenhouse study was established to discover the relative effect of soil versus foliar application of Vitazyme on corn growth. Seven replicates were set up 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**

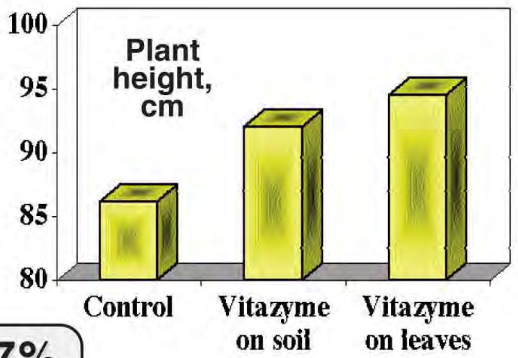
Fertilization: All plants were given 0.88 g/pot at planting of a 13-13-13% N-P_2O_5-K_2O pelleted, slow release fertilizer with 0.65% Mg, 6.0% S, 0.02% B, 0.0006% Co, 0.0006% Cu, 1.40% Fe, 0.06% Mn, 0.0006% Mo, and 0.06 % Zn. This fertilizer gave an effective rate of 50 lb/acre of N, applied to the soil surface.

Vitazyme application: Vitazyme was applied to the soil surface only of Treatment 2 on January 24 about at the six-leaf stage. It was also applied (a spray of a 1% solution) to the leaf whorl of the plants of Treatment 3 on January 24; care was taken to avoid applying any product to the soil surface.

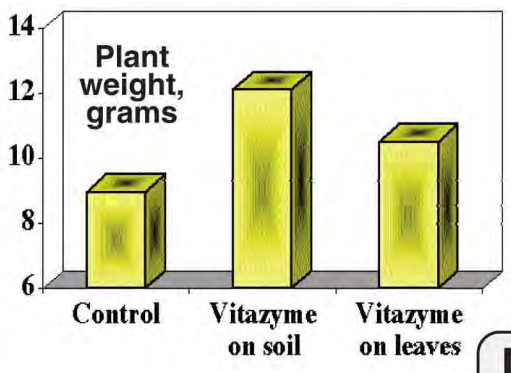
Plant Height

Treatment	Plant height*	Height change
	cm	cm
1. Control	86.2 a	—
2. Vitazyme on soil	92.0 a	5.8 (+7%)
3. Vitazyme on leaves	94.5 a	8.3 (+10%)

*Means followed by the same letter are not significantly different at P=0.10 according to the Tukey-Kramer Test. $LSD_{0.1}$=9.7 cm.



Plant height increase (soil applied): 7%



Plant Dry Weight

Treatment	Dry weight*	Weight change
	grams	grams
1. Control	8.96 b	—
2. Vitazyme on soil	12.11 a	3.15 (+ 35%)
3. Vitazyme on leaves	10.51 ab	1.55 (+17%)

*Means followed by the same letter are not significantly different at P=0.1 according to the Tukey-Kramer Test. $LSD_{0.1}$=1.89 grams.

Dry weight increase (soil applied): 35%

Harvest date: February 13, 2003, 46 days after planting

Harvest results: The corn plants were washed free of soil, the leaves were measured, and then all plants were dried at about 115°F for two days, and weighed to the nearest 0.01 gram.

Conclusions: Vitazyme applied to the soil of corn in this greenhouse study produced a nonsignificant increase in plant height of 7%. Applied to the leaves, the height was increased nonsignificantly by 10%. However, Vitazyme applied to either the soil or leaves increased dry weight accumulations of the corn plants. The soil application increased growth significantly (at P=0.10) by 35%, and almost significantly with a foliar application (17%). It is possible that too few active agents were applied by the foliar applications for a maximum growth response, since only enough product could be applied to fill the leaf whorl; the product would not stick to the slick corn leaves. **It is concluded that both soil and foliar applications of Vitazyme are highly effective in increasing the growth rate of corn.**

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2003 Crop Results

Vitazyme on Corn

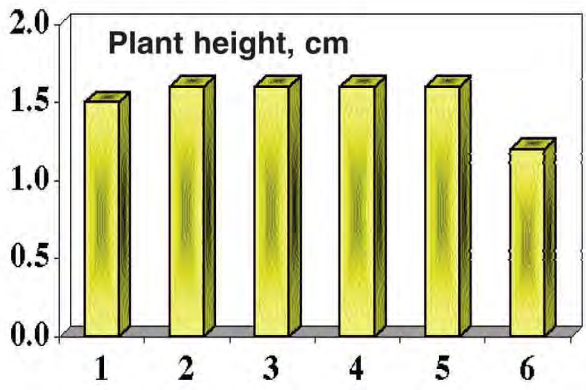
Researcher: unknown *Research organization*: Department of Agriculture, Ondo State, Nigeria
Location: Iju/itaogbolu, Akure North Local Government Area, Ondo State, Nigeria
Soil type: unknown *Planting date*: late season of 2000 *Variety*: unknown
Experimental design: A small plot replicated (3 reps), randomized complete block design was set up to evaluate the effects of Vitazyme on a number of growth parameters. Three levels of fertility were used and two applications of Vitazyme, with the following treatments:

Treatment	NPK Fertilizer	Vitazyme
1	0	yes
2	100 kg/ha	yes
3	200 kg/ha	yes
4	100 kg/ha	no
5	200 kg/ha	no
6	0	no

Fertility treatments: Treatments 2 and 4 received 100 kg/ha of an unknown fertilizer formulation two weeks after planting; Treatments 3 and 5 received 200 kg/ha of this same fertilizer also two weeks after planting.
Vitazyme treatments: Treatments 1, 2, and 3 received a 5% Vitazyme spray on the corn seeds before planting, and the newly emerged plants and soil received 1 liter/ha (13 oz/acre) two weeks after planting.
Harvest date: unknown
Growth and yield results: At harvest time several growth parameters were measured, and the data were statistically analyzed to determine significant differences at P=0.05.

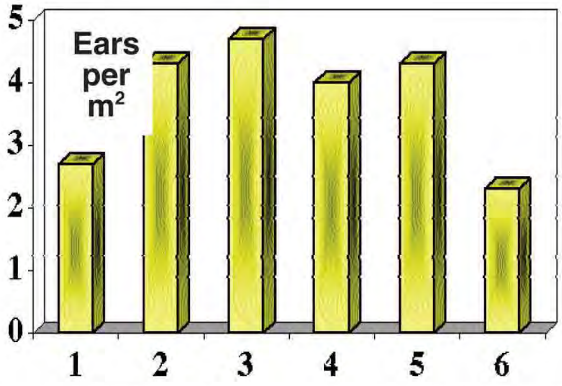
Plant Height

Treatment	Plant height	Change
	m	m
1. (Vitazyme only)	1.5	0.3 (+25%)
2. (100 NPK + Vit.)	1.6	0.4 (+33%)
3. (200 NPK + Vit.)	1.6	0.4 (+33%)
4. (100 NPK)	1.6	0.4 (+33%)
5. (200 NPK)	1.6	0.4 (+33%)
6. (Control)	1.2	—
$LSD_{0.05}$	0.1	



All of the fertilizer and Vitazyme treatments significantly (P=0.05) increased plant height, Vitazyme alone increasing height by 25% and all other treatments increasing it by 33%.

Ears per Square Meter

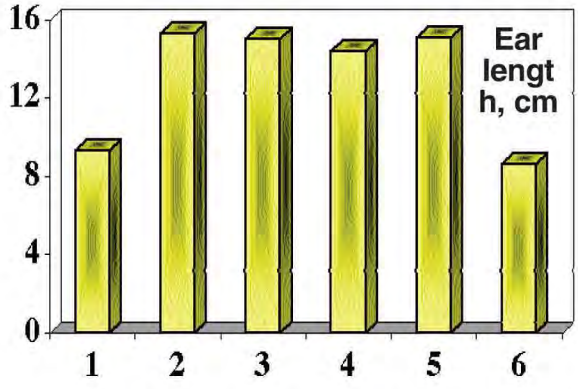


Treatment	Ears	Change
	number/m²	number/m²
1. (Vitazyme only)	2.7	0.4 (+17%)
2. (100 NPK + Vit.)	4.3	2.0 (+87%)
3. (200 NPK + Vit.)	4.7	2.4 (+104%)
4. (100 NPK)	4.0	1.7 (+74%)
5. (200 NPK)	4.3	2.0 (+87%)
6. (Control)	2.3	—
$LSD_{0.05}$	1.3	

Vitazyme alone increased ears/m² by 17%, but not significantly. However, all other Vitazyme + fertilizer treatments and all fertilizer treatments significantly increased ears/m². The Vitazyme + 200 kg/ha NPK increased ears the most, and the Vitazyme + 100 kg/ha NPK increased ears as much as did 200 kg/ha NPK, showing the ability of Vitazyme to increase the efficiency of fertilizer use.

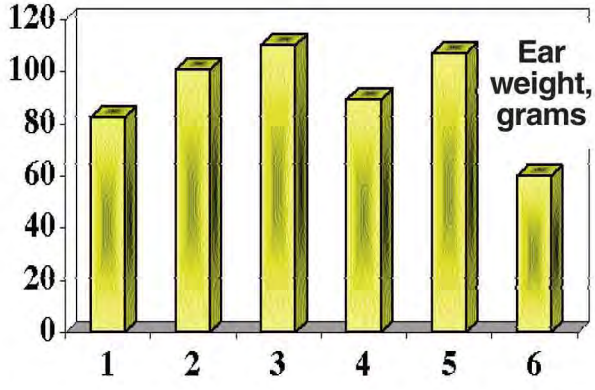
Ear Length

Treatment	Ear length	Change
	cm	cm
1. (Vitazyme only)	9.3	0.7 (+8%)
2. (100 NPK + Vit.)	15.3	6.7 (+78%)
3. (200 NPK + Vit.)	15.0	6.4 (+74%)
4. (100 NPK)	14.4	5.8 (+67%)
5. (200 NPK)	15.1	6.5 (+76%)
6. (Control)	8.6	—
$LSD_{0.05}$	1.0	



All but the Vitazyme only treatment significantly increased ear length. The Vitazyme and 100 kg/ha NPK increased ear length the most (78%), followed closely by the Vitazyme + 200 kg/ha NPK and 200 kg/ha NPK treatments.

Ear Weight



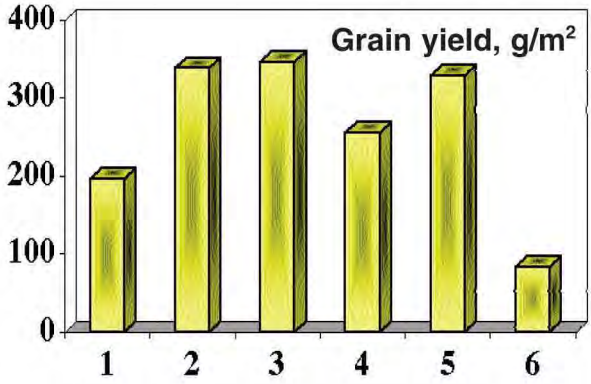
Treatment	Ear weight	Change
	g	g
1. (Vitazyme only)	82.3	22.3 (+37%)
2. (100 NPK + Vit.)	100.7	40.7 (+68%)
3. (200 NPK + Vit.)	110.0	50.0 (+83%)
4. (100 NPK)	89.3	29.3 (+49%)
5. (200 NPK)	107.0	47.0 (+78%)
6. (Control)	60.0	—
$LSD_{0.05}$	11.3	

Ear weight was greatly affected by both Vitazyme alone (+37%) and by fertilizer alone (up to 78% with 200 kg/ha NPK), but most by Vitazyme + fertilizer (+68% for Vitazyme + 100 kg/ha NPK, and + 83% for Vitazyme + 200 kg/ha NPK). As with ears/m² Vitazyme is shown to increase the efficiency of fertilizer use at both the 100 and 200 kg/ha NPK rates, but especially at the 100 kg/ha NPK fertilizer rate.

Grain Yield

Treatment	Grain yield	Change*
	g/m²	g/m²
1. (Vitazyme only)	196.2	113.2 (+136%)
2. (100 NPK + Vit.)	338.3	255.3 (+308%)
3. (200 NPK + Vit.)	345.3	262.3 (+316%)
4. (100 NPK)	255.0	172.0 (+207%)
5. (200 NPK)	328.3	245.3 (+296%)
6. (Control)	83.0	—
$LSD_{0.05}$	110.3	

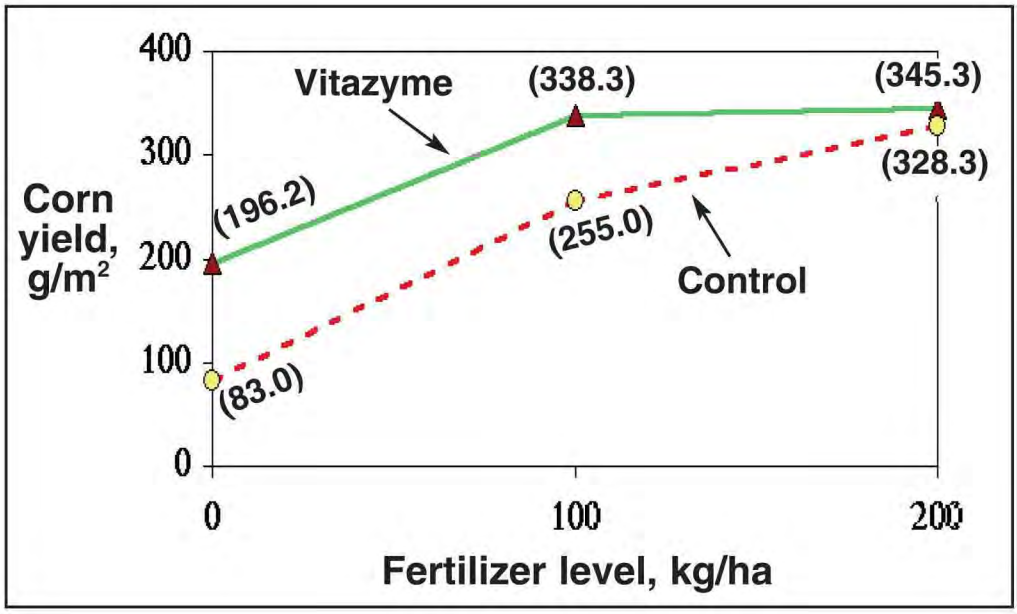
*All comparisons are made with the untreated control (6).



Increase in yield with Vitazyme only: 136%
Increase in yield with Vitazyme + 100 kg/ha NPK: 33%
Increase in yield with Vitazyme + 200 kg/ha NPK: 5%

All treatments significantly increased grain yield above the control. Vitazyme produced a 126% yield improvement, while the highest yield was generated by Vitazyme + 200 kg/ka NPK (+316%). This was 17.0 grams/m² higher than the 200 kg/ha NPK value. The difference was even greater for the 100 kg/ha NPK rate, where Vitazyme plus the fertilizer increased yield by 308%, but without Vitazyme the yield increased 207%. These data show a marked improvement of fertilizer efficiency with Vitazyme at the lower NPK rate, and also an improvement at the high NPK rate. These effects over the three rates are diagrammed below.

Note that the increase in grain yield above the untreated level is greatest at the lower fertilizer levels, with no fertilizer or with the 100 kg/ha NPK rate. The increase was not as dramatic at the highest NPK rate. These responses are similar to those noted in many other trials, and reflect the fact that microorganisms in the rhizosphere are stimulated to produce more available nutrients when soil nutrient levels are less than optimal. As fertility and environmental factors approach the optimum, the response from Vitazyme decreases somewhat.



Conclusions: In this replicated Nigerian corn study Vitazyme has been shown to increase plant growth and yield parameters (grain, ear number, ear length, and ear weight) significantly above the control. Vitazyme also increased yield parameters significantly, especially at the lower fertilizer levels (0 and 100 kg/ha NPK), where the Vitazyme +100 kg/ha NPK yield exceeded the 200 kg/ha NPK yield by 10.0 g/m². At 100 kg/ha NPK, Vitazyme significantly boosted yield by 83.3 g/m² above the same fertility level without Vitazyme.

In this highly weathered tropical soil of Ondo State of Nigeria, Vitazyme is seen as a powerful motivator of higher yield potential for corn.

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2003 Crop Results

Vitazyme on Corn – *testimonial*

Farmer/Researcher: David Schemm
Location: Arrow S Farms, Sharon Springs, Kansas
Variety: NC+ 5021RB *Planting rate*: 26,000 seeds/acre *Soil type*: Keith sandy clay loam
Previous crop: sunflowers *Planting date*: May 3, 2003 *Tillage system*: no-till
Experimental design: A center pivot covering 120 acres was treated with Vitazyme over the entire area.
Fertilization: 180 lb/acre N, 35 lb/acre P_2O_5
Vitazyme and herbicide applications: (1) 13 oz/acre on May 7, with 0.5 lb/acre Atrazine 90df, 1.5 qt/acre Harness Extra, and 24 oz/acre Roundup herbicides; (2) 13 oz/acre on June 4, with 24 oz/acre Roundup herbicide when the corn was 10 inches tall
Irrigation: 16 inches total during the growing season
Weather: 8.5 inches during the growing period, with an 8-inch moisture deficit in 2002 and another 4.5 inch deficit to October of 2003; record heat throughout the summer, including several weeks of 100°F+ temperatures and 25 mph+ winds
Harvest date: October 10, 2003
Yield results: Harvested grain at 16.7% H_2O: 27,500 bushels

Yield per acre for 120 acres: 229.2 bu/acre

Conclusions: The corn received significant hail damage on June 10 when the leaves were stripped. In spite of severe heat and wind as well, the corn did exceptionally well with Vitazyme, exceeding in yield any other fields in the area. Most yields were 140 to 200 bu/acre, with a few in the 220 to 225 bu/acre range.

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2002 Crop Results

Vitazyme and Awaken on Corn

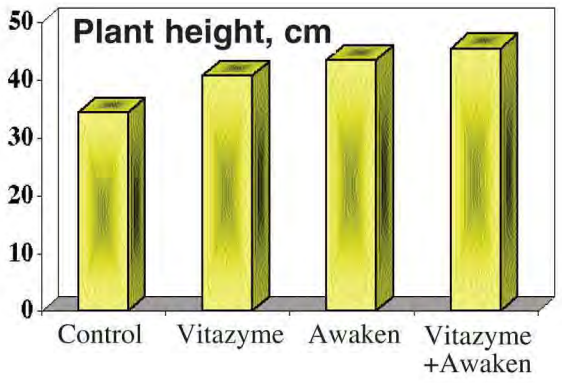
Researcher: Paul W. Syltie, Ph.D.
Location: Vital Earth Resources Research Greenhouse, Gladewater, Texas
Variety: yellow dent *Soil type*: Bowie very fine sandy loam
Planting date: November 21, 2001 *Pot type*: 1 gallon *Population*: 7 seeds/pot, thinned to 3/pot
Experimental design: A complete block design was set up using eight replicates for each of four treatments. The soil was carefully packed into each pot, watered evenly, and then treated with the materials. Plants were watered on demand, and grown in the greenhouse at about 70°F for a high and 55°F for a low temperature.

1. **Control**
2. **Vitazyme only**
3. **Awaken only**
4. **Vitazyme + Awaken**

Vitazyme application: After planting on November 21, 100 ml of a 0.01% Vitazyme solution was applied to the soil surface of each pot for Treatment 2. This rate is higher than recommended, but used so as to obtain a 50-50 mixture of the two products.
Awaken application: Awaken was applied to the soil surface of the pots of Treatment 3 as 100 ml of 0.01% solution; this is equivalent to 71 oz/acre, the recommended rate for this experiment. The Awaken for Treatment 4 was mixed at the same percentage with 0.01% Vitazyme, which was also applied at 100 ml/pot.
Product specifications: **Vitazyme:** a liquid fermentation product of various plant materials, organisms, simple and complex carbohydrates, and other materials to yield a multiple mode of action - multiple active agent metabolic stimulator containing natural growth regulators (triacontanol, etc.), vitamins (B-complex, etc.), enzymes, and other phytoactive substances that are biologically active at very low application rates. Producer: Vital Earth Resources, Gladewater, Texas.
Awaken: a macro/micronutrient solution for plant growth stimulation having 16% N, 2% K_2O, 0.02% B, 0.15% Cu (chelated), 0.15% Fe (chelated), 0.15% Mn (chelated), 0.0006% Mo, and 2.7% Zn of which 0.15% is chelated. Awaken also contains as a major component the material called ACA (Agricultural Crop Additive). ACA's active component is zinc ammonium phosphate, the mechanism of action of which has not been fully characterized. Producer: United AgriProducts (UAP).
Harvest date: January 8, 2002, 48 days after planting.
Height results: On January 8, all of the plant roots were washed clean of soil, and the plants were measured for height. The plants were then dried in a drying oven at 115°F for 48 hours.

Treatment	Plant height*	Change vs. the control
	---------- cm ----------	
4. Vitazyme + Awaken	45.4 a	+11.1 (+32%)
3. Awaken	43.4 ab	+9.1 (+27%)
2. Vitazyme	40.7 b	+6.4 (+19%)
1. Control	34.3 c	—

* Means followed by the same letter are not significantly different at P=0.10, according to the Tukey-Kramer Test. $LSD_{0.10}$=2.0 cm.

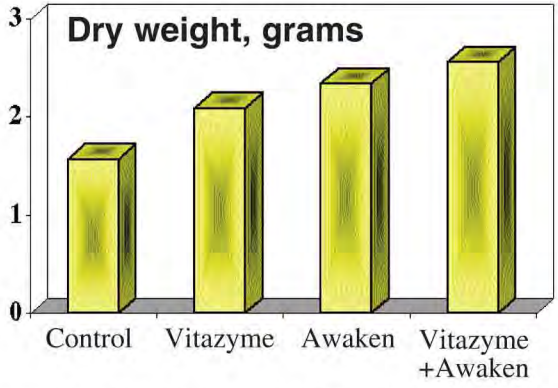


There were some differences in plant height among the four treatments. The control treatment was significantly shorter than the other three treatments, and the Vitazyme treatment was significantly shorter than the combined Vitazyme-Awaken treatment.

Dry weight results: These results showed highly significant differences among treatment means.

Treatment	Dry weight*	Change vs. the control
	grams	
4. Vitazyme + Awaken	2.56 a	+1.20 (+30%)
3. Awaken	2.34 ab	+0.93 (+23%)
2. Vitazyme	2.09 b	+0.46 (+11%)
1. Control	1.57 c	—

* Means followed by the same letter are not significantly different at P=0.10, according to the Tukey-Kramer Test. LSD_{010}=0.27 g.



The dry weight of corn plants treated with Vitazyme plus Awaken was significantly greater than Vitazyme alone or the control, and also exceeded the Awaken treatment by 7%. There appears to be a synergism between Vitazyme and Awaken in this greenhouse study.

Conclusions: It appears that Vitazyme enhances the activity of Awaken for corn in terms of both plant height and dry tissue weight. Awaken, with its nutrients, stimulated corn growth somewhat more than did Vitazyme in this study, though not significantly. **Vitazyme and Awaken together appear to work well together, displaying a noticeable synergism.**

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2001 Crop Results

Vitazyme on Corn and Soybeans

A Testimonial

Farmer: Tom Jones *Location*: Delavan, Minnesota

Soil type: Clarion-Nicollet-Webster series

Experimental design: Several split-field experiments were set up on the Jones farm for both corn and soybeans, with variably sized treated and control areas.

Weather: Weather conditions during the year were very unfavorable for high yields, starting out very wet to delay planting, and then turning very dry for much of the summer. Yields throughout the region were down this year.

Vitazyme application: 13 oz/acre on the seeds at planting for both corn and soybeans

Data collection: Because of considerable variability in field conditions due to the wet spring and dry summer, the farmer decided not to collect yield data but closely observed effects during the season and at harvest, and during post-harvest tillage.

Chlorophyll content: Both the corn and soybeans showed more leaf chlorophyll on July 30, as detected by a Minolta SPAD chlorophyll meter. For example, one soybean trial showed the following results:

Treatment	Leaf chlorophyll*	Change
	SPAD units	
Control	35.8	—
Vitazyme	38.0	+2.2

* Twenty leaves per treatment were examined

Other crop responses noted on July 30, 2001:

Corn: taller plants, larger stalks, darker green color (more chlorophyll), larger roots with more hair roots

Soybeans: larger plants, more leaves, thicker stems, darker green color (more chlorophyll) larger roots

Observations by Tom Jones:

"Where I used Vitazyme on my beans they had more fine root hairs, and they were a little bushier in appearance. Because of the poor growing season and erratic field conditions, I didn't get a yield check. However, they were some of my best beans.

The corn that had Vitazyme on also had a lot more fine root hairs. I couldn't believe the difference when I disced my stalks. I could see all these bushy looking root balls, unlike in the untreated fields. Again, no yield check was taken, but I know I could see a difference in the combine hopper. I plan to use more Vitazyme next year – perhaps on all my acres."

Thanks,

Tom Jones
Faribault County
Southern Minnesota

Effects of Solution pH During Storage On Vitazyme Efficacy With Corn (*Zea Mays L.*)

By Paul W. Syltie, Ph.D., Soil Fertility
Director of Research, Vital Earth Resources
706 East Broadway Avenue, Gladewater, Texas 75647, U.S.A.
June, 2001

Introduction

Vitazyme is a naturally fermented biostimulant that contains a multiple array of active agents — vitamins, enzymes, growth regulators, and other substances — which trigger various growth responses in plants. Typical effects include enhanced root growth, greater leaf chlorophyll, increased carbon fixation, and concomitant increases in overall growth, life-cycle stimulation, root exudation, rhizosphere microbial growth, and crop yields.

Little information is available regarding the effects of the pH of the solution during storage on the resultant effectiveness of Vitazyme's active agents for plant growth. Therefore, this study, using corn as the test crop, was initiated to answer the questions of efficacy with pH over time.

Materials and Methods

Two Vitazyme concentrations were used in this study —1% and 100% — to simulate conditions during use in the field when mixed either undiluted or diluted with agricultural chemicals. These solutions were placed in beakers which were sealed with Parafilm to prevent evaporation. For each concentration, the pH of the solution was adjusted to pH 7.0, 8.0, 9.0, or 10.0. These dilutions, prepared on April 4, 2001, are summarized in Table 1. The pH of each solution was determined again on May 7, 2001, 34 days after initial preparation.

Table 1. Dilutions of Vitazyme at various pH levels for a corn efficacy study.

Solution pH*	Parts of Vitazyme :	Parts of Water (distilled)
	100% solution	1% solution
7.0	100:0	1:99
8.0	100:0	1:99
9.0	100:0	1:99
10.0	100:0	1:99

* Solution pH was adjusted using a NaOH solution having a pH of 12.90

On May 8, 2001, the corn study was initiated in the Vital Earth Resources research greenhouse. One gallon pots were filled with Bowie fine sandy loam and placed in a complete block arrangement (eight replications), with five treatments for each concentration. See Table 2 for a summary of these treatments.

Table 2. Treatments for corn in a Vitazyme study using two concentrations of product stored at various pH's.

Treatment	Vitazyme, 100%	Vitazyme, 1%
1. Control (no Vitazyme)	none	none
2. pH 7.0	x	x
3. pH 8.0	x	x
4. pH 9.0	x	x
5. pH 10.0	x	x

Seven corn seeds (yellow dent, treated with Captan fungicide) were planted in each pot at a depth of 0.75 inch, and each pot received 100 ml of solution carefully distributed to the soil surface of the pots. The 100% Vitazyme pots received 100 ml of a 0.1% (1 ml/liter) solution of actual Vitazyme, while the 1% Vitazyme pots received 100 ml of a 0.05% (50 ml/liter) solution of actual Vitazyme. The 1% solution was applied half as concentrated as the 100% solution because there was not enough prepared solution of the 1% concentration.

On May 5, 2001, the emerged corn plants were thinned to three aggressive plants per pot, and on May 30, 2001, 22 days after planting, the plants were harvested. All soil was washed from the roots, the height of each plant was measured, and the plants were dried in a drying oven at about 115° F for two days. Each set of three plants from each pot was weighed to the nearest 0.01 gram, and a statistical analysis (ANOVA) was run on each concentration (100% and 1%) using Cohort software.

Results and Discussion

Solution pH changes over 34 days

The pH of the stored solutions tended to move towards neutrality over the 34-day storage period. Interestingly, the 1% concentration moved more towards neutrality than did the 100% concentration (see Figure 1).

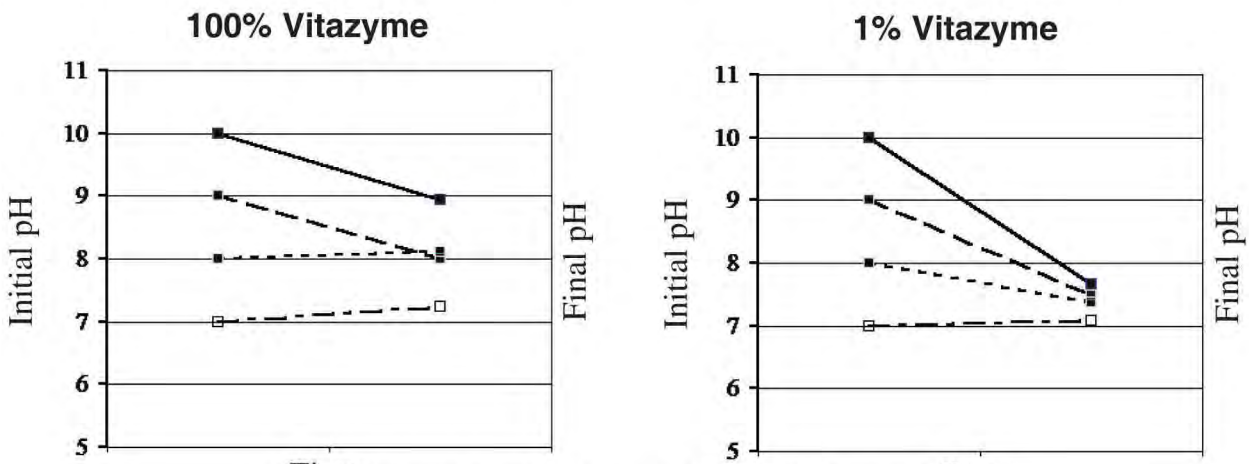


Figure 1. pH changes during 34 days of storage of Vitazyme solutions.

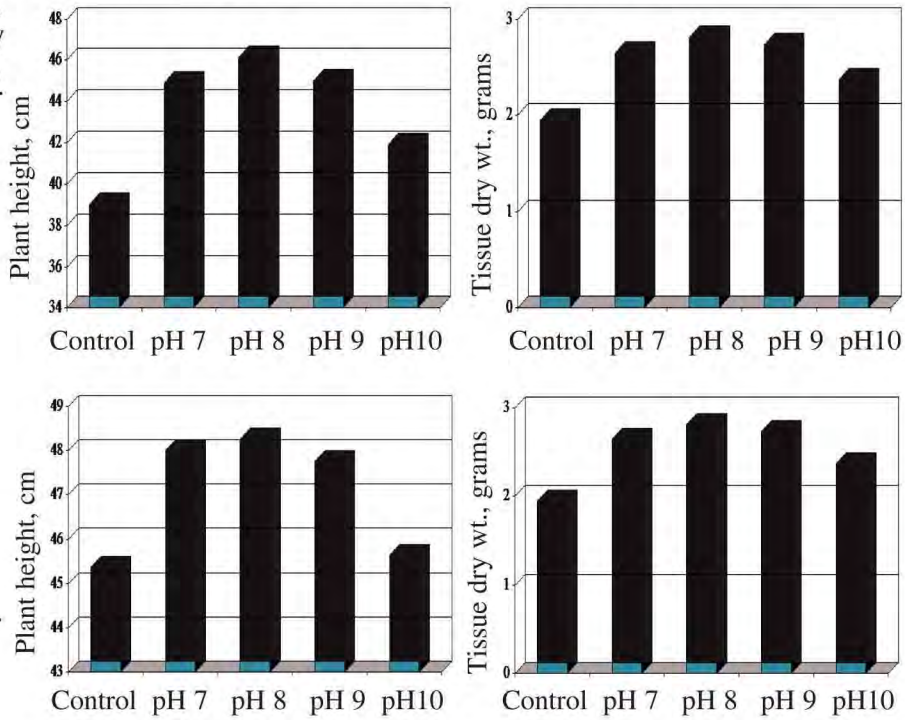
Vitazyme tended to move towards neutrality (pH 7.0) at both the 1% and 100% concentrations when stored at room temperature for 34 days. This was equally true for the dilute (1%) solution, where all four solution pH's ended up between pH 7.08 and 7.66 at the end of the storage period.

Corn Growth Effects

The average height and weight of the corn plants for the treatments are shown in Table 3.

Table 3. Corn heights and weights treated with different Vitazyme solutions stored at various pH's.

Treatment	Corn height (cm)	Tissue dry weight (g)
1% Vitazyme		
1. Control	39.00	1.95
2. pH 7.0	44.88	2.64
3. pH 8.0	46.13	2.81
4. pH 9.0	45.00	2.73
5. pH 10.0	41.88	2.37
100% Vitazyme		
1. Control	45.38	2.59
2. pH 7.0	48.00	2.79
3. pH 8.0	48.25	2.97
4. pH 9.0	47.75	2.71
5. pH 10.0	45.63	2.70



A statistical analysis of the data revealed the following, as shown in Table 4.

Table 4. A statistical analysis of a corn study, using Vitazyme stored at different pH's.

Treatment	Corn height (cm)	Tissue dry weight (g)
1% Vitazyme*		
3. pH 8.0	46.13 a (+18%)	2.81 a (+44%)
4. pH 9.0	45.00 a (+15%)	2.73 a (+40%)
2. pH 7.0	44.88 ab (+15%)	2.64 ab (+35%)
5. pH 10.0	41.88 bc (+7%)	2.37 b (+22%)
1. Control	39.00 c	1.95 c
CV	5.48%	10.70%
$LSD_{0.10}$	2.02	0.23
100% Vitazyme*		
3. pH 8.0	48.25 a (+6%)	2.97 a (+15%)
2. pH 7.0	48.00 a (+6%)	2.79 ab (+8%)
4. pH 9.0	47.75 a (+5%)	2.71 ab (+5%)
5. pH 10.0	45.63 a (+1%)	2.70 ab (+4%)
1. Control	45.38 a	2.59 b
CV	4.78%	9.51%
$LSD_{0.10}$	1.91	0.22

*Means followed by the same letter are not significantly different according to the Tukey-Kramer Test (P=0.10).

It is clear that Vitazyme in every case, at both the 1% and 100% concentrations, and at all pH's, provided height and dry weight increases in this corn study. Several of these increases were significant at P=0.01, especially when Vitazyme was stored at pH 8.0 for both the 1% and 100% concentrations. At 1%, the pH 8.0 solution provided a 44% dry weight increase for Vitazyme, and at 100% a 15% increase. Plant height increases were in all cases less than half of the dry weight increases, but followed the same order as with dry tissue weight.

Vitazyme stored at pH 7.0, 8.0, and 9.0 always provided good dry weight increases for corn, especially for the 1% solution. At pH 10.0, however, the increases were less — indicating some deactivation of active agents — though with the 1% solution the increase was still significant; for the 100% solution the increase was not significantly greater than with the untreated control.

Summary and Conclusions

Vitazyme at 1% dilution, when adjusted to pH 7.0, 8.0, or 9.0, and stored for 34 days at room temperature, always caused significant height and weight increases for corn in this study. Increases in dry weight were up to 44% above the control. At pH 10.0 the increases were smaller but, in the case of dry weight, still significantly greater than the control. At the 100% dilution the increase in dry weight with Vitazyme at pH 8.0 was significant, and all other pH's also produced increases.

This study reveals that Vitazyme significantly improved corn height and dry weight at any product pH when stored for 34 days, but especially at pH 8.0. Thus, the use of Vitazyme in fertilizer or pesticide solutions of pH 7.0 to 9.0 is recommended, and such use can boost product efficacy. Product effectiveness when stored at pH 10.0 appears to be somewhat diminished.

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2001 Crop Results

Vitazyme on Corn

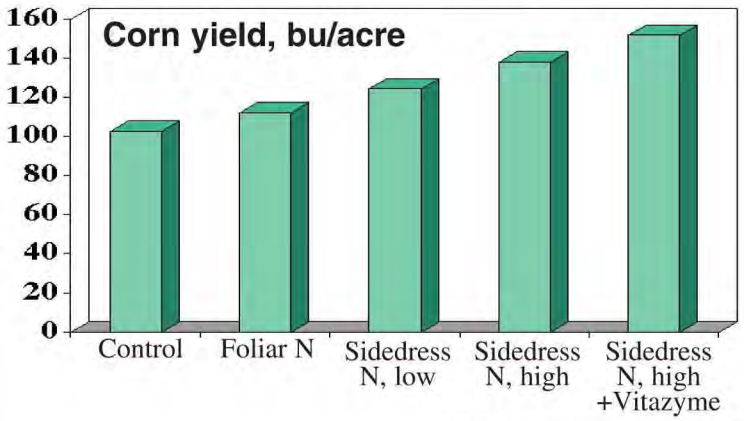
Researcher: Dennis Parrett, Cecilia Farm Service, Inc. *Location*: Cecelia, Kentucky
Farm cooperator: Richard Preston *Variety*: Novartis 6367 *Row spacing*: 30 in
Population: 26,600 seeds/acre *Planting date*: April 10, 2001 *Soil type*: unknown
Experimental design: A test field was divided into five portions, each with a treatment as shown below.

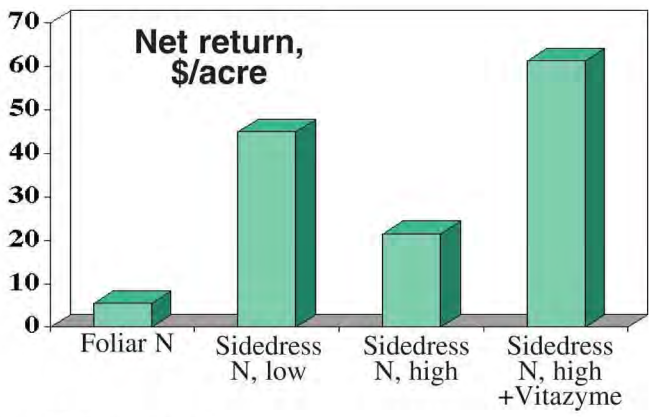
Treatment	Foliar N	Sidedress N	Vitazyme
1. Control	0	0	0
2. Foliar N	5 gal/acre of 28% N	0	0
3. Sidedress N, low	0	80 lb/acre of 28% N	0
4. Sidedress N, high	0	105 lb/acre of 28% N	0
5. Sidedress N, high + Vitazyme	0	105 lb/acre of 28% N	13 oz/acre

Fertilization : 50-60-60 lb/acre N-P_2O_5-K_2O preplant incorporated; sidedress fertilizer as shown above
Vitazyme treatments: 13 oz/acre along with the 28% nitrogen solution, applied June 9
Yield and income results: Harvest was on October 11, 2001.

Treatment	Grain yield	Increase over the control	Product cost*	Net return
	bu/acre	bu/acre	$/acre	$/acre
1. Control	102.6	—	0	—
2. Foliar N	112.3	9.7 (+9%)	15.88	5.46
3. Sidedress N, low	124.4	21.8 (+21%)	33.25	44.85
4. Sidedress N, high	138.1	35.5 (+35%)	26.52	21.48
5. Sidedress N, high + Vitazyme	151.9	49.3 (+48%)	37.25	61.27

* Product costs were determined by Cecilia Farm Service, including $4.00/acre for Vitazyme and $2.00/bu for corn.





True increase from Vitazyme

Yield: Treatment 5 vs. Treatment 4: 151.9 bu/acre – 138/bu/acre = **13.8 bu/acre**

Net income: Treatment 5 vs Treatment 4: $61.27/acre – $21.48/acre = **$39.79/acre**

Conclusions: In this corn study in Kentucky, Vitazyme proved to be highly beneficial to corn production in terms of yield increase and income increase. The 13.8 bu/acre increase in yield provided an extra $39.79/acre income, showing its high profitability in farming programs.

Return per dollar invested in Vitazyme: $9.95

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2001 Crop Results

Vitazyme on Sweet Corn

New York Crop Research Facility, Cornell University

Researchers: Arlie McFaul, Alan Erb, Lee Stivers, and Christy Hoepting
Location: near Batavia, New York *Variety*: Bonus *Row spacing*: 30 inches
Spacing-in-row: 9 inches *Planting date*: June 4, 2001

Experimental design: A small field experiment was designed in a randomized complete block fashion, with four replications. Individual plots were 6 rows wide and 20 feet long. Foliar treatments were made to the center two rows only for all eight treatments.

1. **Vitazyme**
2. **Harpin protein seed treatment**
3. **Messenger**
4. **ACA**
5. **Asset RS**
6. **Auxigrow**
7. **K–Mag**
8. **Control**

Fertilization: All areas received 250 lb/acre of a 15-15-15% N-P_2O_5-K_2O dry formulation banded along the seed row at planting. On July 10, 100 lb/acre of N was applied.

Vitazyme application: (1) 13 oz/acre sprayed over the soil after emergence on July 6, and (2) again before tasseling on July 30; other products were added according to supplier recommendations.

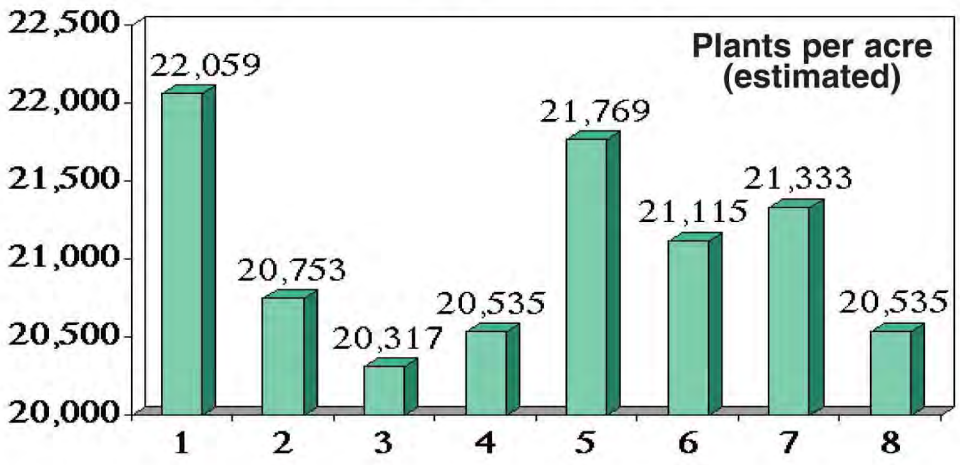
Herbicides: Atrazine (3 pints/acre) and Basagran (1.5 pints/acre) post-emergent on June 21

Harvest date: August 31, 2001

Weather: It was very hot and dry during the summer, with growth and yields curtailed due to the drought. Monthly totals: May, 3.84 in; June, 1.47 in; July, 1.02 in; August 2.21 in; September, 2.82 in.

Yield and harvest results: Total yield and cob characteristics were evaluated before or at harvest

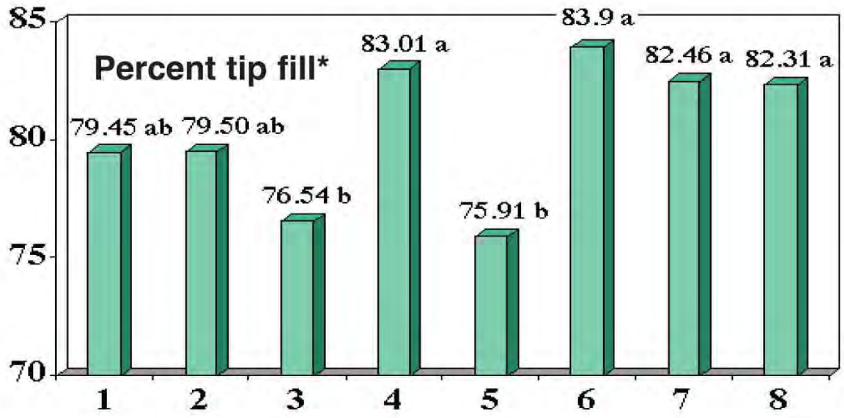
Plant population

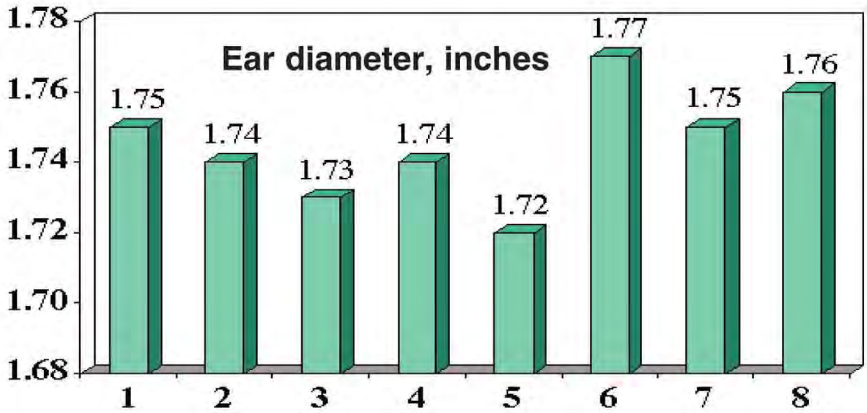


Percent Tip Fill

All values were not significantly different, but the population with Vitazyme was the highest, being 7% higher than the control.
Some significant differences in percent tip fill appeared, with Messenger and Asset RS being the lowest in value of all treatments. Vitazyme was statistically equal to the highest tip fill value.

*Means followed by the same letter are not significantly different according to Fisher's Protected LSD; $P_{0.05}$= 0.04.



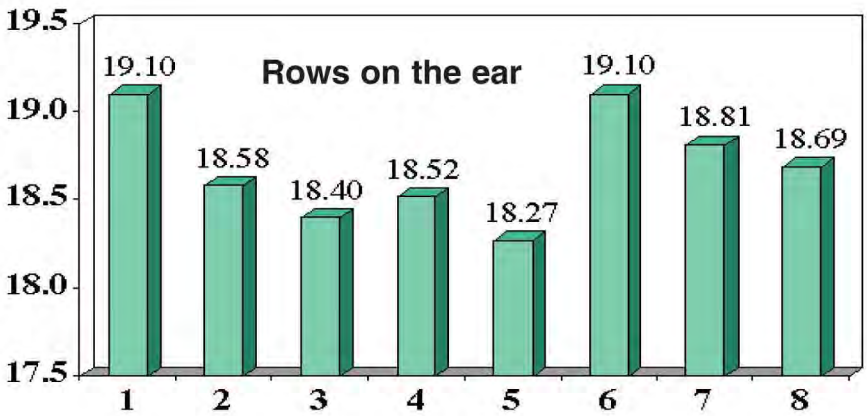


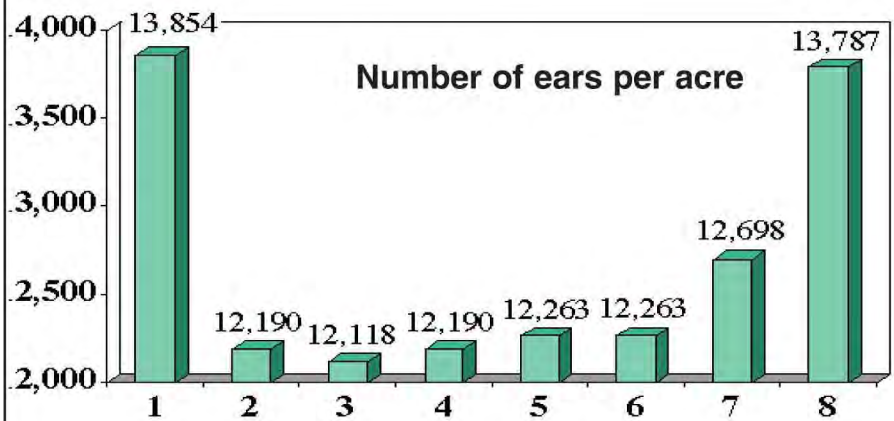
Ear Diameter

There was relatively little difference amongst the various treatments for ear diameter. None were significantly different.

Number of Rows

Vitazyme and K-Mag had the highest numbers of rows of kernels per ear, being 2% higher than the control. There were no significant differences amongst these values.



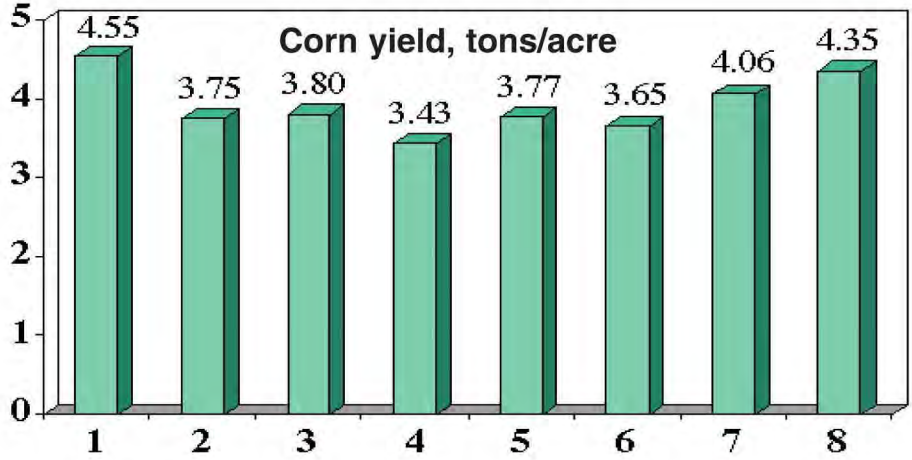


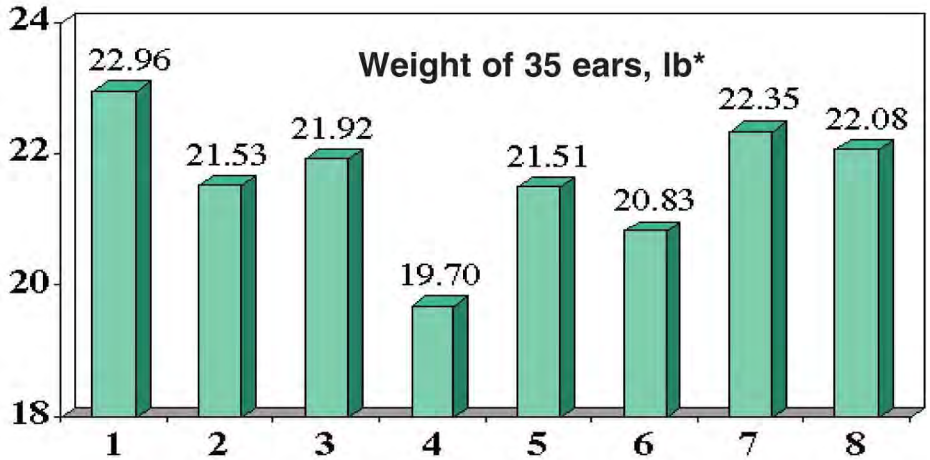
Ears per Acre

Vitazyme produced the greatest number of ears per acre, being slightly greater than the control but considerably greater than the other treatments by about 13%. This increase was a reflection of higher estimated plant population as noted earlier. No treatment means were significantly different.

Corn Yield

Vitazyme yielded the most corn of any treatment, exceeding the control by 5% but exceeding the lowest other treatment (ACA) by 33%. The difference was equivalent to $54.88/acre based on a $49/ton sweet corn price. None of these differences were significant, however.





Cob Weight, 35 Ears

* Growers are urged to grow large ears, so the weight of 35 ears should equal or exceed 25 lb; lower prices result from underweight ears. In 2001 the weights were low because of the severe drought. Nonetheless, the 25-ear weight for Vitazyme was the highest of all the treatments, exceeding the control by 4%. Vitazyme exceeded ACA ear weight by 17%.

Conclusions: Results with sweet corn in this study were greatly affected by a severe summer drought. In spite of this fact, **Vitazyme performed the best of all seven treatments used in this study, being highest in plant population, rows per ear, ears per acre, yields per acre, and total weight per 35 ears. Vitazyme treatment produced 33% more yield than the lowest yielding other treatment.** Though significance in the mean differences was lacking, the consistent trend of this study was for Vitazyme to provide excellent plant responses that would substantially benefit sweet corn growers.

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2000 Crop Results

Vitazyme on Corn

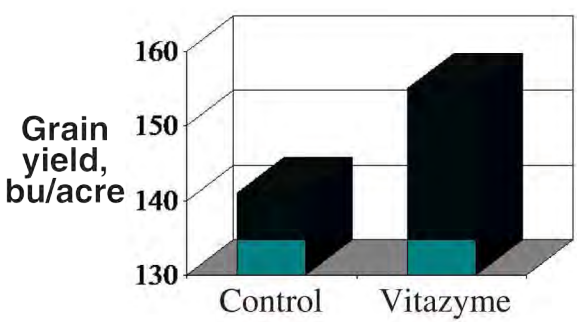
Grower: Jim Clise _Location_: Waterloo, New York _Variety_: Agway 501
Researcher: Jake Gephart, Agway, Inc. _Planting date_: May 31, 2000 _Seeding rate_: unknown
Row spacing: 30 inches
Experimental design: A 100-acre field was divided into halves (50 acres each), with half treated with Vitazyme and half left untreated.

1. Control **2. Vitazyme**

Fertilization: 380 lb/acre of a urea and potash mixture, broadcast before planting and incorporated; 250 lb/acre of 11-37-0% N-P_2O_5-K_2O as a starter
Weed control: Bicep and Prowl tank-mixed
Vitazyme application: 13 oz/acre with the herbicide, at 18-inches corn height
Harvest date: December 3, 2000
Yield results:

	Control	Vitazyme	Change
		bu/acre	
Corn yield	141	155	(+) 14 (+10%)

Yield increase: 10%



Income results:

	Control	Vitazyme	Change
		$/acre	
Income	246.75	271.25	(+) 24.50

Income increase: $24.50/acre

Conclusions: Only 13 oz/acre of Vitazyme, applied with the herbicide, resulted in a 10% grain yield increase and a $24.50/acre income increase. This increase resulted in a return on investment of about 5:1 for this low-value crop. In spite of a very wet and cool year, Vitazyme still produced a very good crop response.

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1999 Crop Results

Vitazyme on Corn

Farmer: Craig Rice, Rice Farms
Location: Geneseo, New York
Supervisor: Don Jones, Agway Inc.
Variety: unknown
Planting date: unknown
Harvest date: November 10, 1999

Experimental design: A large field was divided in two, with part treated with Vitazyme and part left untreated. Yields were determined by harvesting a 15- ft wide strip that was 254 to 768 feet long for each treatment.

1. Control **2. Vitazyme**

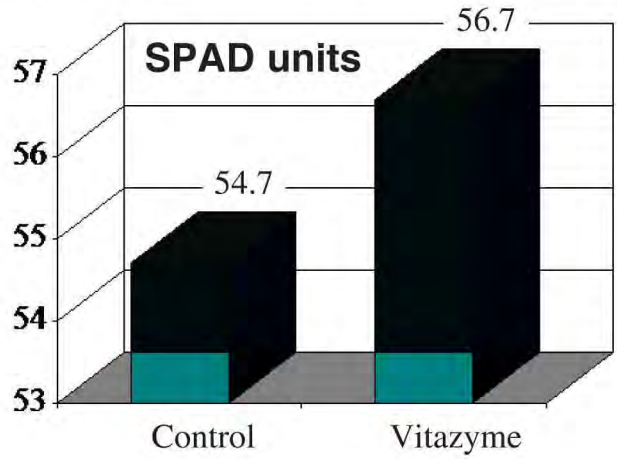
Fertility treatments: unknown

Vitazyme treatment: 13 oz/acre at planting

Chlorophyll determinations: On August 12 readings were taken of leaves from the corn treatments with a Minolta SPAD chlorophyll meter. Each value represents an average of 10 individual leaf determinations.

Treatment	SPAD units	Increase
Control	54.7	--
Vitazyme	56.7	2.0

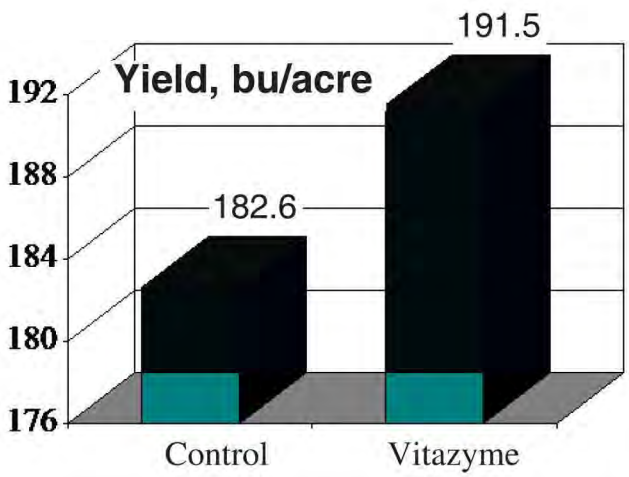
Chlorophyll increase: 2.0 SPAD units



Yield results:

Treatment	Yield	Plot area	Yield
	lb/plot	acre	bu/plot
Control	2,700	0.264	182.6
Vitazyme, area 1	2,865	0.259	197.5
Vitazyme, area 2	2,690	0.259	185.4
Vitazyme, average	---	---	191.5

Yield increase: 5%



Income increase: Estimated corn price = $2.50/bu.
8.9 bu/acre increase x $2.50/bu = $22.25/acre

Income increase: $22.50/acre

Comments: In spite of a very dry and hot summer, the Vitazyme treatment boosted the corn yield significantly (8.9 bu/acre). Leaf chlorophyll increases during the growing season would explain most of this increase, since this would promote greater root growth and exudation to feed a more vigorous rhizosphere organism population.

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1999 Crop Results

Vitazyme on Corn

Farmer: Bill Goodell *Location*: Shortsville, New York *Variety*: Pioneer 3573
Planting date: May 4, 1999 *Population*: 30,000 seeds/acre planted, 28,000 plants/acre final
Experimental design: A 5-acre field was split in half, one half receiving Vitazyme with 50% of the usual starter fertilizer at planting, and the other half receiving the regular starter rate but no Vitazyme.

1. **Control**: 100% starter
2. **Vitazyme** + 50% starter

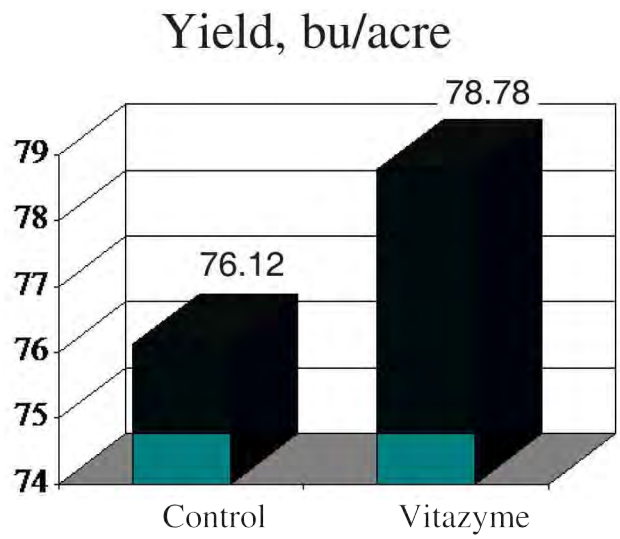
Fertility treatments: All areas of the field received a broadcast application of 100 lb/acre $(NH_4)_2SO_4$ (21%N) + Boron + Copper, 500 lb/acre EnviroSoil (composted sewage sludge mixed with high-calcium lime), 32 gal/acre 30% UAN, and 1 gal/acre liquid Ca-nitrate. At planting the control received 10 gal/acre of 3-18-18 ($3.25/gal = $32.50/acre), while the Vitazyme treated area received 5 gal/acre of 3-18-18 ($16.25/acre). Total N per acre for the broadcast fertilizer was 107 lb/acre, excluding the compost, for the control, and 106 lb/acre for the Vitazyme treatment.

Vitazyme treatment: 13 oz/acre mixed with the 3-18-18, on the seeds at planting

Weather conditions: very dry season-long

Yield results:

Treatment	Yield	Test weight
	bu/acre	lb/bu
Control	76.12	57.0
Vitazyme	78.78 (+3.5%)	57.5



Test weight increase: 0.5 lb/bu

Yield increase with 50% starter: 3.5 %

Income results: Corn is priced at $2.00/bu.

Treatment	Corn value	Fertilizer savings*	Total Increase
Control	$152.24/acre	---	---
Vitazyme	$157.56/acre	$12.35/acre	**$17.67/acre**

Comments: Yields were reduced by about 50%, due to very dry conditions throughout the summer. In spite of this, Vitazyme stimulated a yield increase with a reduced starter fertilizer input, illustrating its ability to activate rhizosphere nutrient uptake.

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1997 Crop Results

Vitazyme on Corn

Researcher: William (Bill) Goodell
Seeding date: May 14, 1997
Location: Shortsville, New York
Row width: 30 inches
Seeding rate: 30,000 seeds/acre
Variety: Pioneer 3752 (97 day)
Experimental design: A field of reasonable uniformity was divided into two parts: an untreated control part and a Vitazyme treated part.

1. **Control (no Vitazyme)**
2. **Vitazyme + 33% of fertilizer at planting**

Fertility treatments: The entire field received 10 tons/acre of manure, plus 26 gal/acre of 30% nitrogen and 4 gal/acre of ammonium thiosulfate. The control area received an additional 8 gal/acre of 9-18-9 plus 4 gal/acre of 0-0-30 at planting on the seed. The Vitazyme treatment received 2.7 gal/acre of 9-18-9 plus 1.3 gal/acre of 0-0-30 at planting, or 33% of the control treatment.
Vitazyme application: 12 oz/acre with the liquid fertilizer, on the seeds at planting
Soil: Ontario loam, 3 to 10% slope
Previous crop: wheat *Harvest date*: November 26, 1997
Yield results: Both treatments yielded about 22.7% grain moisture.

	Control	Vitazyme	Increase with Vitazyme
Corn yield	129.6 bu/acre	142.2 bu/acre	12.6 bu/acre

Yield Increase: 10%

Income results: The grain price has been calculated at about $3.00/bu. Natures 9-18-9 + 0-0-30, mixed at a 2:1 ratio retails for about $3.20/gal.

	Control	Vitazyme	Income Increase
Corn income	$386.12/acre	$423.64/acre	$37.80/acre
Fertilizer savings, less Vitazyme	—	$25.60/acre	$25.60/acre
Net income increase			$63.40/acre

Income Increase: $63.40/acre

Test weight results:

	Control	Vitazyme
Test weight	53 lb/bu	55 lb/bu

Test weight increase: 2 lb/bu

Comments: The cropping year was quite good. Only July 13, leaf chlorophyll measured on 20 average leaves of each treatment gave 50.7 SPAD units for the Vitazyme treatment and 49.1 SPAD units for the control.

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1997 Crop Results

Vitazyme on Corn

Researcher: William (Bill) Goodell *Seeding date*: May 14, 1997
Location: Shortsville, New York *Row width*: 30 inches
Seeding rate: 30,000 seeds/acre *Variety*: Pioneer 3752 (97 day)
Experimental design: A field of reasonable uniformity was divided into two parts: an untreated control part and a Vitazyme treated part.

1. **Control (no Vitazyme)**
2. **Vitazyme + 33% of fertilizer at planting**

Fertility treatments: The entire field received 10 tons/acre of manure, plus 26 gal/acre of 30% nitrogen and 4 gal/acre of ammonium thiosulfate. The control area received an additional 8 gal/acre of 9-18-9 plus 4 gal/acre of 0-0-30 at planting on the seed. The Vitazyme treatment received 2.7 gal/acre of 9-18-9 plus 1.3 gal/acre of 0-0-30 at planting, or 33% of the control treatment.
Vitazyme application: 12 oz/acre with the liquid fertilizer, on the seeds at planting
Soil: Ontario loam, 3 to 10% slope
Previous crop: wheat *Harvest date*: November 26, 1997
Yield results: Both treatments yielded about 22.7% grain moisture.

	Control	Vitazyme	Increase with Vitazyme
Corn yield	129.6 bu/acre	142.2 bu/acre	12.6 bu/acre

Yield Increase: 10%

Income results: The grain price has been calculated at about $3.00/bu. Natures 9-18-9 + 0-0-30, mixed at a 2:1 ratio retails for about $3.20/gal.

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