22nd Edition

VITAZYME®

an All Natural Concentrate

2017 FIELD TESTS RESULTS

A SUMMARY OF EXPERIMENTS USING VITAZYME SOIL AND PLANT BIOSTIMULANT ON FIELD, ORCHARD, AND GREENHOUSE CROPS

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Vital Earth RESOURCES

Introduction

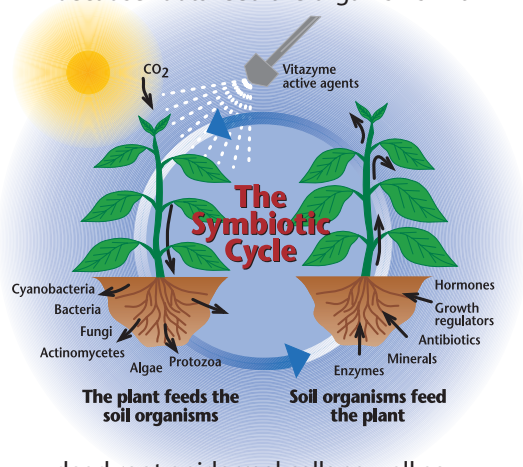
How Vitazyme works within the plant-soil system.

This edition of Vitazyme crop reports represents the twenty-second year in which this biostimulant has been used successfully across many soil and climatic regimes in many nations.

For those unfamiliar with Vitazyme soil and plant biostimulant and its recommended program, please review the information given below to understand how the material works within the plant-soil system.

Improved Symbiosis: The Secret of Vitazyme's Action

All plants that grow in soils develop an intimate relationship between the roots and the organisms that populate the root zone. The teeming billions of bacteria, fungi, algae, cyanobacteria, protozoa, and other organisms that grow along the root surfaces— the rhizosphere—are much more plentiful than in the bulk of the soil. This is because roots feed the organisms with



dead root epidermal cells as well as compounds exuded from the roots themselves. The plant may inject 25% or more of its energy, fixed in the leaves as carbohydrates, amino acids, and other compounds, into the root zone to feed the organisms, for a very good purpose.

The microorganisms which feed on these exuded carbon compounds along the root surfaces benefit the plant in many ways creating a beautiful symbiotic relationship. The plant feeds the bacteria, fungi, algae, and other microbial species in the rhizosphere, which in turn secrete enzymes, organic acids, antibiotics, growth regulators, hormones, and other substances which are absorbed by the roots and transported to the leaves. The acids help dissolve essential minerals, and reduced iron releases anionic elements. Organism types include mycorrhizae, cyanobacteria and various other bacteria, fungi, and actinomycetes.

Vitazyme contains "metabolic triggers" that stimulate the plant to photosynthesize more efficiently, fixing more sunlight energy in the form of carbon compounds to increase the transfer of carbohydrates, proteins, and other growth substances into the root zone. These active agents may enter the plant through either the leaves or the roots. Root growth and exudation are both enhanced. This enhancement activates the metabolism of the teeming population of rhizosphere organisms to a higher level, triggering a greater synthesis of growth-benefiting compounds and a faster release of minerals for plant uptake. Thus the plant-microbial symbiosis is stimulated.

Very small amounts of these metabolic triggers in Vitazyme are needed to greatly improve plant and rhizosphere microbe response. This is because of the **enzyme cascade effect**. Successive tiers of enzymes are activated in plant and microbial tissues to give a large physiological response from very little activator.

In short, Vitazyme enables the plant to better express its genetic potential by reducing the stresses that repress that expression.

Vitazyme may be used for crop production at any degree of technology, from animal power and low inputs to GPS-guided tractor power and high fertility inputs. Please consult the Vitazyme User's Guide for details.

General use for field crops with less than optimal fertilization levels, when soil testing is not possible:

1. Apply normal levels of organic and commercial fertilizers.
2. Treat the seeds, transplant roots, or seed pieces whenever possible at planting.

To treat seeds, typically use 250 ml/ha in the minimum water for good seed coverage. Mixing 1 liter/ton of seeds is also very effective. Dip roots or transplants in a 0.5 to 1% solution, or spray with a 5% solution.

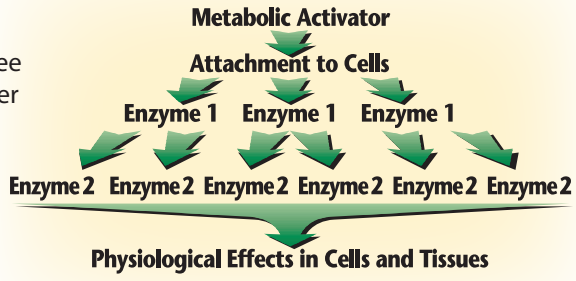
Soil Organic Matter			Previous Crop		Compaction		Soil NO_3-N Test		
Low (<1.5%)	Medium (1.5-3%)	High (>3%)	Non-legume	Legume	Much	Little	Low	Medium	High
1	2	3	1	3	1	3	2	4	6
Total additive score: Apply this % optimum N	15	14 13	12		11	10 9	8	7 6	5
	← 50-60% →				← 60-70% →			← 70-80% →	

3. Apply Vitazyme to the soil and/or leaves according to recommendations. In most cases use 1 to 1.5 liters/ha per application, from one to three times during the growing season.

General use for field crops with optimal fertilization and soil testing:

1. Test the soil at a reputable laboratory, and obtain expert fertilization recommendations.
2. Fertilizer nitrogen rates may be lowered somewhat, depending on soil conditions; refer to the table above.
3. Treat the seeds using a seed treater to achieve about 1 liter/ton of seed of actual product, or apply 1 liter/ha in-furrow at planting, with or without starter fertilizer.
4. Apply Vitazyme to the soil and/or leaves according to recommendations.

Remember that Vitazyme is a complement to other sound, sustainable crop management practices. Incorporate crop rotations, minimal tillage, erosion control, and adapted plant varieties whenever possible.



Vitazyme Highlights *from throughout the world.*

Vitazyme Highlights for 2017

The Vitazyme program worked excellently in the many parts of the world where it was used in 2017. Note the following highlights from this past year.

1. A Master's Degree investigation at the University of Guanajuato, Mexico, revealed that Vitazyme application greatly reduced the incidence of gray mold for strawberries, by 23% alone and by 46% when combined with a standard fungicide, while the yield was increased by 47 to 54% when combined with a fungicide. Moreover, the Brix level of the fruit was improved with Vitazyme, as was the fruit pressure, insuring better keeping quality in shipping and marketing.

2. The agrichemical company Syngenta has continued researching and marketing their own version of Vitazyme in Brazil, using their formulation as part of a soybean seed coating along with an insecticide, a nematicide, and a fungicide. Since 2016 there have been over 70 field trials conducted that have resulted in an average yield increase of 5.2% for soybeans. Work continues with the product on corn, cereal grains, and other crops.

3. University of Missouri studies on Vitazyme with and without glyphosate added to the foliar application continued to show excellent results, as have studies with corn and soybeans in past years. With corn in 2017, the product greatly reduced the damage done to populations of beneficial microbes in the rhizosphere from glyphosate additions, and greatly reduced the incidence of Fusarium infections in the root zone, bringing them to the levels of the control treatments. Manganese oxidizing bacteria were reduced and manganese reducing bacteria were increased with Vitazyme as well. These results were presented at the Third International Biostimulant Congress in Miami in November of 2017.

4. Studies have been initiated in Morocco to evaluate the effect of the program on dates and pomegranates. Date palm yields were improved by 18% in a replicated study at an oasis research station, and pomegranate yields rose by 15%, showing how well the program can work under harsh and dry Sahara Desert environments.

5. The final analysis of data from a South Dakota State University study conducted in 2016 on nitrogen efficiency for corn showed that Vitazyme not only increased the efficiency of nitrogen utilization, and increased the yield of corn by 21 bu/acre at a reduced nitrogen level (75 lb/acre), but also reduced water stress yield loss and nitrogen stress yield loss considerably at the 75 lb/acre nitrogen level. These reductions were statistically significant, and ranged from 71 to 79%.

6. In Malawi, tobacco treated with and without Vitazyme, at three nitrogen levels (50, 75, and 100% of optimal), showed excellent responses in terms of total leaf yield, root mass, and stems, but especially at the 75% fertilizer level. Moreover, the quality of the leaves and their color were improved with Vitazyme. By improving both yield and quality, the benefit:cost ratio was increased to 55:1 at the 75% fertilizer level, revealing the ability of the program to improve fertilizer use efficiency.

7. Results with trials for a number of crops in Ukraine proved the great efficacy of the program in that country, continuing the yield and quality increases that have been recorded there for many years. Yield increases with Vitazyme on winter wheat, winter barley, corn, sunflowers, winter canola, potatoes, and chickpeas were excellent despite a very dry and difficult year for farmers in that part of Eastern Europe.

Avocados *with Vitazyme application*

Researcher: Francisco E. González Valdés, M.S., Agronomy Engineer
Research Institution: Belloto Consulting Ltd., Chile

Experiment 1. Vitazyme used with avocado under unfavorable conditions (2016)

Variety: a Phytophthora-sensitive rootstock
Soil type: clayey
Planting date: 2013

Experimental design: Root-rot sensitive avocado trees were treated with three Vitazyme regimes to determine the products effectiveness to control the problem. Each plot had 10 trees, with 16 plots (four reps), or 160 total trees.

Observations: At six months after these applications, there was a noticeable increase in leaf area for the Vitazmye treatments, but final results were not yet available.

Treatment	Vitazyme in drip irrigation	Vitazyme foliar
1	0	0
2	1 liter/ha, four applications	0
3	0	0.2% four applications
4	1 liter/ha, four applications	0.2% four applications

Vitazyme applied to avocados in Chile has been proven to enhance tree growth and yields consistently, as can be seen in this photo showing vigorous new growth in a producing plantation.

Avocados *with Vitazyme application*

Experiment 2. *Vitazyme for avocado tree vigor (2013)*

Variety: unknown

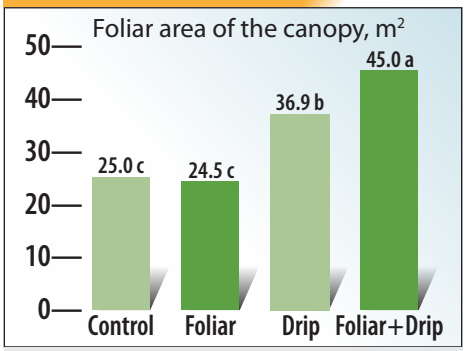
Experimental design: Four treatments were made in an avocado orchard, replicated four times, to determine the effectiveness of this product in accelerating the vigor of the trees.

Treatment	Vitazyme application sequence[1]			
	1	2	3	4
1	0	0	0	0
2	Foliar	Foliar	Foliar	Foliar
3	Drip	Drip	Drip	Drip
4	Foliar	Drip	Foliar	Drip

[1]Treatment levels are at 1 liter/ha; foliar applications used a 0.2% solution spray.

Leaf area results:

Leaf Area*



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

Conclusions: In these Chilean avocado trials, Vitazmye increased leaf area of the trees substantially and significantly, using both a foliar spray and a drip irrigation application. In Experiment 2, leaf area was increased by 48% using four drip irrigation applications, whereas by alternating foliar and drip irrigation applications the leaf area increased a remarkable 80%. This latter treatment is thus recommended for avocado growers to attain vigorous leaf canopies which should translate to greater fruit yields.

Increase in leaf area with drip irrigation: 48%

Increase in leaf area with foliar + drip irrigation: 80%

Vitazyme Field Tests for 2017

Cabbage *with Vitazyme application*

Researcher: W.H. "Butch" Palmer
Research organization: Reality Research, Williamson, New York
Location: Williamson, New York
Variety: Bronco
Planting date: July 6, 2017
Planting spacing: 18 x 36 inches
Planting rate: 9,680 plants/acre
Plot size: 12 x 100 feet
Experimental design: A randomized complete block design, with four replicates, was established on a cabbage field to determine the effects of Vitazyme and WakeUp Summer, alone and in combination, on the yield and plant characteristics of cabbage grown in New York State.

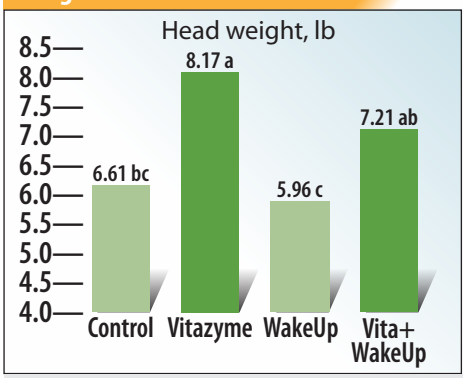
1 ***Control*** 2 ***Vitazyme***
3 ***WakeUp Summer***
4 ***Vitazyme + WakeUp Summer***

Fertilization: unknown
Vitazyme application: 13 oz/acre (1 liter/ha) on the seedlings at transplanting on July 7, and 13 oz/acre (1 liter/ha) sprayed on the leaves and soil mid-season on August 14
WakeUp Summer application: 4 oz/acre (0.3 liter/acre) on the seedlings at transplanting on July 7, and 4 oz/acre (0.3 liter/ha) sprayed on the leaves and soil mid-season on August 14
Growing season conditions: favorable
Harvest date: October 5, 2017

Cabbage has always responded extremely well to Vitazyme in trials conducted over many years of research. Note the much growthier treated plants on the right.

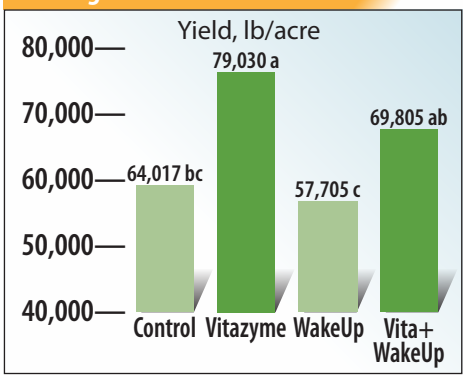
Growth and yield results: Several parameters for the cabbages were measured and are outlined below. For all parameters, means followed by the same letter are not significantly different at P=0.05, using ARM 2014.7 Analysis of Variance.

Weight of One Head*

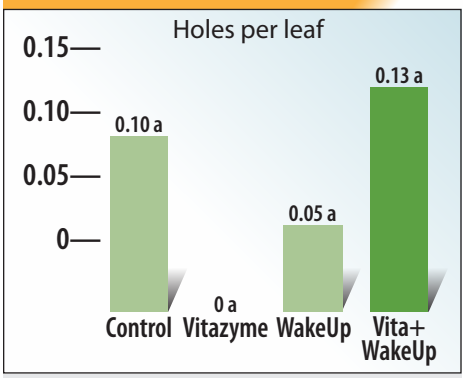


*Ten heads were evaluated per treatment

Cabbage Yield

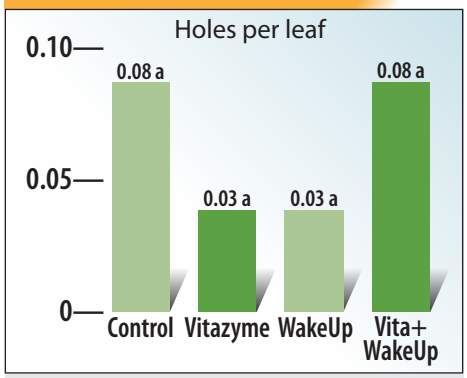


Holes on Leaf 1*



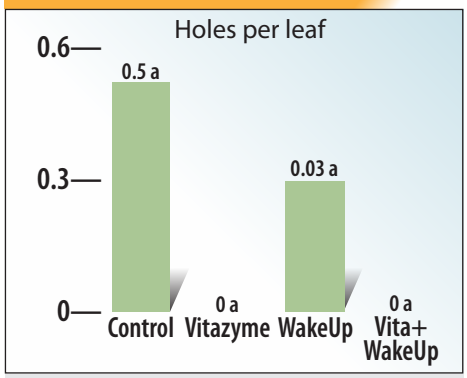
*Number of holes were evaluated on the first three leaves peeled back from the head. 0=clear, 1=1 to 2 holes, 2= 3 to 10 holes, and 3> 10 holes.

Holes on Leaf 2*



*Number of holes were evaluated on the first three leaves peeled back from the head. 0=clear, 1=1 to 2 holes, 2= 3 to 10 holes, and 3> 10 holes.

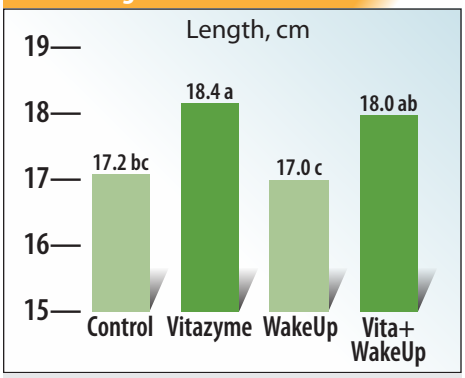
Holes on Leaf 3*



*Number of holes were evaluated on the first three leaves peeled back from the head. 0=clear, 1=1 to 2 holes, 2= 3 to 10 holes, and 3> 10 holes.

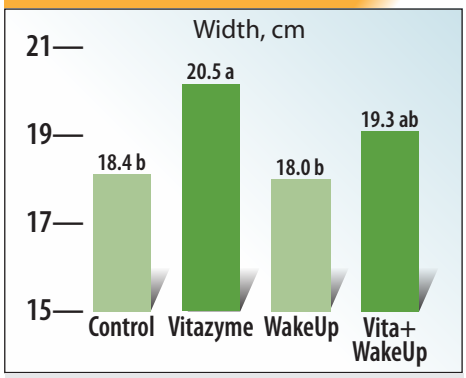
Leaf fungal infection: All three exterior leaves were evaluated for fungal infection, and there were no significant differences in the disease incidence for any treatment.

Head Length*



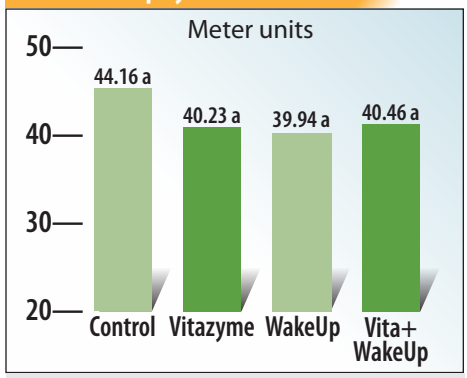
*Measurements made on cut halves of heads.

Head Width*



*Measurements made on cut halves of heads.

Leaf Chlorophyll*



*Measured with an A+Leaf Meter.

Parameter	Change from the control		
	Vitazyme	WakeUp	Vita + WakeUp
Head width	+24%	-10%	+9%
Yield	+24%	-10%	+9%
Holes on leaf 1	No significant differences		
Holes on leaf 2	No significant differences		
Holes on leaf 3	No significant differences		
Leaf fungal infection	No significant differences		
Head length	+7%	-1%	+5%
Head width	+11%	-2%	+5%
Leaf chloryphyll	-9%	-10%	-8%

Conclusions: This cabbage trial in western New York State revealed that two Vitazyme applications, at planting and mid-season, greatly increased cabbage weight and yield (24%). Both head length and width were increased by 7% and 11%, respectively, although leaf chlorophyll was slightly reduced, though not significantly. Worm holes in leaves were not different for any of the treatments, nor were fungal infections. WakeUp Summer, applied at 4 oz/acre (0.3 liter/ha), reduced the yield and head weight, length and width slightly, whereas the combined products provided modest yield weight and size gains, though these were statistically the same as the control. This trial shows no synergism between Vitazyme and WakeUp Summer at the timing and rates used.

Cabbage *with Vitazyme application*

Researcher: W.H. "Butch" Palmer
Research organization: Reality Research, Williamson, New York
Location: Willliamson, New York
Variety: unknown
Planting date: June 22, 2016
Planting rate: about 21,780
Soil test values: Soil samples were taken for each treatment on June 30, 2016.

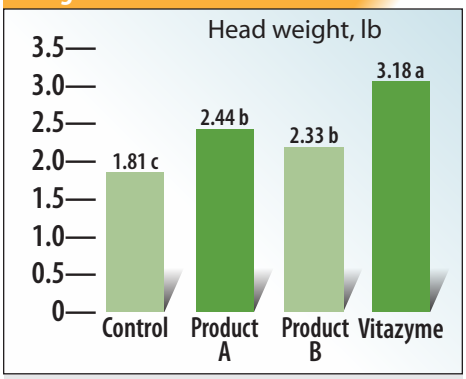
Treatment	pH	Potassium		Magnesium		Calcium	
		lb/acre	% B.S.	lb/acre	% B.S.	lb/acre	% B.S.
1	5.0	175	2.1	140	5.5	1591	37.5
2	5.2	179	2.6	106	5.0	1165	33.1
3	5.3	234	3.1	140	6.1	1403	36.5
4	6.8	224	2.6	303	11.4	3007	67.7

Experimental design: A randomized complete block design with four replications was established to determine the effect of Vitazyme and two other products on yield and growth parameters.

1 ***Control*** **2** ***Product A*** **3** ***Product B*** **4** ***Vitazyme***

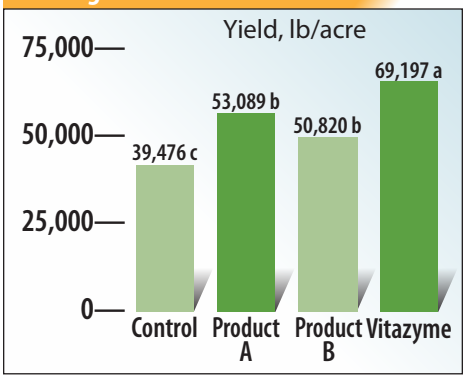
Fertilization: 400 lb/acre of a 15-15-15% N-$P_2 0_5$-$K_2 0$ fertilizer preplant
Vitazyme application: four applications: 16 oz/acre (1.3 liters/ha) at planting (June 22), on July 15, on August 9, and on August 31
Product A and Product B applications: Both products were applied at 4 oz/acre (0.3 liter/ha) at planting (June 22), on July 15, on August 9, and on August 31.
Growing season conditions: favorable
Harvest date: October 13, 2016
Growth and yield results: Several parameters for the cabbages were measured and are given below. For all parameters, means followed by the same letter are not significantly different at P=0.05, using ARM 2014.7 Analysis of Variance.

Weight of One Head*

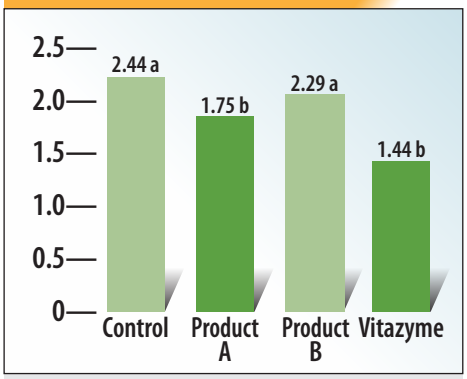


*Twelve heads were evaluated per treatment.

Cabbage Yield

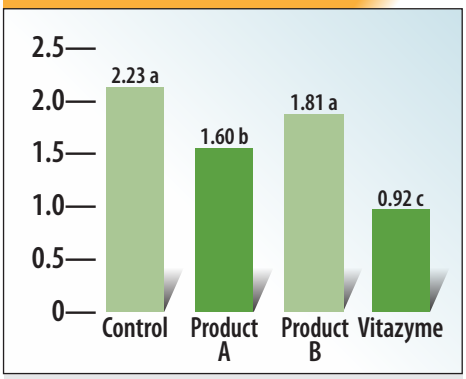


Holes On Leaf 1*



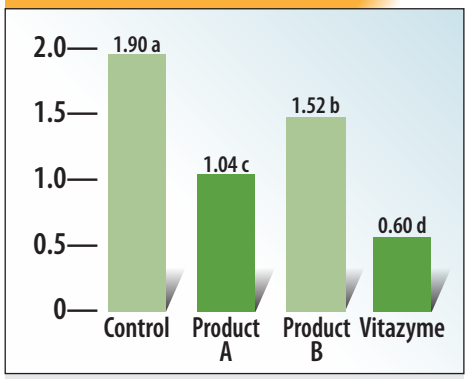
*Number of holes were evaluated on the first three leaves peeled back from the heads. 0 = clean, 1 = 1 to 2 holes, 2 = 3 to 10 holes, and 3 = > 10 holes.

Holes On Leaf 2*



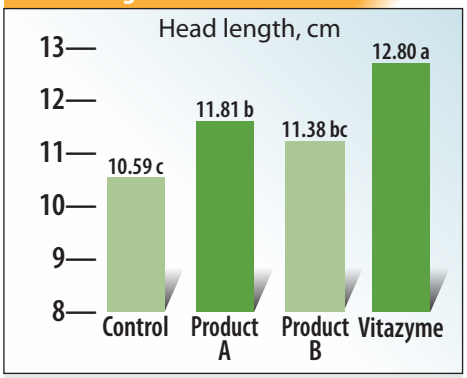
*Number of holes were evaluated on the first three leaves peeled back from the heads. 0 = clean, 1 = 1 to 2 holes, 2 = 3 to 10 holes, and 3 = > 10 holes.

Holes On Leaf 3*



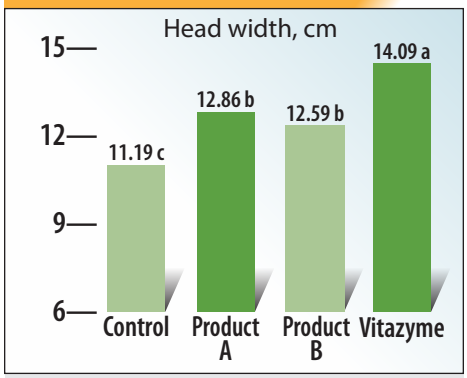
*Number of holes were evaluated on the first three leaves peeled back from the heads. 0 = clean, 1 = 1 to 2 holes, 2 = 3 to 10 holes, and 3 = > 10 holes.

Head Length*



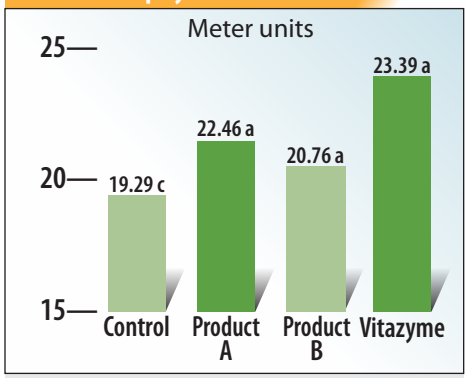
*Measurements made on cut halves of heads.

Head Width*



*Measurements made on cut halves of heads.

Leaf Chlorophyll*



*Measured with an A+Leaf Meter.

Parameter	Change from the control		
	Product A	Product B	Vitazyme
Head weight	+35%	+29%	+76%
Yield	+34%	+29%	+75%
Holes on leaf 1	-28%	-6%	-41%
Holes on leaf 2	-28%	-19%	-59%
Holes on leaf 3	-45%	-20%	-68%
Head length	+12%	+7%	+21%
Head width	+15%	+13%	+26%
Leaf chlorophyll	+16%	+8%	+21%

Conclusions: This 2016 cabbage trial in New York, comparing Product A, Product B, and Vitazyme, revealed that Vitazyme increased the head weight (76%), yield (75%), head length (21%), and head width (26%) significantly above the control and both Products A and B in every case. Products A and B in most cases significantly increased these parameters above the control, but were less effective in such improvements than was Vitazyme. Insect damage to the three outer leaves of the cabbage heads was significantly less with Vitazyme compared to the control, and both Products A and B, showing that Vitazyme appeared to have some anti-insect effect on the insect larvae. Although leaf chlorophyll was greatest for Vitazyme, it was not significantly greater at P=0.05 than the other treatments. These results prove the great effectiveness of Vitazyme using four 16 oz/acre (1.3 liters/ha) applications, to increase cabbage yield and quality in New York State.

Vitazyme Field Tests for 2017

Chickpeas *with Vitazyme application*

Researcher: Vadim Plotnikov
Research organization: PJSC "Maiaky", Ukraine, Plant Designs, New York, USA, and Agro Expert International, Ukraine
Location: Biliaivka District, Odessa Region, Maiaky Village, Ukraine
Variety: Iordan
Seeding rate: 0.6 million seeds/ha
Planting date: April 4, 2017
Previous crop: wheat
Soil type: typical Chernozem; humus = 4.1%
Soil preparation: disking to 6-8 cm, plowing to 22-24 cm, harrowing to 4-5 cm
Experimental design: A chickpea field was divided into Vitazyme treated and untreated control areas to determine the efficacy of this product in promoting yield increases.

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

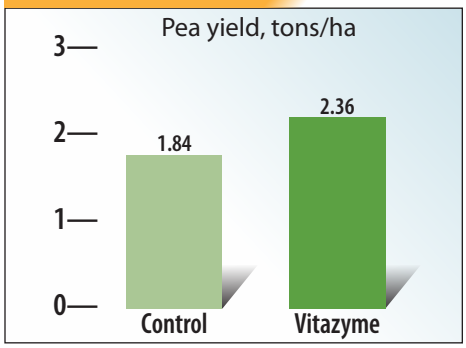
Fertilization: 16-16-16 kg/ha of N-P_2O_5-K_2O as a starter at planting
Vitazyme application: 0.6 liter/ha sprayed on the leaves and soil at flowering
Growing season weather: dry
Yield results:

Treatment	Pea yield	Yield change
	tons/ha	ton/ha
1. Control	1.84	—
2. Vitazyme	2.36	0.52 (+28%)

Increase in pea yield with Vitazyme: 28%

Income results: At a price of $875.00/ton of chickpeas, the added 0.52 ton/ha gave an additional $455/ha income.

Pea Yield



Conclusions: A chickpea trial in southern Ukraine, during a drought-stricken year, using Vitazyme at 0.6 liter/ha sprayed on the leaves and soil at bloom, resulted in a 0.52 ton/ha (28%) yield increase. This increase resulted in an income increase of $455/ha. Such results illustrate the great utility of this program for chickpea production 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 applied 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

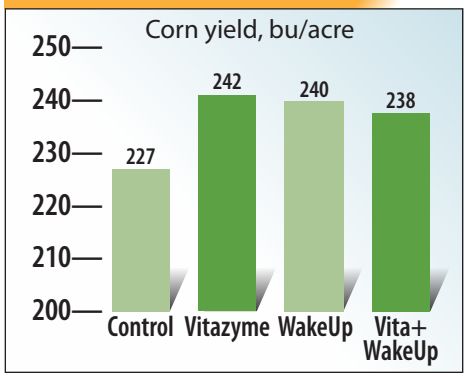
The Vitazyme treated corn showed the greatest rooting and overall growth in this Iowa study, from two applications, at planting and at V8.

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 control 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*

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.

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

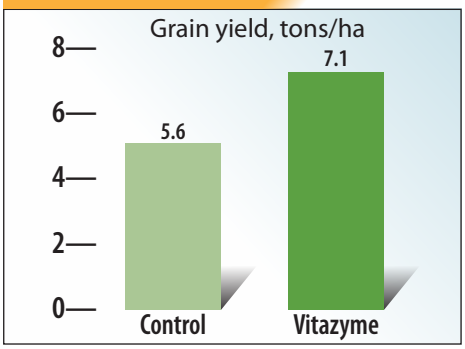
Fertilization: 50-70 kg/ha of N-S broadcast before planting
Vitazyme application: 1 liter/ha sprayed on the leaves and soil at the 8 to 9-leaf stage
Growing season weather: dry
Yield results:

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

Note the improved ear development with Vitazyme treatment in Ukraine.


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

Grain Yield



Increase in grain yield with Vitazyme: 27%

Income results: At a price of $164.67/ton of corn grain, the added 1.5 tons/ha gave an additional $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—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

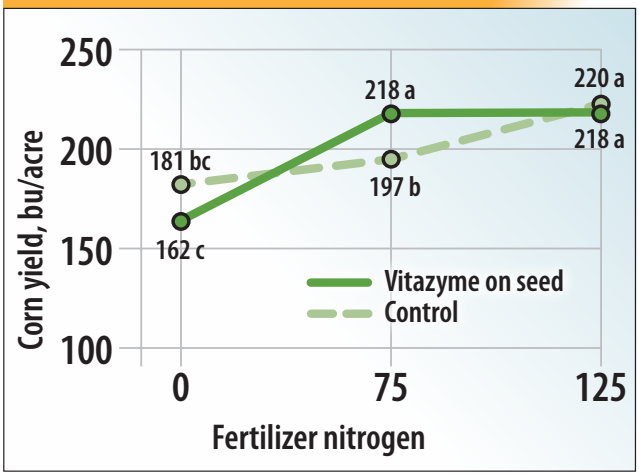
Yield, nitrogen efficiency, and water efficiency results: Ears were dried at 140° F and weighed daily until moisture loss ceased. Grain was then removed by a portable sheller and weighed. Yields were adjusted to 15% moisture. Yield loss due to water and nitrogen stress were then calculated using ^{14}N, and ^{15}N, and ^{13}C formulas.

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

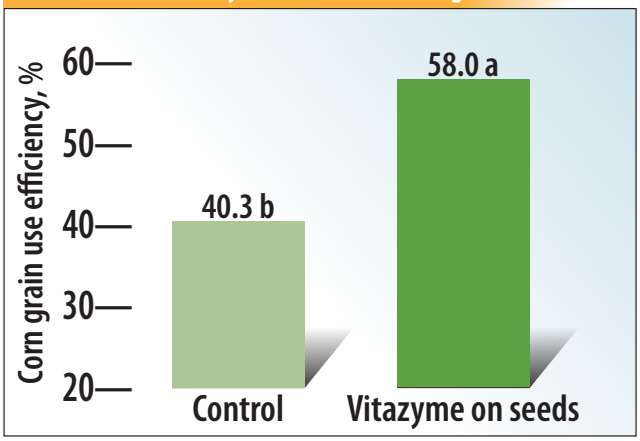
Treatment	Nitrogen fertilizer	Corn yield[1]	Corn grain use efficiency[2]
	bu/acre	bu/acre	%
1. None	125	220 a	43.3 b
	75	197 b	40.3 b
	0	181 bc	—
2. Vitazyme on seeds	125	218 a	42.6 b
	75	218 a	58.0 a
	0	162 c	

[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



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



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

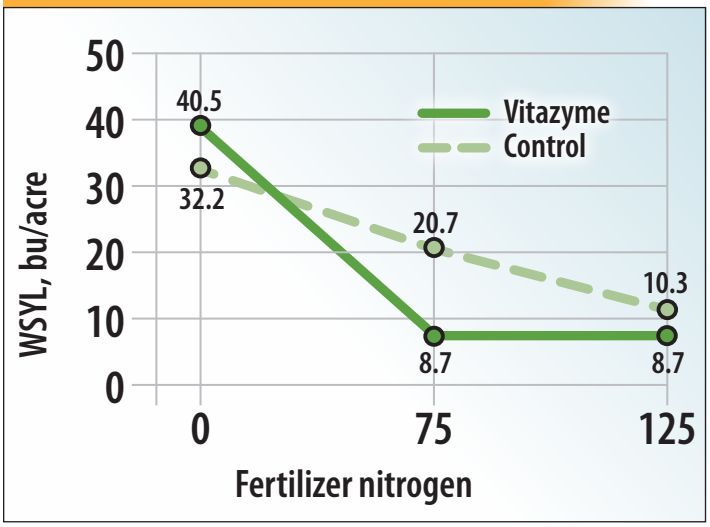
Corn yield with 75 lb/acre of N, using a 40% reduction in N, yielded the same as for the 100% (125 lb/acre) N rate.

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

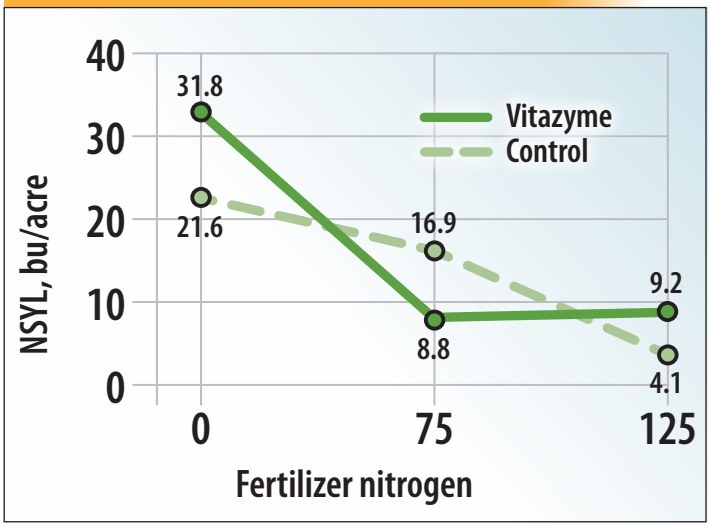
Vitazyme seed treatment	Nitrogen fertilizer rate	Grain yield	Yield loss water stress	Yield loss nitrogen stress	Grain nitrogen
	lb/acre	lb/acre	lb/acre	lb/acre	%
Yes	125	218 a*	8.7 b*	9.2 b*	1.31 a*
Yes	75	218 a	8.7 b	8.8 b	1.30 a
Yes	0	162 b	40.5 a	31.8 a	1.09 b
No	125	220 a*	10.3 c**	4.1 b **	1.47 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 colonization, 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:

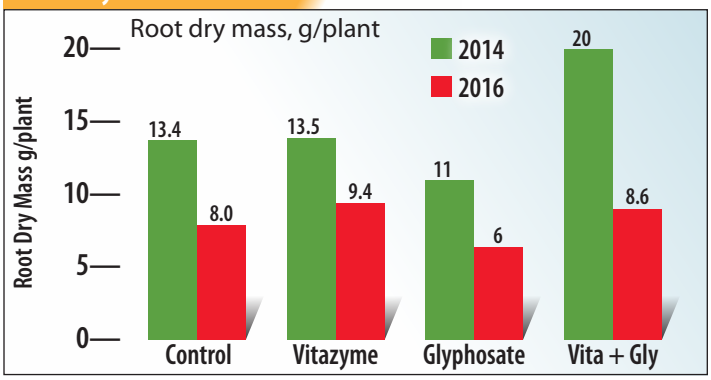
- Determine effects of Vitazyme on selected soil health indicators
- Determine effects of Vitazyme on rhizosphere biology in transgenic soybean and maize receiving glyphosate in field trials
- Determine potential effects of Vitazyme on crop growth in soils with residual glyphosate contents

Experimental design:

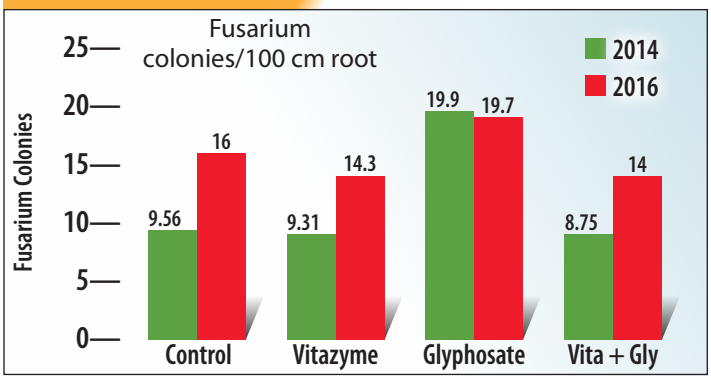
- Field trials conducted at Columbia (2014) and Novelty (2016-17), Missouri, on Mexico sil soil (fine, smectitic, sesic Vertic Epiaqualfs), maize and soybean planted conventionally using minimum tillage; plants and soils collected at R2 soybean and V10 maize growth stage
- Root-colonizing Fusarium assessed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

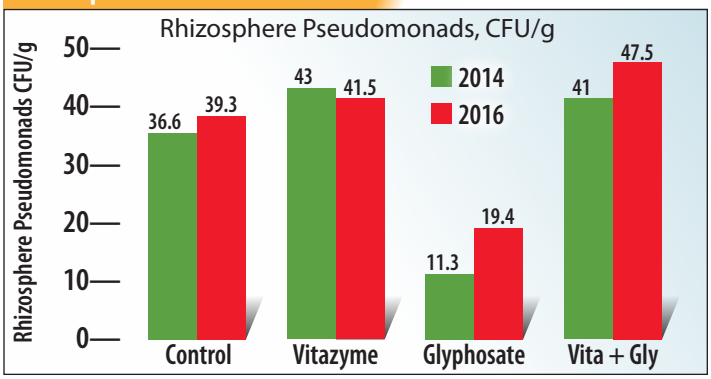
Root Dry Mass



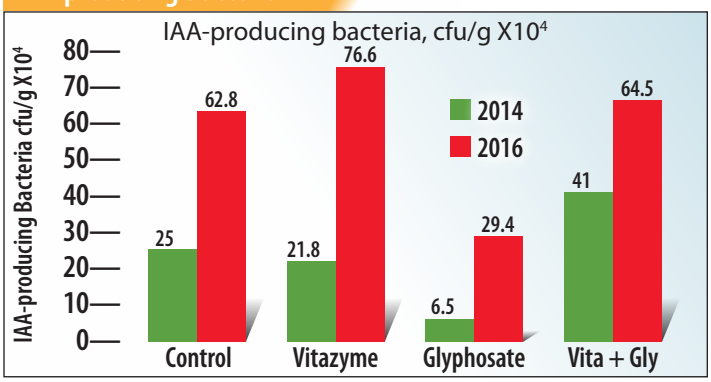
Fusarium

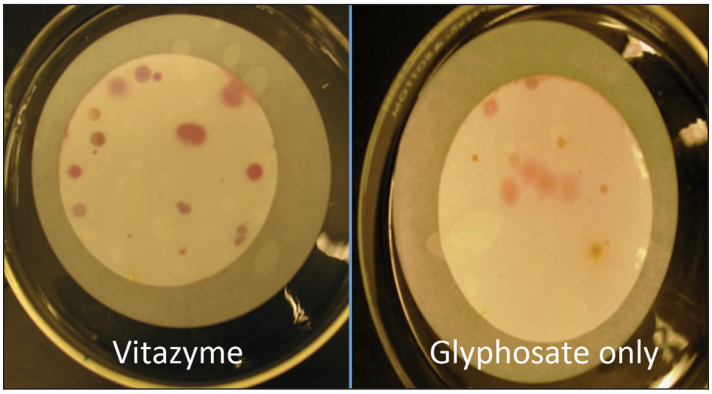


Rhizosphere Pseudomonads



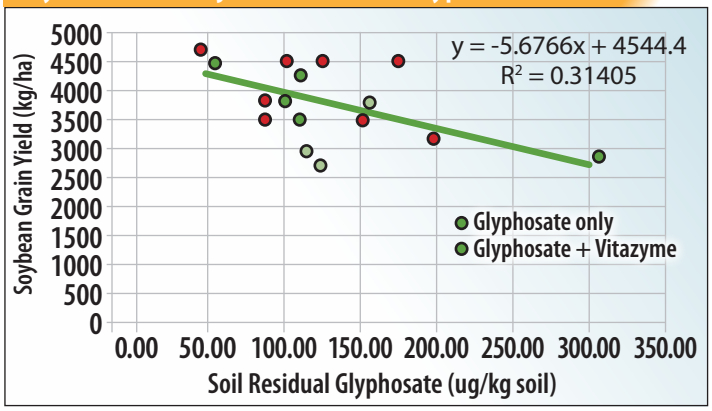
IAA-producing Bacteria





Note how indole acetic acid bacteria, which are detected in the petrie 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.

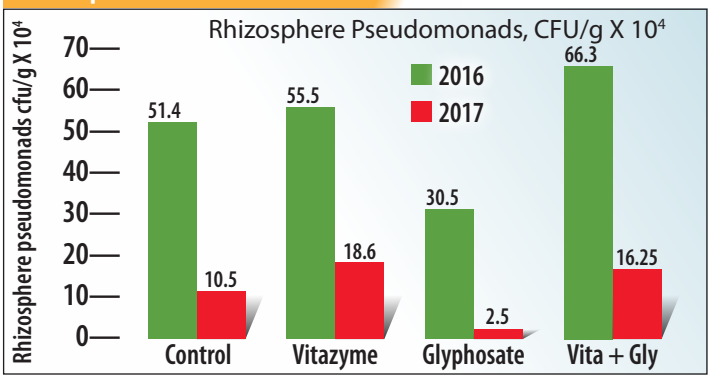
Soybean Yield Projection With Soil Glyphosate



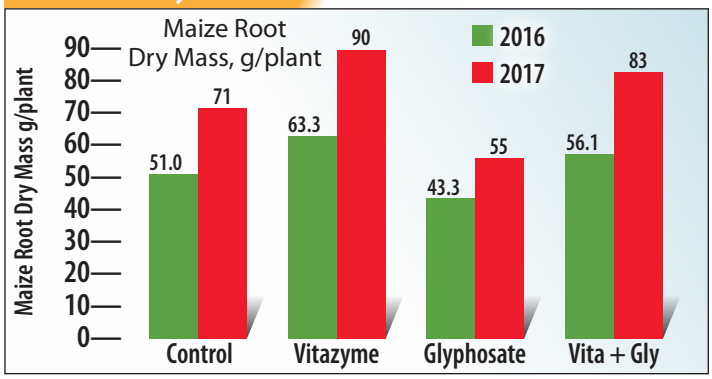
Corn Results:

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

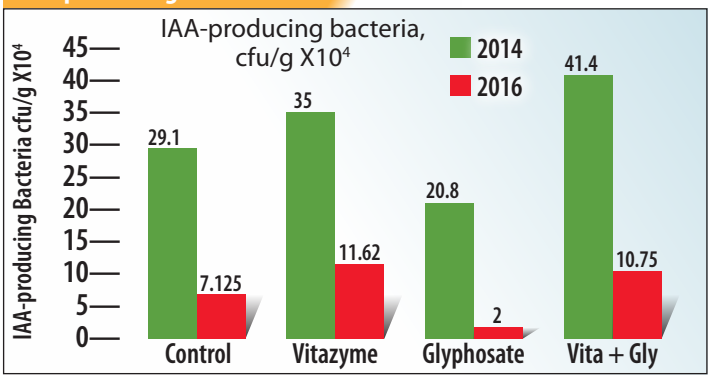
Rhizosphere Pseudomonads



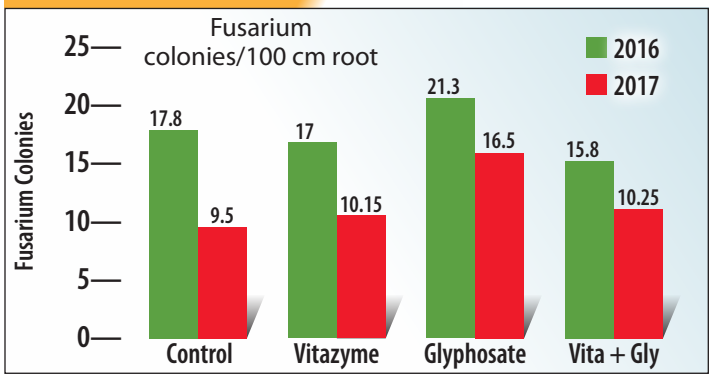
Maize Root Dry Mass



IAA-producing Bacteria

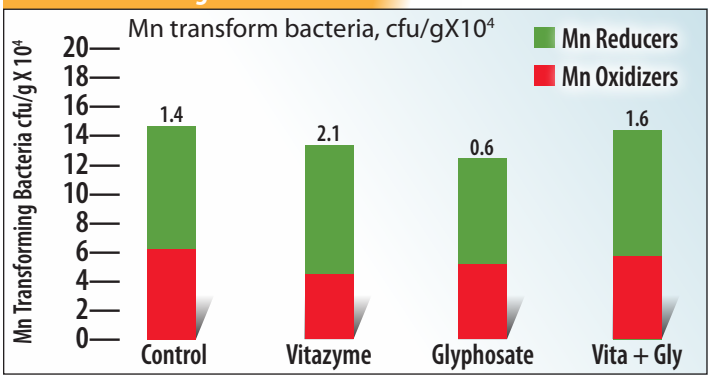


Fusarium

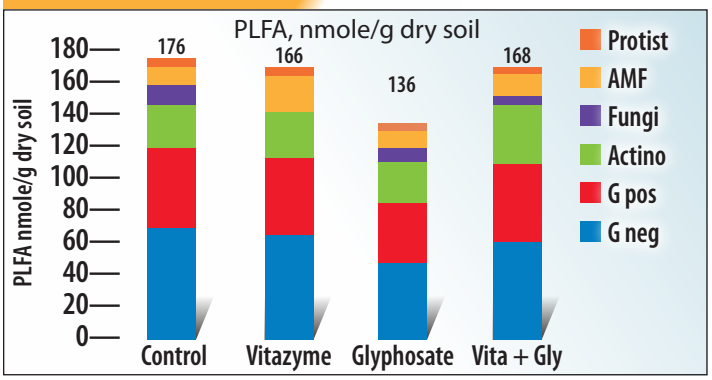


With corn rhizosphere soil samples, the prevalence of Fusarium fungi is much higher when glyphosate is applied to the leaves, but when Vitazyme is added with the glyphosate these fungi are held in check. The same occurs with soybeans.

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 functions, 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 (Fig. 1G)

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 assessments 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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Vitazyme Field Tests for 2017

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 $N\text{-}P_2O_5\text{-}K_2O$ in-furrow at planting

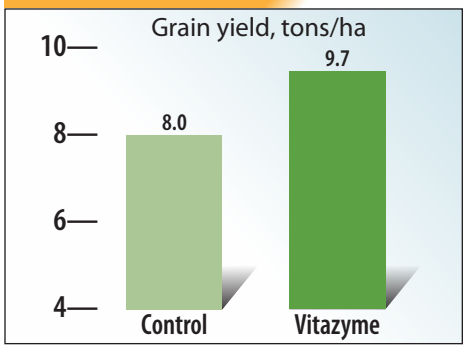
Vitazyme application: 1 liter/ha sprayed on the leaves and soil on June 5, 2017, at the 7 to 8-leaf stage
Growing season weather: dry
Yield results:

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.

Vitazyme Field Tests for 2017

Date Palm *with Vitazyme application*

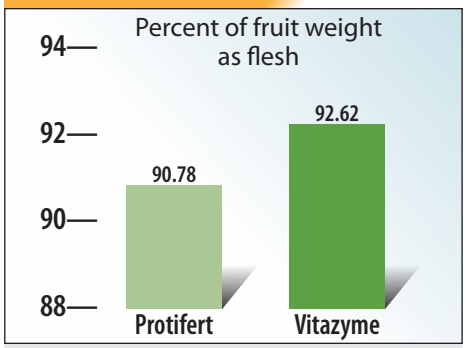
Researchers: Zerhoune Messaoudi, Ph.D., Hakim Outghouliast, A. Touhami Ouazzani, and L. Ait Haddou
Research Institution: Department of Arboriculture—Viticulture, National School of Agriculture, Meknes, Morocco, and Laboratory of Botany, Biotechnology and Plant Protection, Faculty of Sciences, University of Ibn Toufail, Kenitra, Morocco
Location: Tafilalet Oases, Tinejdad, Errachidia, Morocco
Variety: Mejhoul date palm
Soil type: saline
Experimental design: Two products, Protifert LMW 6.3 and Vitazyme were evaluated in a completely randomized block design (three replications and three trees per treatment, or 27 total trees), on a date palm plantation to determine the effect of the products on yield and fruit quality parameters.

1 ***Control*** **2** ***Protifert LMW 6.3***
3 ***Vitazyme***

Fertilization: unknown
Vitazyme application: Three spray applications: after pollination in late April, and again in mid-July and mid-August of 2016; a 1.3 ml/liter of water dilution was used.
Protifert LMW 6.3 application: as with Vitazyme, three spray applications were made: after pollination in late April, and again in mid-July and mid-August of 2016; a 4.0 ml/liter of water dilution was used. Protifert LMW 6.3 is a fertilizer containing 8% organic nitrogen, 25% organic carbon, and 39% total amino acids, of which 13% are free amino acids. It is made by Sicit 2000, an Italian company.
Quality results:

- Fruit length. Protifert produced somewhat longer fruit than Vitazyme and the control.
- Fruit width. Both Vitazyme and Protifert produced wider fruit.
- Fruit total size. Likewise, fruit size was enhanced by both Vitazyme and Protifert.

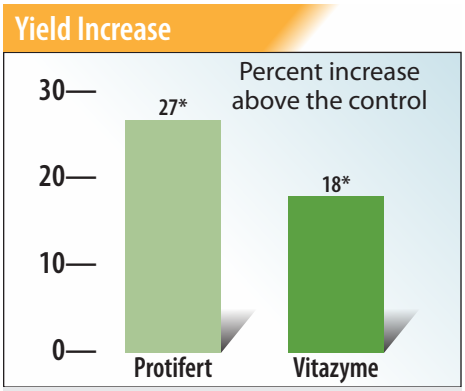
Percent Fruit Flesh



*Significantly greater than the control.

Fresh weight, seed weight, sugar content, and pulp/fruit ratios were also determined, with both Vitazyme and Protifert increasing these parameters, but data are not available.

Yield results:



*Significantly greater than the control.

Conclusions: This date palm study on an oasis in Morocco revealed that both products increased the yield and quality of dates, with yield increases above the control of 27% for Protifert LMW 6.3 and 18% for Vitazyme. This report is incomplete for all parameters, but significant increases occurred for all quality and yield parameters for both products. A comparison between the products is not legitimate because Protifert LMW 6.3 contains fertilizer elements, whereas Vitazyme is a true biostimulant containing no fertilizer elements. Nevertheless, Vitazyme performed nearly as well as the Protifert formulation, and is seen to be an excellent supplement for date palm production in North Africa.

Vitazyme *Enzyme Activity*

Researcher: Tonia Lane, Ph.D.

Research institution: Department of Chemistry, Mississippi State University, Mississippi State, Mississippi

Experimental design: The goal of Phase 1 of this two-phase study plan was to screen for the presence of enzyme activity in Vitazyme by analyzing for broad activities identified through a review of the literature. The literature review identified the enzyme activities listed below as commonly present in substrates such as soils, composted solids, and fermented products.

Enzyme Activity	Role
β-glucosidase	Catalyzes the breakdown of cellobiose into glucose. A predominant enzyme in soils. Commonly found in fermented and composted samples.
Chitinase	Catalyzes the breakdown of chitin, a major component of fungal cell walls.
Sulfatase	Catalyzes the breakdown of sulfur containing compounds. Had been linked to suppression of root rot (Leon, 2006).
Phosphatase	Catalyzes the removal of phosphate groups from molecules. Is thought to influence the ability of plants to cope with P-stress conditions. (Karthikeyan, 2002. Mudge, 2002. Versaw, 2002)
α-glucosidase	Catalyzes the breakdown of starch.
Cellulase	Catalyzes the breakdown of cellulose into smaller polysaccharides.

The analysis was performed using a modified version of ISO method 22939, which details the use of fluorogenic substrates to measure enzyme activity in soils. The fluorogenic reporting molecule used for this analysis is 4-methylumbelliferone (MUF) and associated MUF-linked substrates are available for each of the enzyme activities listed above.

Analysis of enzymes in Vitazyme:

MUF labeled substrates were received in powdered form. Many of the compounds had limited solubility in water and all were diluted in dimethyl sulfoxide (DMSO). Stock solutions were prepared at 25 mg/ml. Due to the limited stability of some of these compounds, stock solutions were prepared fresh each day. MUF labeled substrates were diluted 1:10 into the matrix with a final concentration of 2.5 mg/ml. Reactions were incubated at 37°C and stopped with the addition of 3 mL MUB to the 1 mL reaction mixture. Reactions run with heat treated Vitazyme served as a negative control and were used as blanks for activity calculations.

A summary of the results is shown in the table to the right. There was significant time dependent breakdown of 4-MUF-phosphate that was both consistent and reproducible, providing strong evidence for acid phosphatase activity. Most of the activity was complete by four hours, with the reaction continuing at a slower pace between 4 and 15 hours.

Breakdown of 4-MUF-N-acetyl-β-D-glucosaminide, while not as intense, followed the same time dependant pattern as the breakdown of 4-MUF-phosphate. This combined with the consistent and reproducible nature of result points to possible chitinase activity.

Low levels of 4-MUF-β-D-gulcopyranoside breakdown occurs with overnight incubations. However, this activity is not consistently reproducible. There is not convincing evidence of the presence of significant levels of β-glucosidase activity. There is no breakdown of 4-MUF-α-D-gulcopyranoside, 4 MUF-sulfate, or 4-MUF-β-D-cellobioside or evidence of corresponding α-glucosidase, sulfatase, or cellulase enzyme activity by this method. Incubation of the reaction mixtures for 15 hours gave no indication of the presence of these enzyme activities.

Summary of Enzyme Activity Results

Substrate	MUF Produced (uM)		
	2 hrs	4 hrs	15 hrs
4-MUF-N-acetyl-β-D-glucosaminide	1.8	3.6	4.4
4-MUF-phosphate	5.5	18.6	19.8
4-MUF-α-D-gulcopyranoside	none	NA	none
4-MUF-β-D-gulcopyranoside	none	NR	NR
4-MUF-sulfate	none*	NA	none
4-MUF-β-D-cellobioside	none	NA	none

Samples incubated with 2.5 mg/ml substrate for 2 hrs at 37°C.
*4-MUF-sulfate concentration is 5.0 mg/ml for sample incubated for 2 hrs.
None = a value of zero or below background.
NA = Data was not collected for the 4 hr time point since no enzyme activity was exhibited at the 15 hr time point.
NR = not reported, values were obtained but the data was not consistent or reproducible.

Conclusions:

There is strong evidence of the presence of **acid phosphatase** in the product. However, it is recommended that additional studies be done using commercially available acid phosphatase as a control to confirm that the breakdown of 4-MUF-phosphate is enzymatically driven, and to quantify acid phosphatase activity in the product relative to microgram amounts of the enzyme. Acid phosphatases are active across a wide range of temperatures and pH. This, combined with inhibition of phosphatase activity by a variety of compounds including phosphate, the product of the reaction, may require some additional refinement of the assay in order to clearly quantify the phosphatase activity. It is also recommended that due to the strong signal associated with acid phosphatase that future investigations and assay refinements be done with this enzyme first.

There is convincing evidence of **chitanase** activity in the product. Additional study using a commercially available chitinase as a control is recommended as a way to both confirm the activity and to quantify chitinase activity in terms relative to microgram amounts of the enzyme.

There is not convincing evidence of the presence of significant levels of β-glucosidase activity. Any signal produced by the breakdown of 4-MUF-β-gulcopyranoside was weak at best. There is no evidence of α-glucosidase, sulfatase, or cellulase enzyme activity by this method. Even overnight incubation of the reaction mixtures gave no indication of the presence of these enzyme activities. It is recommended that there should be no further investigation of β-glucosidase, α-glucosidase, sulfatase, or cellulase enzyme activities at this time.

Vitazyme Field Tests for 2017

Red Kidney Beans *with Vitazyme application*

Researcher: James Anderson
Research organization: J and H Distributing, Belgrade, Minnesota
Location: Atwater, Minnesota
Variety: Chapparel dark red kidney beans
Planting date: early June, 2017
Soil type: silty clay loam Chernozem
Irrigation: center-pivot
Experimental design: A kidney bean field was treated with a strip of Vitazyme applied at planting to determine the effect of the product on bean yield.

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

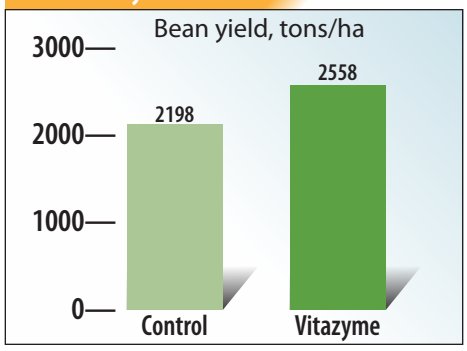
Fertilization: 2 gallons/acre of Red-Line liquid fertilizer, containing 6-12-2% N-P_2O_5-K_2O plus 1.0% Zn, 0.3% Fe, 0.04% Mn, and 0.05% Cu
Vitazyme application: 13 oz/acre (1 liter/ha) in the seed row at planting
Weather conditions: some wind damage, and quite warm and dry midsummer
Harvest date: September 25, 2017
Yield results: The yield was affected by considerable white mold.

Treatment	Yield	Yield change
	lb/acre	lb/acre
1. Control	2,198	—
2. Vitazyme	2,558	360 (+16%)

Yield increase in red kidney bean yield with Vitazyme: 16%

Vitazyme has caused the development of more and larger pods in this west-central Minnesota red kidney bean field trial.

Red Kidney Bean Yield



Income results: At about $0.25/lb, this additional 360 lb of beans netted $90/acre more income.

Conclusions: This red kidney bean trial in west-central Minnesota revealed that a Vitazyme in-furrow application, using only 13 oz/acre (1 liter/ha), produced a sizable yield increase of 16%. This yield increase netted about $90/acre more income, showing the great efficacy of this product to benefit kidney bean growers.

Red Kidney Beans *with Vitazyme application*

Researcher: James Anderson
Research organization: J and H Distributing, Belgrade, Minnesota ***Location:*** Atwater, Minnesota
Variety: Red Hawk dark red kidney beans
Planting date: early June, 2017
Soil type: sandy clay loam Chernozem
Irrigation: center-pivot
Experimental design: A dark red kidney bean field was treated on one portion with Vitazyme as a foliar application to determine the effect of the product on bean yield.

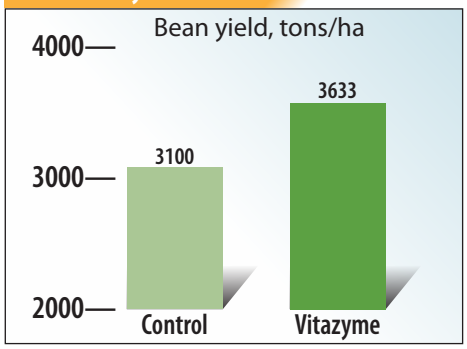
1 *Control* 2 *Vitazyme*

Dark red kidney beans show an excellent response to Vitazyme treatment in this Minnesota trial. Note the greater leaf and stem development and root mass.

Fertilization: 2 gallons/acre of Red-Line liquid fertilizer, containing 6-12-2% N-P_2O_5-K_20 plus 1.0% Zn, 0.3% Fe, 0.04% Mn, and 0.05% Cu
Vitazyme application: 13 oz/acre (1 liter/ha) sprayed on the leaves at early bloom
Weather conditions: quite warm and dry midsummer
Harvest date: September 21, 2017
Yield results: White mold was not a serious problem in this field.

Treatment	Yield	Yield change
	lb/acre	lb/acre
1. Control	3,100	—
2. Vitazyme	3,633	533 (+17%)

Red Kidney Bean Yield



Income results: At $0.25/lb of beans, the additional yield of 533/acre produced additional income of $133.25/acre.
Conclusions: A dark red kidney bean field-scale trial in west-central Minnesota revealed that Vitazyme, applied at 13 oz/acre (1 liter/ha) to the leaves at early bloom, increased bean yield by 17%. This 533 lb/acre increase netted the farmer an additional $133.25/acre, showing the great value of this program for kidney bean growers.

Yield increase in red kidney bean yield with Vitazyme: 17%

Lettuce *with Vitazyme application*

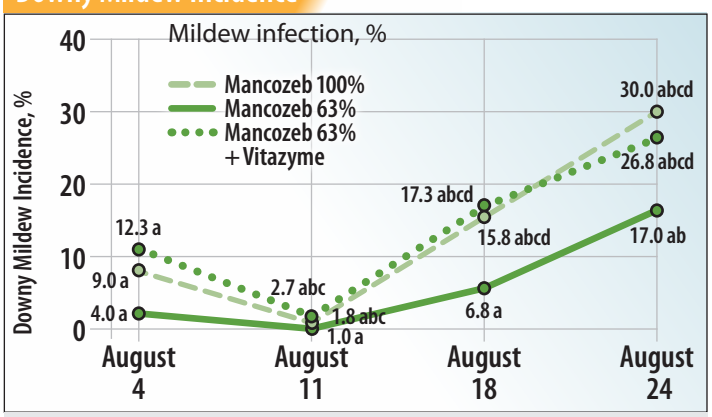
Researcher: Jan Ties Malda
Research institution: Wageningen University, Holland
Location: Lelystad, Holland
Variety: unknown
Planting date: May 12, 2017
Experimental design: A small plot replicated trial was established using four replications, and several different products, to determine the relative value of these products in inhibiting downy mildew and botrytis infection and promoting lettuce yield. A reduced fungicide rate with Vitazyme was evaluated as well to determine if this product could replace some of the fungicide during the cropping cycle.

1 *Mancozeb, 100%* 2 *Mancozeb, 63%*
3 *Mancozeb, 63% + Vitazyme*

Fertilization: on July 4, 130 kg/ha of CAN
Vitazyme application: (1) 1 liter/ha (13 oz/acre) shortly after seeding on May 12; (2) 1 liter/ha (13 oz/acre) at the 3 to 4-leaf stage ; (3) 1 liter/ha (13 oz/acre) seven days after T1

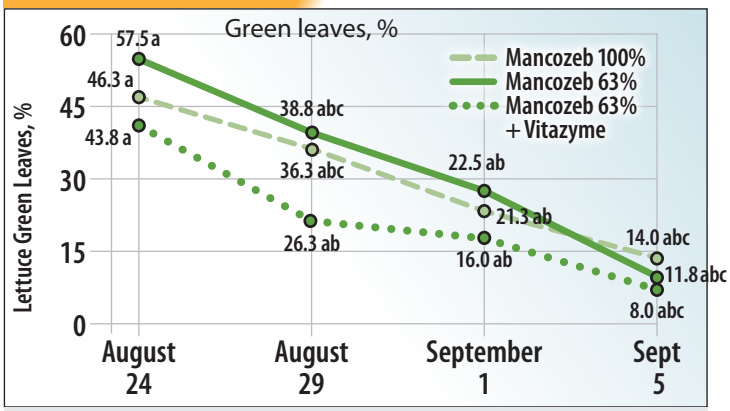
Fungicide applications: Various fungicides, including CHD, Fandago, Movento, Mancozeb, and others were applied frequently during the growth period. Mancozeb is a popular fungicide from Dow Chemical, sold as Dithane.
Irrigation: The plots were irrigated on July 7 and July 10.
Harvest date: September 25, 2017
Yield and growth results: Only the results with Vitazyme and Mancozeb are shown here, while other products were also evaluated.

Downy Mildew Incidence[1]



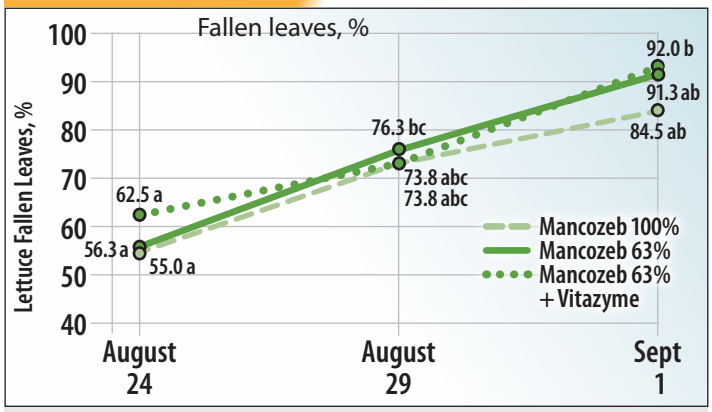
[1]Means followed by the same letter are not significantly different at P=0.05.

Green Leaves[1]



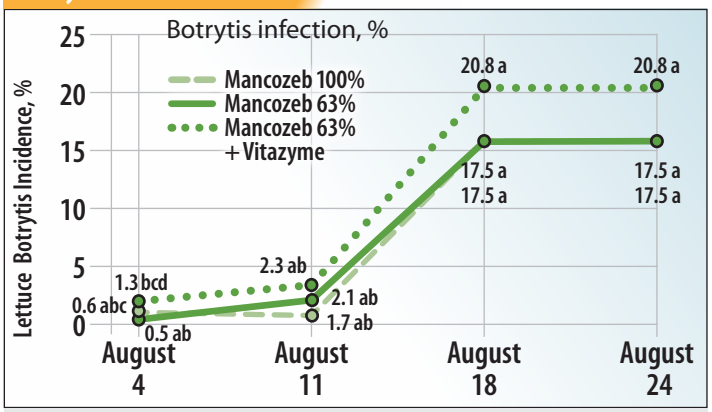
[1]Means followed by the same letter are not significantly different at P=0.05.

Fallen Leaves[1]



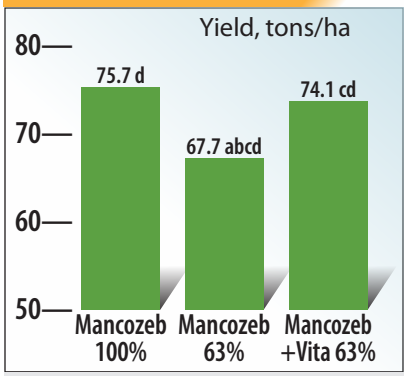
[1]Means followed by the same letter are not significantly different at P=0.05.

Botrytis Incidence[1]



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

Yield[1]



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

Conclusions: A lettuce trial at Lelystad, The Netherlands, comparing the effects of Mancozeb fungicide at 63% of the normal rate with that same rate plus Vitazyme (three applications at 1 liter/ha), revealed that the yield was increased by 9% when Vitazyme was added to this reduced fungicide rate. All three treatments were not significantly different in yield. This yield improvement with Vitazyme occurred in spite of the fact that leaf diseases were not fully controlled, as noted in the graphs for downy mildew and botrytis. Apparently photosynthetic activity occurred at a higher rate with Vitazyme treatment on the leaves to overcome the leaf death caused by fungi. This trial gives compelling evidence that Vitazyme can allow a reduction in fungicide use for lettuce production without hindering optimum yields.

Increase in lettuce yield with Vitazyme at 63% Mancozeb: 9.5%

Vitazyme Field Tests for 2017

Oranges *with Vitazyme application*

Researchers: Agron. Lucero Fernandez (Quimica Lucava) and Ambrosio Monita (Tecno AG)
Research organization: Quimica Lucava, Mexico
Location: Las Conchas and La Soledad, Municipality of Padilla, State of Tamoulipas, Mexico
Variety: Valencia ***Population:*** 152 trees/ha
Experimental design: Two orange orchards were selected to evaluate the effects of Vitazyme (both sites) and Avian Control (one site) on orange quality, yield, and profitability. A 1 hectare area of each orchard was utilized for the study.

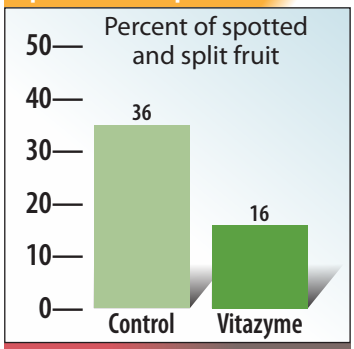
1. ***La Soledad orchard—Vitazyme only***
2. ***Las Conchas orchard—Vitazyme and Avian***

The Vitazyme treated oranges harvested in this Mexican study reveal greater size, as well as yield increases of from 8 to 16%, along with less spotted and split fruit.

Fertilization: unknown
Vitazyme application: 1.5 liters/ha on April 6 and May 4, 2016, using an orchard blast sprayer
Avian Control application: a bird repellant applied October 25 and November 15, 2016, at 2 liters/ha. This repellant is used to deter the eating of fruit by the black-throated magpie-jay *(Calocitta colliei)*
Quality and yield results:

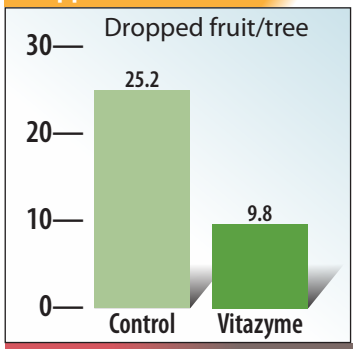
Las Conchas Orchard Trial (Harvest date: April 20, 2017)

Spotted and Split Fruit



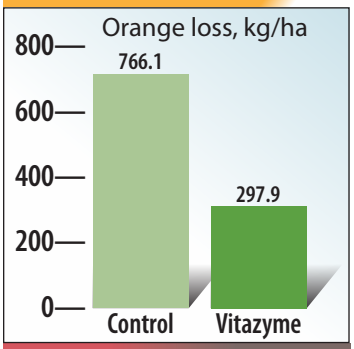
Reduction in spotted and split fruit with Vitazyme: 20%-points

Dropped Fruit



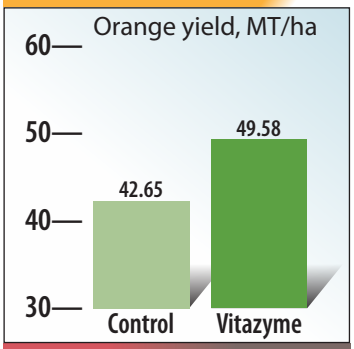
Reduction in dropped fruit with Vitazyme: 15.4 fruit/tree

Fruit Loss



Reduction in fruit loss with Vitazyme: 61%

Fruit Yield



Increase in fruit yield with Vitazyme: 16%

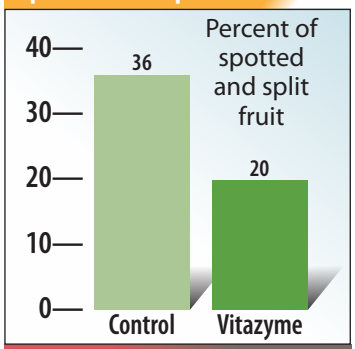
La Soledad Orchard Trial (Harvest date: April 20, 2017)

Income results, Las Conchas: Based on a farm price of $0.162/kg for orange fruit, and a dollar to peso exchange rate of 18.50, the added income from using Vitazyme is $8,040.39/ha.
Income results, La Soledad: Based on a farm price of $0.162/kg for orange fruit, and a dollar to peso exchange rate of 18.50, the added income from using Vitazyme is $522.55/ha.
Conclusions: An orange study at two sites in Mexico, using Vitazyme at both sites and Avian Control on one of them, gave good yield increases—16 and 8%—in part because of reductions in spotted, split, and dropped fruit. Because both orchards were of the same variety and similar age, it was presumed that the yield and income differences (8.4%) for the trial sites was due to reduced bird damage due to Avian Control. These differences were as follows:

Yield difference: 3.71 MT/ha

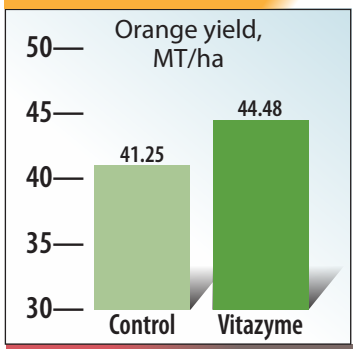
Income difference: $601.43/ha

Spotted and Split Fruit



Reduction in spotted and split fruit with Vitazyme: 16%-points

Fruit Yield



Increase in fruit yield with Vitazyme: 8%

These results indicated that both Vitazyme and Avian Control are effective products for improving the yield of oranges, especially in bird-ravaged areas. Vitazyme also has the effect of reducing spotted and split fruit, and fruit droppage.

Pomegranates *with Vitazyme application*

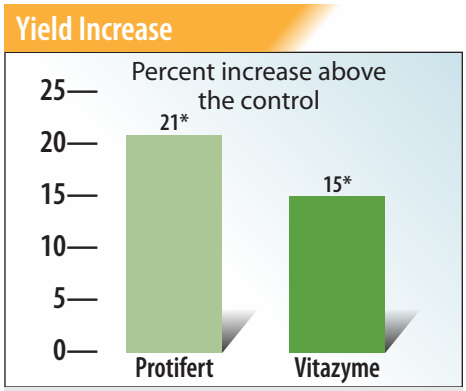
Researchers: Zerhoune Messaoudi, Ph.D., K. Semaoui, A. Rahou, and L. Ait Haddou
Research Institution: Department of Arboriculture—Viticulture, National School of Agriculture, Meknes, Morocco, and Laboratory of Biology, Faculty of Sciences, University Moulay Ismail, Meknes, Morocco
Variety: Sefri ***Location:*** Tadla, Morocco
Experimental design: A pomegranate orchard was selected and divided into three replicates for three treatments in a completely randomized design. The objective of the study was to evaluate the effects of Vitazyme and Protifert LMW 6.3 on pomegranate fruit yield and quality under hot and dry North African conditions.

1 ***Control*** **2** ***Vitazyme*** **3** ***Protifert LMW 6.3***

Fertilization: unknown
Vitazyme application: Four spray applications were made over the trees, using a 1.3 ml/liter dilution rate: end of flowering, end of petal fall, fruit set, and rapid fruit growth.
Protifert LMW 6.3 application: Four spray applications were made to the leaves, using a 4.0 ml/liter dilution rate: end of flowering, end of petal fall, fruit set, and rapid fruit growth. Protifert LMW 6.3 is a fertilizer containing 8% organic nitrogen, 25% organic carbon, and 39% total amino acids, of which 13% are free amino acids. It is made by Sicit 2000, an Italian company.
Quality results: A number of parameters were measured:

- Fruit width
- Fruit length.
- Fruit weight
- Fruit cracking
- Fruit juice content
- Edible part: Fruit weight
- Sugar content

Both Vitazyme and Protifert significantly improved most of these quality parameters, and in particular reduced the incidence of cracking.
Yield results:



*Significantly greater than the control.

Conclusions: A pomegranate study in Morocco revealed that both Vitazmye and Protifert LMW 6.3 significantly improved fruit yield, by 15 and 21%, respectively. Moreover, both products improved characteristics quality of the fruit including fruit weight, length, and width, fresh juice content, edible part: fruit weight, and sugar content. Fruit cracking was reduced as well. A comparison of the two products was not totally legitimate because Protifert LMW 6.3 is a fertilizer material, containing certain levels of major and micro-elements, whereas Vitazyme contains only biostimulant active agents. The products are proven to be excellent supplements to pomegranate production in North Africa.

Potatoes *with Vitazyme application*

Researcher: W. H. "Butch" Palmer
Palmer Research organization: Reality Research, Williamson, New York
Location: Williamson, New York
Variety: Atlantic
Planting date: June 24, 2017
Tillage: Conventional
Row spacing: 3 feet
In-row spacing: 8 inches
Plant population: 21,780 plants/acre
Experimental design: A randomized complete block design with six replications was selected for a potato trial, using plots that were 12 x 100 feet. Five treatments were used, including Vitazyme and WakeUp Summer, alone and in combination, to evaluate the effects of these treatments on tuber yield, plant growth, and tuber quality.
Fertilization: See the table to the right.
Vitazyme application: See the table to the right.
WakeUp Summer application: See the table to the right. WakeUp Summer is a vegetable-based adjuvant.
Yield, quality, and growth results: Harvest occurred on August 27, 2017. In all cases, means followed by the same letter are not significantly different at P=0.10.

Treatment	Fertilizer[1]	Vitazyme[2]	WakeUp Summer[3]
1. Control	0	0	0
2. Vitazyme + Fert	x	x	0
3. WakeUp + Fert	x	0	x
4. Vita + WakeUp+ Fert	x	x	x
5. Fertilizer only	x	0	0

[1]1,000 lb/acre of a 15-15-15 dry fertilizer to give 150-150-150 lb/acre of N-P_2O_5-K_2O; applied June 29.
[2](1) 13 oz/acre (1 liter/ha) in-furrow at planting on June 24; (2) 13 oz/acre (1 liter/ha) sprayed on the leaves and soil at tuber initiation (July 28); (3) 13 oz/acre (1 liter/ha) sprayed on the leaves at tuber bulking (August 28).
[3](1) 4 oz/acre (0.3 liter/ha) in-furrow at planting on June 24; (2) 4 oz/acre (0.3 liter/ha) sprayed on the leaves and soil at tuber initiation (July 28); (3) 4 oz/acre (0.3 liter/acre) sprayed on the leaves at tuber bulking (August 28).

Treatment	Emerged plants, 7-11	Plant height, 8-3	Leaf chlorophyl, 8-4	Leaf length, 8-4	Leaf width, 8-4	Plant height, 8-29	Plant width, 8-29	Plant width, 8-3
	%	in	value	cm	cm	in	in	in
1. Control	24.2 d	19.0 d	39.3 c	—	—	15.7 b	15.5 d	26.0 cd
2. Vitazyme	84.2 ab	24.8 a	46.2 a	6.5 a	4.2 ab	19.5 a	43.0 b	31.2 bc
3. WakeUp	90.0 a	24.0 ab	42.6 b	6.2 b	4.0 b	21.2 a	40.8 b	27.0 cd
4. Vitazyme + WakeUp	70.8 b	21.0 c	46.6 a	6.5 ab	4.3 a	22.0 a	50.2 a	24.3 d
5. Fertilizer only	53.3 c	23.0 b	—	—	—	22.1 a	25.7 c	45.8 a

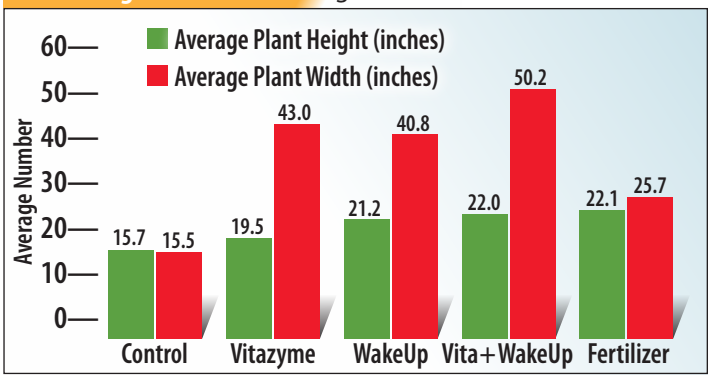
Treatment	Tubers per plants, 8-3	Total tuber weight, 8-3	Average tuber weight, 8-3	Tubers per plant, 8-29	Total tuber weight, 8-29	Average tuber weight, 8-29	Root weight fresh, 8-3
		g	g		g	g	g
1. Control	5.2 b	50.5 c	10.8 a	8.0 a	190.5 c	25.2 d	108 a
2. Vitazyme	9.3 ab	104.7 ab	13.4 a	10.3 a	772.6 ab	78.3 bc	222 a
3. WakeUp	10.5 a	101.5 abc	11.1 a	9.8 a	577.6 b	64.2 c	176 a
4. Vitazyme + WakeUp	8.5 ab	58.0 bc	10.0 a	9.7 a	715.2 ab	79.6 abc	180 a
5. Fertilizer only	7.2 ab	114.7 a	16.5 a	10.0 a	943.5 a	97.4 ab	248 a

Treatment	Foliage wt. fresh, 8-3	Root wt. fresh, 8-29	Total wt. sellable Chefs	Dry matter in roots, 9-5	Foliage wt. fresh, 8-29	Total wt. sellable, As	Dry matter in foliage, 8-14	Total wt. sellable, Bs
	kg	g	cwt/acre	%	kg	cwt/acre	%	cwt/acre
1. Control	0.46 a	80 a	0 c	23.8 a	0.6 a	89.83 b	64.9 a	40.08 cd
2. Vitazyme	3.21 a	222 a	4.60 c	25.7 a	3.2 a	376.95 a	73.8 a	64.25 a
3. WakeUp	2.21 a	176 a	12.25 c	24.4 a	2.2 a	384.62 a	63.8 a	59.23 ab
4. Vitazyme + WakeUp	4.68 a	180 a	58.77 bc	25.0 a	4.7 a	431.45 a	81.2 a	39.37 cd
5. Fertilizer only	3.48 a	280 a	125.95 a	23.0 a	5.8 a	435.90 a	81.3 a	30.13 d

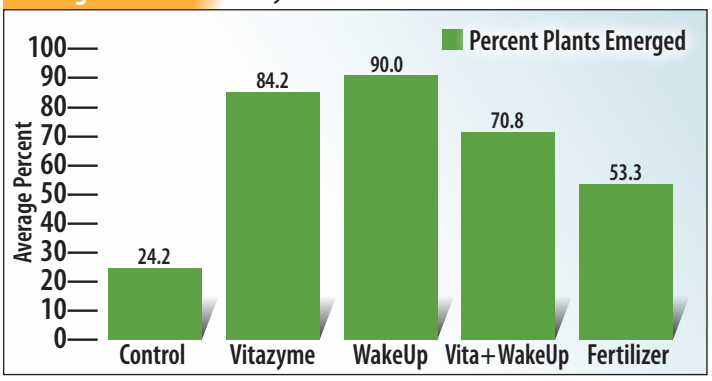
Many other measurements were taken in this study, some of which are summarized in the graphs that follow along with some of the data shown in the graphs on the previous page.

Treatment	Total weight sellable tubers
	cwt/acre
1. Control	89.8 b
2. Vitazyme	376.9 a
3. WakeUp	384.6 a
4. Vitazyme + WakeUp	431.5 a
5. Fertilizer only	435.9 a

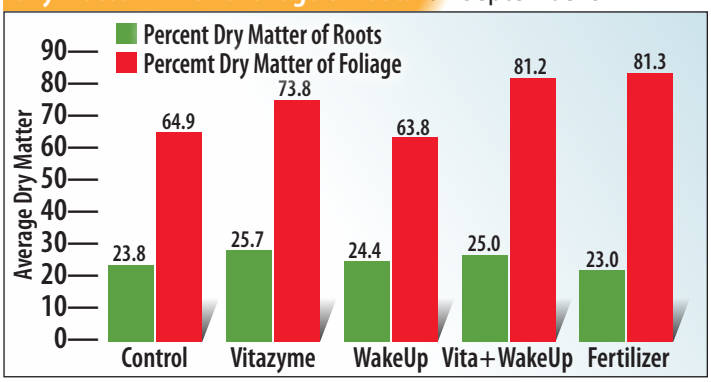
Plant Height & Width on August 29



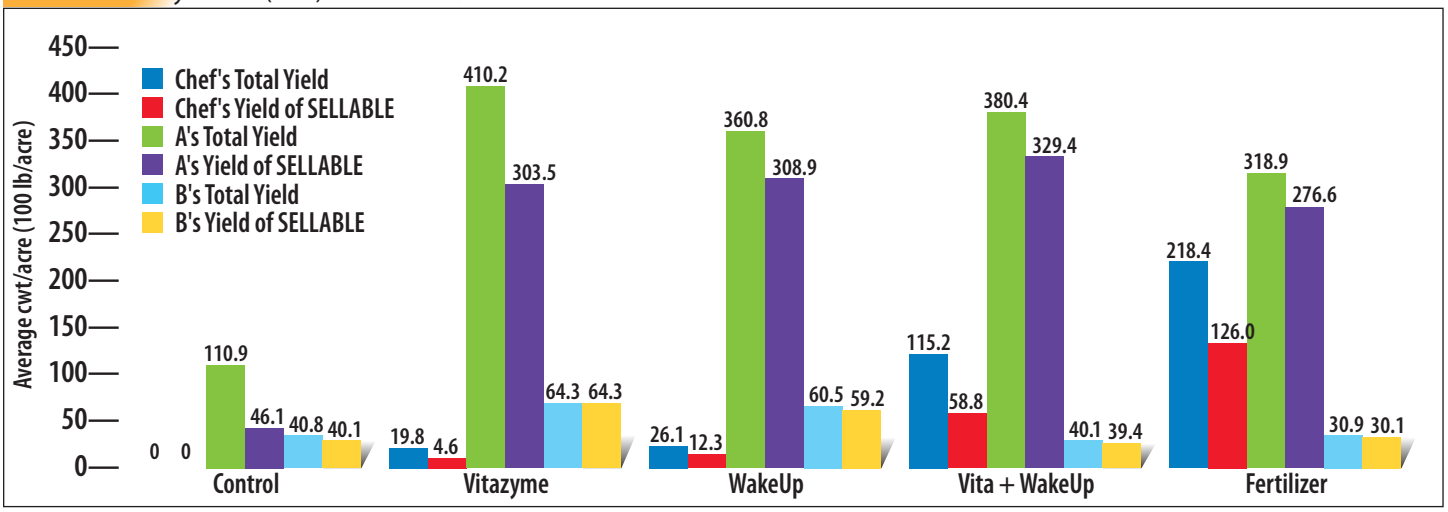
Emerged Plants on July 11



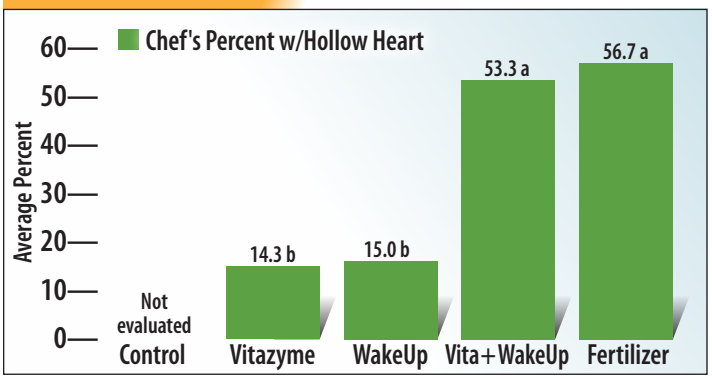
Dry Matter in Plant Foliage & Roots on September 5



Tuber Yield by Grade (Size)



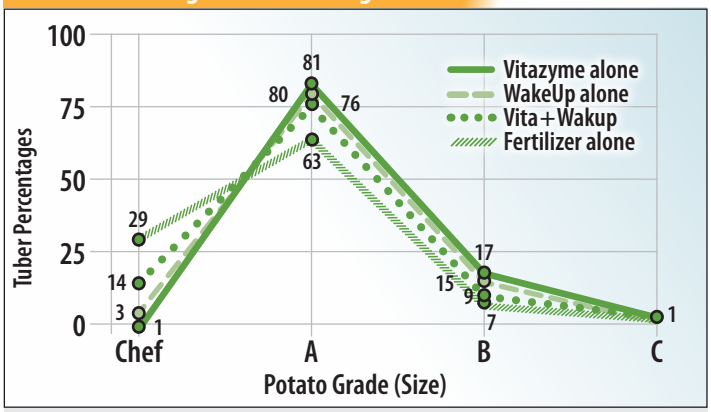
Hollow Heart in Tubers



Conclusions: A medium-sized plot potato trial in western New York produced very interesting results in terms of effects of Vitazyme, WakeUp, and fertilizer effects on the crop. All plots were treated with a 15-15-15 fertilizer, except for the control, and Vitazyme and WakeUp were applied in-furrow and twice more foliar—at tuber initiation and at tuber bulking. The statistically analyzed data revealed the following

- Significantly faster emergence of plants with Vitazyme and WakeUp, alone and in combination, compared to the control and fertilizer alone
- Greater height and width of plants mid-season for Vitazyme, WakeUp, and the combined products than fertilizer alone or the control
- Higher leaf chlorophyll with Vitazyme and WakeUp than the control, though Vitazyme alone and combined with the WakeUp had significantly more chlorophyll in the leaves than did WakeUp alone
- No significant difference in dry matter of the leaves and roots among th five treatments
- No significant total sellable tuber weight among the four treatments, all of them exceeding the control at P=0.10
- Significantly less hollow heart in Chef grade tubers for both Vitazyme and WakeUp alone (14.3 and 15.0%) compared to the combined products and to fertilizer alone (53.3 and 56.7%)
- Tuber size effects: The Vitazyme, WakeUp, and Vitazyme + WakeUp treatments all produced more medium-sized (Grades A and B) tubers than did the fertilizer treatment alone, though the fertilizer alone produced the greatest number of large (Chef) sized tubers. Note the following size distribution graph to the right.

Tuber Percentages in Size Categories*



*Based on percentage of sellable tubers for each size category.

Vitazyme and WakeUp Summer, alone and in combination, modified the fertilizer effects on potatoes by increasing the number of medium-grade tubers, especially Grade A, while reducing the number of large Chef-sized tubers. Total tuber yields were not significantly different.

Potatoes *with Vitazyme application*

Researcher: Vadim Plotnikov
Research organization: "Gontarevo" Farm, Ukraine, Plant Designs, New York, USA, and Agro Expert International, Ukraine
Location: Illintsi District, Vinnytsia Region, Slobodyshche Village, Ukraine
Variety: Grenada (generation 1)
Seeding rate: 50,000 tubers/ha
Planting date: April 25, 2017
Previous crop: wheat
Soil type: typical Chernozem; humus = 4.5%
Soil preparation: disking to 6-8 cm, plowing to 22-24 cm, harrowing to 10-12 cm
Experimental design: A potato field was divided into Vitazyme treated and untreated control areas to determine the efficacy of this product in promoting yield increases.

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

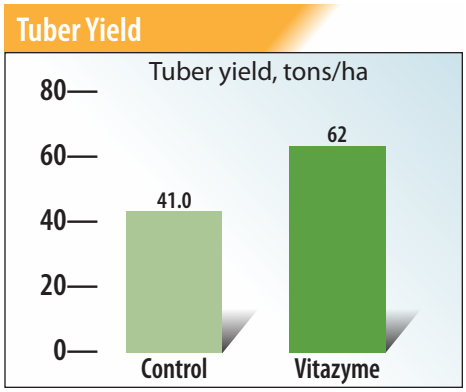
Fertilization: 40 tons/ha of manure before plowing, the fall of 2016, providing 200-100-240 kg/ha of $N\text{-}P_2O_5\text{-}K_2O$
Vitazyme application: 1 liter/ha sprayed on the leaves and soil at flower bud formation (June 11), and 1 liter/ha sprayed on the leaves at mid-flowering (July 1)
Growing season weather: dry

These potatoes grown in Ukraine show a pronounced advantage when treated with Vitayme. Note the plant size, tuber number, and tuber uniformity.

Yield results:

Treatment	Tuber yield	Yield change
	tons/ha	ton/ha
1. Control	41.0	—
2. Vitazyme	62.0	21.0 (+51%)

Yield increase in tuber yield with Vitazyme: 51%



Income results: At a price of $97.95/ton of potatoes, the added 21.0 tons/ha gave an additional $2,057/ha income.
Conclusions: A potato field-scale trial in central Ukraine proved that Vitazyme, applied two times at 1 liter/ha, at flower bud formation and at mid-bloom, yielded an additional 21.0 tons/ha of tubers (51%) compared with the untreated control. This additional yield provided the farmer an additional $2,057/ha of income, revealing the great efficacy of this program for potato production in Ukraine.

Soybeans *with Vitazyme application*

Researcher: Graig Reicks
Research organization: South Dakota Soybean Association
Location: Kingsbury County, South Dakota
Variety: AG 1935
Relative maturity: 1.8
Row spacing: 30 inches
Planting rate: 150,000 seeds/acre
Tillage: conventional
Previous crop: soybeans
Planting date: May 9, 2015
Soil type: Poinsett-Buse Complex, 2-6% slopes; Poinsett-Waubay silty loams, 1-6% slope; Poinsett-Buse-Forman, 5-9% slope
Seed treatment: fungicide, insecticide

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

Experimental design: A soybean field was planted in three alternating strips of in-furrow Vitazyme applications, the intervening strips serving as controls. The objective of the study was to discover if Vitazyme would increase soybean yield.

1 *Control* 2 *Vitazyme*

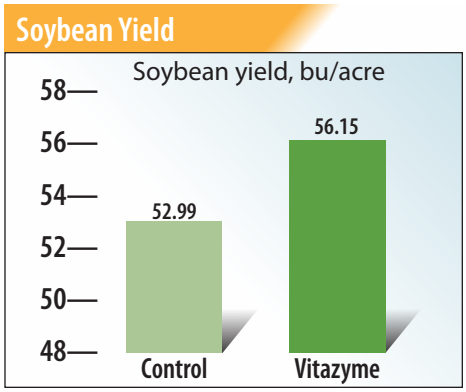
Fertilization: none
Vitazyme application: 13 oz/acre (1 liter/ha) in-furrow at planting
Growing season weather: favorable: 16.3 inches of rain, and 1,698 growing degree days from June 1 through August 31

Yield results:

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

*Significantly greater than the control at P=0.05.

Yield increase in soybean yield with Vitazyme: 6%



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

Soybeans *with Vitazyme application—A Greenhouse Study*

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

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

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

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

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

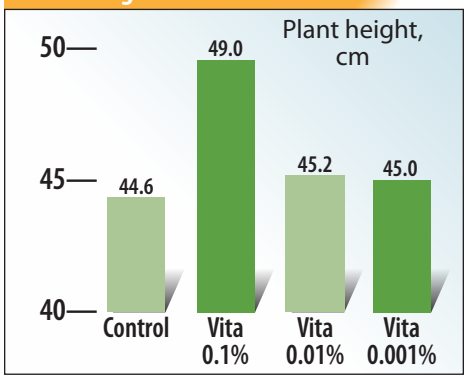
- **Treatments:** (1) Control, (2) 0.1% Vitazyme, (3) 0.01% Vitazyme, (4) 0.001% Vitazyme
- **Vitazyme application:** 100 ml of each treatment were applied at planting.
- **Data collection:** At five weeks after planting, shoots were cut off at the base, and roots were carefully washed with tap water.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

- **Results:** The 0.1% Vitazyme showed a significant increase in height compared to all other treatments.

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

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

Plant Height



Increase in plant height with 0.1% Vitazyme: 10%

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

Vitazyme Field Tests for 2017

Soybeans *with Vitazyme application*

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

1 *Control* 2 *Vitazyme*

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

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

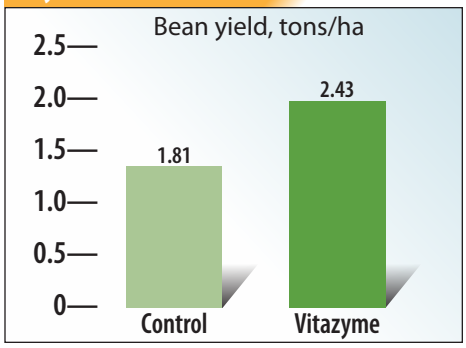
These Ukrainian soybean Rhizobium nodules reveal excellent nodulation, as indicated by the red color (leghemoglobin). Vitazyme assists nodule development and N-fixation.

Yield results:

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

Yield increase in soybean yield with Vitazyme: 34%

Soybean Yield



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

Soybeans *with Vitazyme application*

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

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

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

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

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

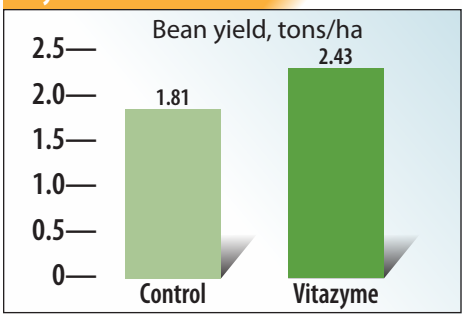
Yield results:

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

Yield increase in soybean yield with Vitazyme: 34%

Income increase: The extra yield of soybeans gave an increased income of $250/ha.

Soybean Yield



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

Vitazyme Field Tests for 2017

Soybeans *with Vitazyme application*

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

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

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

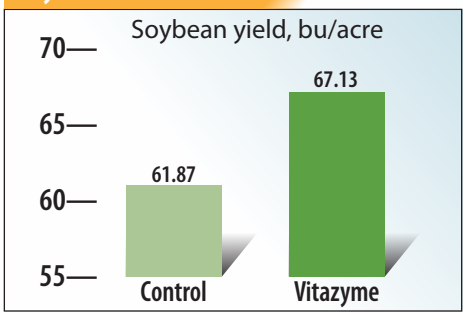
Yield results:

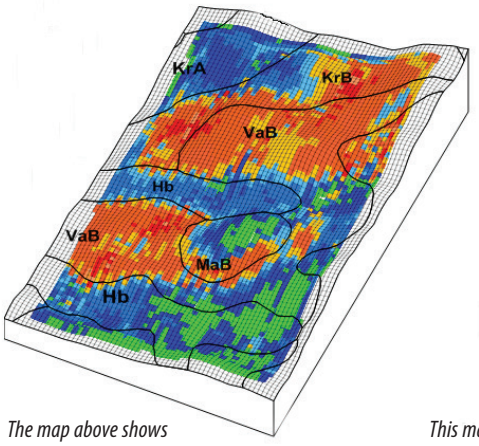
Treatment	Bean yield	Yield change
	bu/acre	bu/acre
1. Control	61.87	—
2. Vitazyme	67.13*	5.26 (+9%)

*Significantly greater than the control at P=0.05.

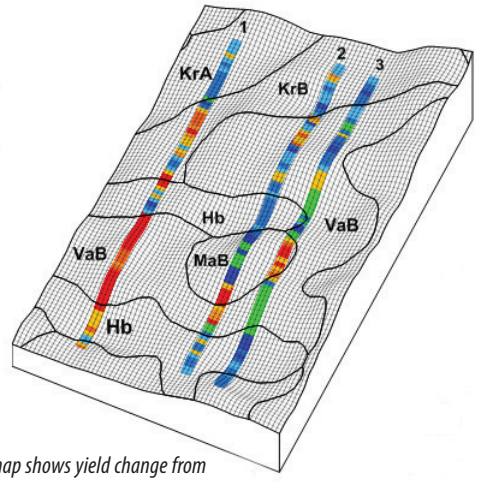
Increase in soybean yield with Vitazyme: 9%

Soybean Yield





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



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

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

Soybeans *with Vitazyme application*

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

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

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

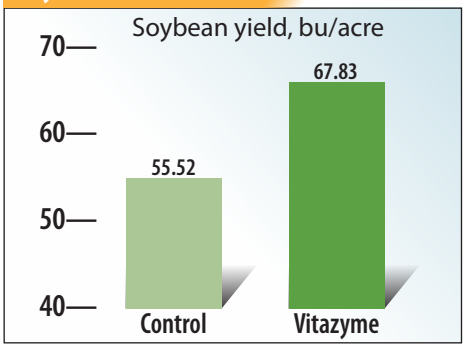
Yield results:

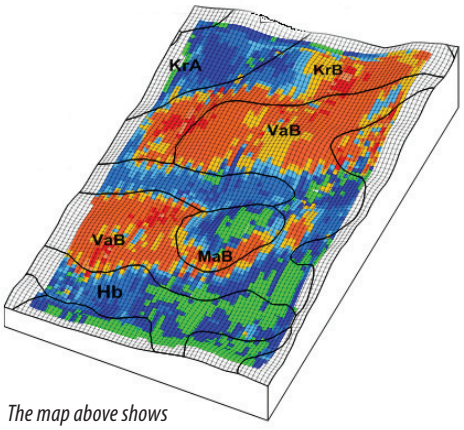
Treatment	Bean yield	Yield change
	bu/acre	bu/acre
1. Control	55.52	—
2. Vitazyme	67.83*	12.31 (+22%)

*Significantly greater than the control at P=0.05.

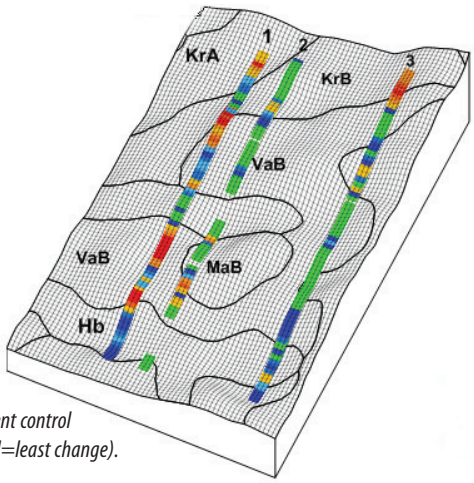
Increase in soybean yield with Vitazyme: 22%

Soybean Yield





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



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

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

Strawberries *A Thesis: Induction of Resistance to Gray Mold (Botrytis Cinerea)*

Researcher: Lucera Berenice Fernandez Alejandrez

Research institution : University of Guanajuato, Mexico, in cooperation with the University of Almeria, Spain

Degree objective: International Masters in Protected Agriculture (MIAP)

Location: Guanajuato, Mexico

Variety: Fragaria sp., variety Fortuna

Experimental design: A small-plot, replicated experiment was conducted in Irapuato, Guanajuato, México, in order to study the possible induction of resistance to Gray Mold (*Botrytis sp.*) in strawberries (*Fragaria sp.*), var. Fortuna, by a mixture of brassinosteroids + triacontanol + beta-vitamins (Vitazyme) and with the fungicide iprodione (Rovral WP 50), alone and combined. Evaluations were made of Botrytis incidence, Brix and firmness of the fruit, yield, and income.

Fertilization: Unknown

Vitazyme application: Either 0.5, 1.0, or 1.5 liters/ha were applied at 15-day intervals to the leaves.

Rovral application: Either 1.0 or 1.5 liters/ha were applied to the leaves at 15-day intervals.

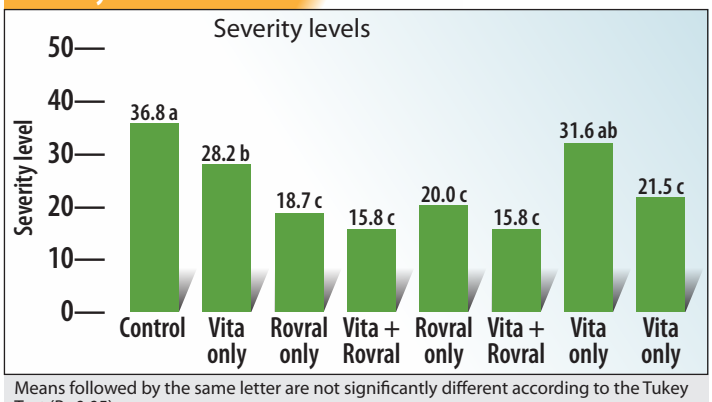
Treatment	Vitazyme*	Rovral*
	liters/ ha	kg/ha
1. (Control)	0	0
2. (Vita only)	1.0	0
3. (Rovral only)	0	1.0
4. (Vita + Rovral)	1.0	1.5
5. (Rovral only)	0	1.5
6. (Vita + Rovral)	1.0	1.0
7. (Vita only)	0.5	0
8. (Vita only)	1.5	0

*Three sprays on the leaves at 15-day intervals.

Strawberries are susceptible to fungal diseases under the right conditions, but Vitazyme is able to help the plant combat this problem through better nutrient uptake and improved plant health.

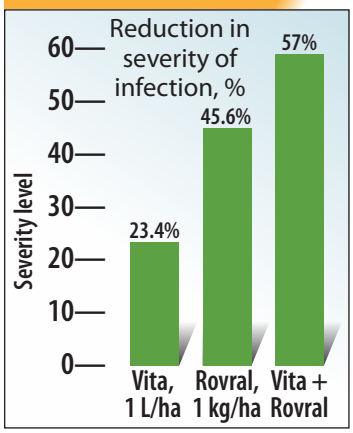
Botrytris infection results:

Severity of Infection



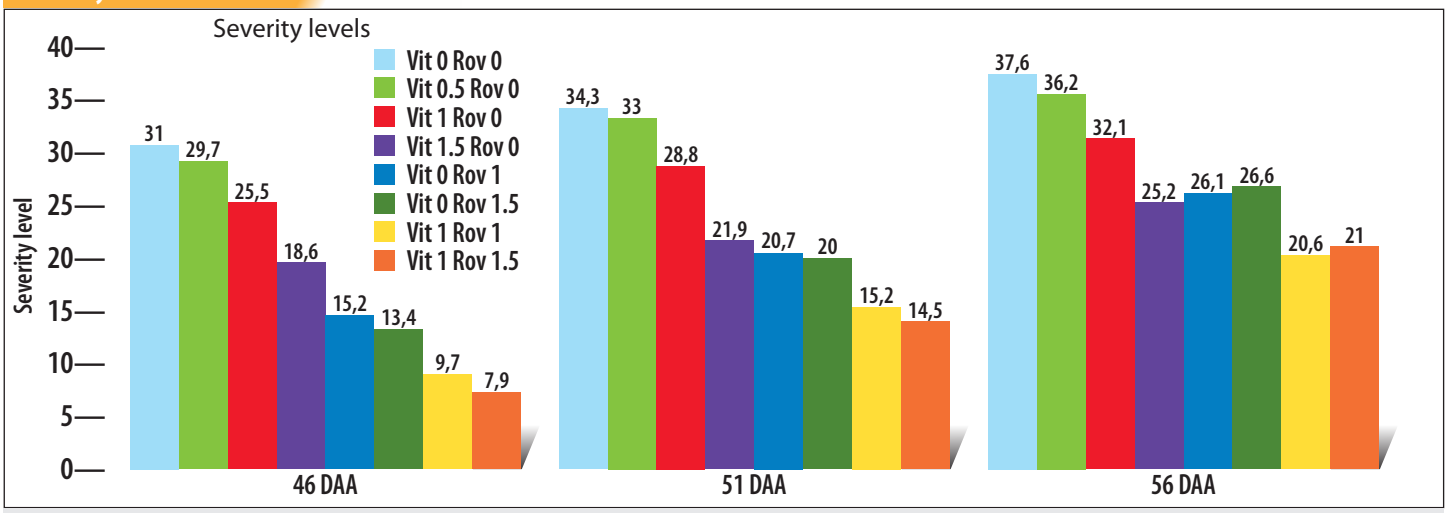
Means followed by the same letter are not significantly different according to the Tukey Test (P=0.05).

Reduction in Infection



Severity of Botrytis infection affected by Vitazyme and Rovral according to model y = 0.813 - 44.102* Rov + 8.205* $(Rov)^2$ + 0.436 *DAA*Rov - 5.519*$(Vit)^2$ + 0.657 *DAA. R = 0.973; R^2 = 0.948; Std. Error Estim. = 2.22; ANOVA F=65.14, sig = 0.000.

Severity of Infection



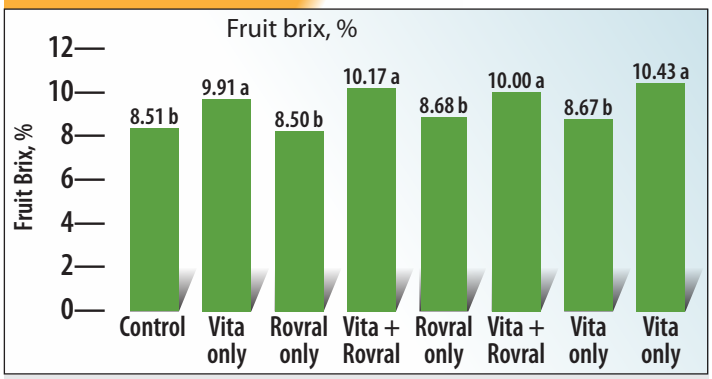
DAA = Days after application.

Both Vitazyme and Rovral had highly significant effects on the severity of Botrytis infection, as well as the incidence of it (data not shown). The best reductions in infection were with both products applied, as shown by the multiple regression analysis above.

On the other hand, the effect of Rovral (both on incidence and on severity) was influenced by the DAA or interval between application and evaluation. Thus in Rovral alone, the difference between 1.5 kg/ha and the Absolute Control (without Rovral and Vitazyme) changed from 35.3% in the initial evaluation at 46 DAA (66-30.7) to only 10.7% in the third evaluation at 56 DAA (66-55.3) while in severity the difference between Rovral 1.5 kg/ha and the Absolute Control remains constant during three evaluations-intervals (DAA), which shows a more lasting effect on the disease in Vitazyme than in Rovral. Thus, with Vitazyme, in the three evaluations the difference is 16.8% in incidence (66-49.2), and in severity is 12.4% (31-18.6; 34.3-21.9; and 37.6-25.2).

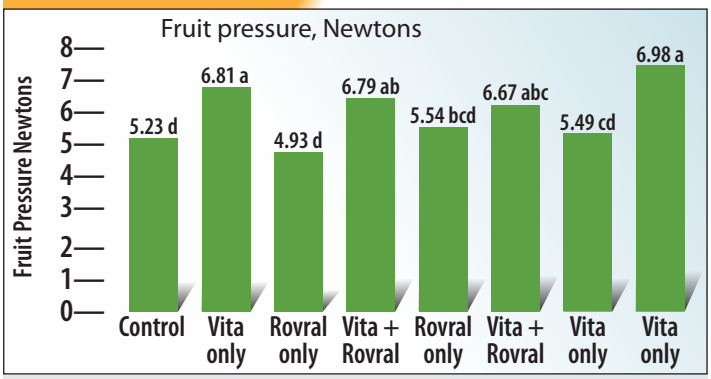
Brix and firmness results:

Fruit Brix



Means followed by the same letter are not significantly different at (P=0.05) according to the Tukey Test.

Fruit Pressure

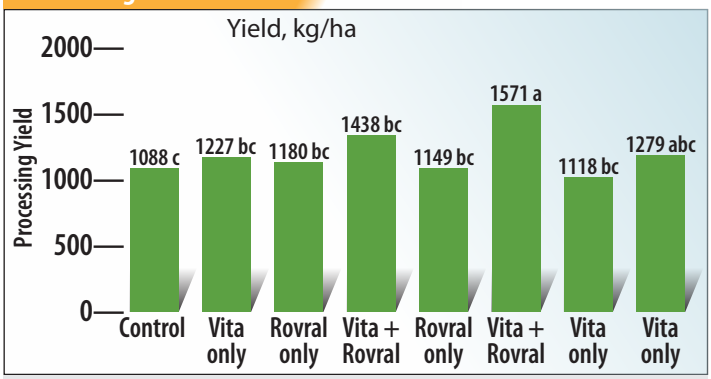


Means followed by the same letter are not significantly different at (P=0.05) according to the Tukey Test.

Vitazyme alone, at manufacturer-recommended rates of 1 and 1.5 L/ha (Treatments 2 and 8, respectively), increased significantly both the Brix or % of soluble solids (mean increase over the control or rate zero of 1.40 and 1.92 percentage points), as well as fruit firmness in 1.58 and 1.74 Newtons, respectively, which represents a marked improvement in fruit quality, while Rovral had no effect whatsoever on these two parameters, at any rate.

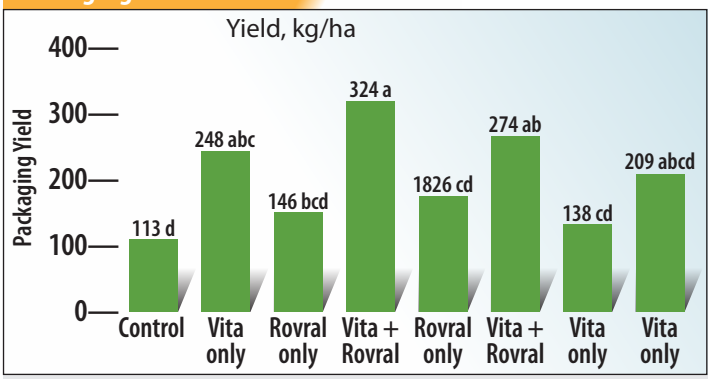
Yield results:

Processing Yield



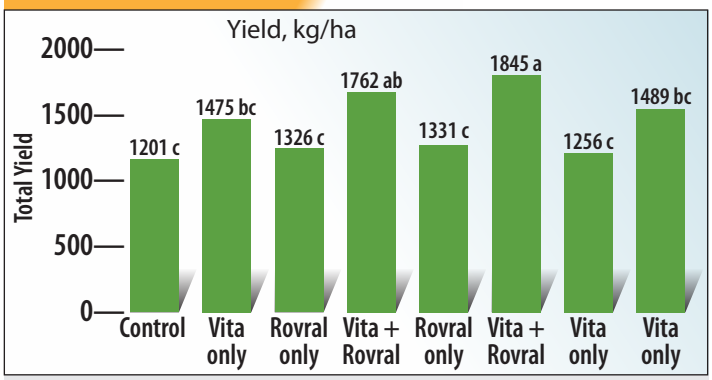
Means followed by the same letter are not significantly different at (P=0.05) according to the Tukey Test.

Packaging Yield



Means followed by the same letter are not significantly different at (P=0.05) according to the Tukey Test.

Total Yield



Means followed by the same letter are not significantly different at (P=0.05) according to the Tukey Test.

Total Yield Increase

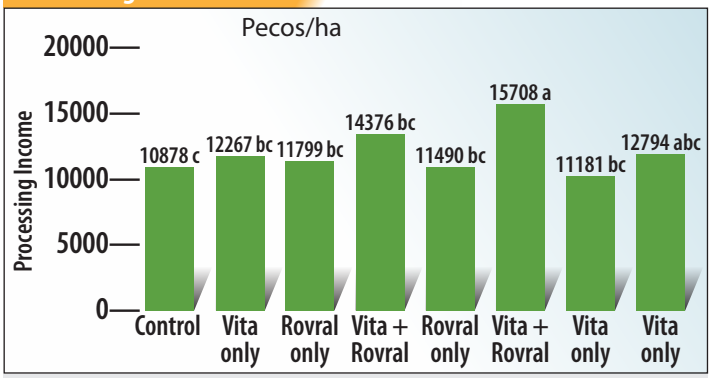
Vitazyme, 0.5 L/ha .....+5%
Vitazyme 1.0 L/ha.....+23%
Vitazyme, 1.5 L/ha .....+24%
Rovral, 1.0 kg/ha.....+10%
Rovral, 1.5 kg/ha.....+11%
Vita (1.0) + Rovral (1.0) ....+54%
Vita (1.0) + Rovral (1.5) ....+47%

The yield was increased the most by the combined Vitazyme + Rovral treatments (4 and 6), by 47% and 54%, respectively, Vitazyme alone progressively increased berry yield, by up to

24% above the control for the 1.5 liters/ha rate. Rovral alone increased the yield by 10% to 11%. Interestingly, the processing yield showed the fewest significant differences among treatments, while the packaging yield, which included the highest quality berries, showed remarkable differences among treatments. For example, a single 1 liter/ha Vitazyme treatment increased the packaging yield by 119%, while Vitazyme + Rovral increased the yield by 187%.

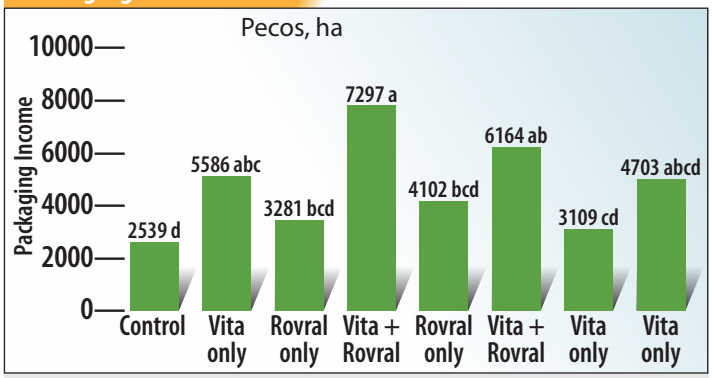
Income results: All values are gross income for the berry category.

Processing Income



Means followed by the same letter are not significantly different at (P=0.05) according to the Tukey Test.

Packaging Income



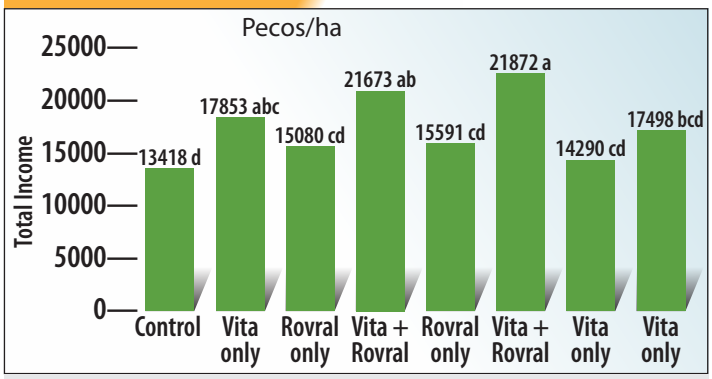
Means followed by the same letter are not significantly different at (P=0.05) according to the Tukey Test.

Conclusions: This thesis study with Vitazyme and Rovral fungicide in Mexico, to control Botrytis infection on strawberries, revealed the great power of Vitazyme to control the fungus, as well as improve fruit quality (Brix and pressure). Especially effective was the combination of the two materials. Botrytis incidence and severity were greatly reduced with each product alone, and in combination: 23.4% with Vitazyme, 45.6% with Rovral, and 57.0% when combined. Regression analyses showed highly effective reduction of infection and severity, especially with the combined products. Fruit Brix was significantly increased by Vitazyme—up to 1.92 points higher with 1.5 liter/ha—and by the combined products as well, and fruit pressure followed a similar pattern being 1.75 Newtons higher for the 1.5 liter/ha Vitazyme treatment. Only the low Vitazyme treatment (0.5 liter/ha) and both Rovral treatments showed no quality parameter improvements.

Yields of the Vitazyme treatments were increased by up to 24%, while Rovral alone boosted the yield by 10 to 11%, but the products applied together gave a 47 to 54% total yield boost. The packaging yield was especially, and significantly, enhanced by Vitazyme at 1.0 liter/ha and the two products applied together.

Finally, income was increased dramatically by Vitazyme at 1.5 liters/ha (9555 pesos/ha) and 1.0 liter/ha (11417 pesos/ha), but even more dramatically the yield was boosted by the combined Vitazyme and Rovral, at 20808 to 22627 pesos/ha. Especially noteworthy in this study is the observation that Rovral did not improve berry quality apart from Vitazyme, nor did it improve the yield nearly as much as Vitazyme alone. This study proves the great efficacy of Vitazyme, alone or combined with a fungicide, to control Botrytis fungi in strawberries, and thus greatly improve crop yield, quality, and net profits for the grower.

Total Income

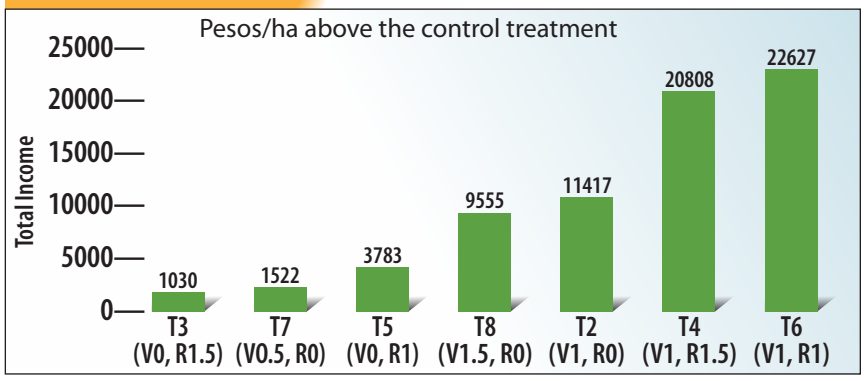


Means followed by the same letter are not significantly different at (P=0.05) according to the Tukey Test.

Profit results: The net profit for each treatment was calculated using the following values.

Item	Cost
Vitazyme	530 pesos/liter
Rovral	812.60
Labor	100 pesos/ha

Profit Results



Sunflowers *with Vitazyme application*

The head size has been dramatically improved in this central Ukraine sunflower study. Yield increases over 20% are common.

Researcher: Vadim Plotnikov
Research organization: State Enterprise "Drabivske", Plant Designs, New York, USA, and Agro Expert International, Ukraine
Location: Drabiv District, Cherkasy Region, Drabovo-Baryatinske Village, Ukraine
Variety: NK Neoma
Seeding rate: 50,000 seeds/ha
Planting date: April 26, 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 sunflower field was divided into Vitazyme treated and untreated control areas to determine the efficacy of this product in promoting yield increases.

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

Fertilization: 120 kg/ha of nitrogen broadcast before planting, and 10-26-26 kg/ha of N-P_2O_5-K_2O in-furrow starter at planting
Vitazyme application: 0.5 liter/ha sprayed on the leaves and soil at the 8 to10-leaf stage on June 10, 2017
Growing season weather: dry

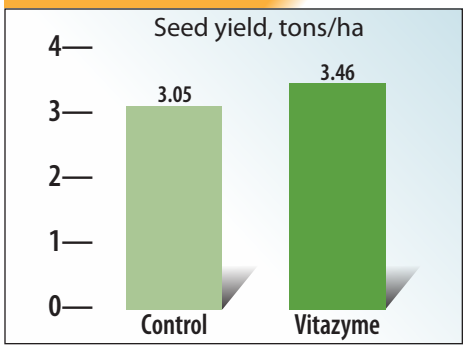
Yield results:

Treatment	Seed yield	Yield change
	tons/ha	ton/ha
1. Control	3.05	—
2. Vitazyme	3.46	0.41 (+13%)

Increase in sunflower seed yield with Vitazyme: 13%

Income increase: At a price of $397.56/ton of sunflower seeds, the added 0.41 ton/ha gave an additional $163/ha income.
Conclusions: This Vitazyme full-scale field trial with sunflowers in the Ukraine, utilizing just one foliar/soil application of 0.5 liter/ha at the 8 to 10-leaf stage, provided an excellent 0.41 ton/acre (13%) seed yield increase, which gained the farmer $163/ha more income. These results show how useful this program is for sunflower growers in Ukraine.

Sunflower Seed Yield



Vitazyme treated sunflowers in Ukraine display a much improved and vigorous root system, which translates into higher yields.

Sunflowers *with Vitazyme application*

Researcher: Vadim Plotnikov
Research organization: PJSC "Kurland", Ukraine, Plant Designs, New York, USA, and Agro Expert International, Ukraine
Location: Zhmerynka District, Vinnytsia Region, Tarasivka Village, Ukraine
Variety: NK Roki
Seeding rate: 50,000 seeds/ha
Planting date: May11, 2017
Previous crop: wheat
Soil type: brown podzolic; humus=2.0%
Seedbed preparation: disking to 6-8 cm, plowing to 22-24 cm, harrowing to 5-6 cm
Experimental design: A sunflower field was divided into Vitazyme treated and untreated control areas to determine the efficacy of the product in promoting yield increases.

❶ ***Control*** ❷ ***Vitazyme***

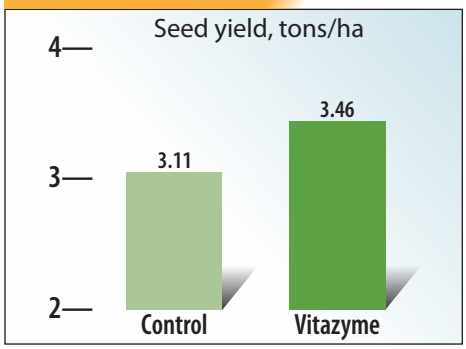
Fertilization: 20-20-12 kg/ha N-P_2O_5-K_2O broadcast before plowing, and 32/ kg/ha of N in-furrow at planting
Vitazyme application: 1 liter/ha sprayed on the leaves and soil at the 10-leaf stage on June 25, 2017
Growing season weather: dry
Yield results:

Treatment	Seed yield	Yield change
	tons/ha	ton/ha
1. Control	3.11	—
2. Vitazyme	3.46	0.35 (+11%)

Increase in sunflower seed yield with Vitazyme: 11%

Income increase: At a price of $362.86/ton of sunflower seeds, the added 0.35 ton/ha gave an additional $127/ha income.

Sunflower Seed Yield



Conclusions: A sunflower trial in a field in Ukraine in 2017, using a single 1 liter/ha application of Vitazyme at the 10-leaf stage, showed an 11% yield increase (0.35 ton/ha) despite very dry conditions during the growing season. This increase resulted in $127/ha greater returns to the farmer, revealing the excellent efficacy of this product for sunflower growers in Ukraine.

Tobacco *with Vitazyme application*

Researcher: Yaona Mtonga, agronomist, J.B. Mumba, senior technical officer, Neil A. Mphembera, soil chemist, and C. E. D. Mainjeni, plant pathologist
Research organization: Farmers Organization Limited, Malawi
Location: Kandiya Research Station, Lilongwe District, and Kabwafu Research Station, Northern Malawi
Transplanting date: December 6, 2016
Variety: unknown
Soil type: sandy loam

Soil Properties												
Time of analysis	pH		P		K		Ca		Mg		Organic matter	
	[1]Kand.	[2]Kab.	[1]Kand.	[2]Kab.	[1]Kand.	[2]Kab.	[1]Kand.	[2]Kab.	[1]Kand.	[2]Kab.	[1]Kand.	[2]Kab.
			---ppm---		---meq---		---meq---		---meq---		---%---	
Initial	5.29	5.74	8.93	14.67	0.18	0.15	3.89	3.05	1.37	0.76	3.40	0.86
Final	5.34	5.16	17.10	13.44	0.19	0.16	0.60	0.56	0.86	0.84	3.48	1.26

[1]Kand. = Kandiya Station; [2]Kab. = Kabwafu Station.

Experimental design: A flue-cured tobacco study was initiated at the two locations in Central Malawi using seven treatments (see right), organized in a randomized complete block design with three replications. Transplants were planted about three weeks before the onset of rains in plots consisting of four ridges spaced 1.2 meters apart, with 12 plants per row spaced 0.6 meter in the rows. Data was collected from the two middle rows, excluding the plants at the end of each row.

Treatment	Vitazyme	Fertilizer
1. Control	0	0%
2. Fertilizer only	0	100%
3. Vitazyme only	Yes	100%
4. Fertilizer only	0	75%
5. Vitazyme only	Yes	75%
6. Fertilizer only	0	50%
7. Vitazyme only	Yes	50%

Fertilization: 100% fertilizer = 32.4 g/plant of Super D + 6.24 g/plant CAN, broadcast (9 bags of Super D + 1.78 bags of CAN); 75% fertilizer = 24.3 g/plant of Super D + 4.68 g/plant of CAN, broadcast (6.75 bags of Super D + 1.34 bags of CAN); 50% fertilizer = 16.5 g/plant of Super D + 3.12 g/plant of CAN, broadcast (4.5 bags of Super D + 0.89 bag of CAN). Super D fertilizer: 10.5-24-20% N-P_2O_5-K_2O. CAN = calcium ammonium nitrate (27% N).

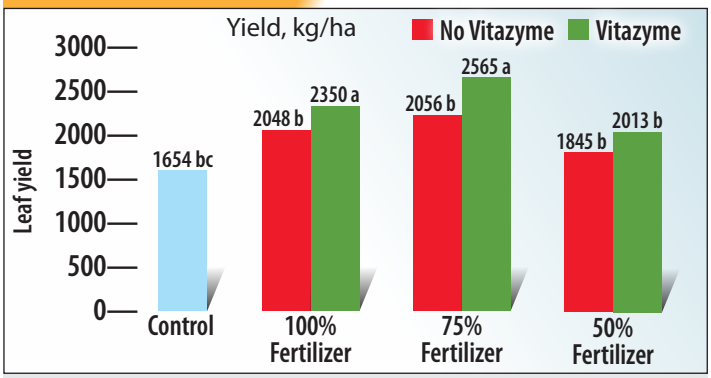
This tobacco comparison reveals the remarkable response expected with Vitazyme application (treated on the right). The photo was taken in Guatemala, with similar results to this Malawi trial.

Vitazyme application: (1) seedling dip in a 2.3% Vitazyme solution, which translated to 0.7 liter/ha; (2) 1 liter/ha of Vitazyme in the transplanting water; (3) 1 liter/ha as a foliar spray 21 days after planting using a backpack sprayer

Growing season weather: good, with 101.6 cm of rainfall at Kandiya during January and February, 2017; Kabwafu was much dryer

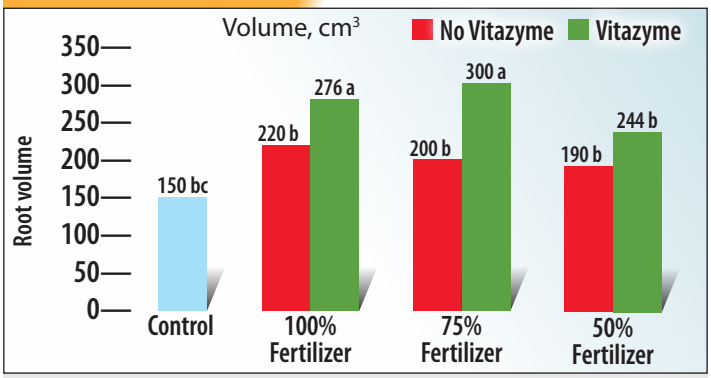
Yield results:

Leaf Yield



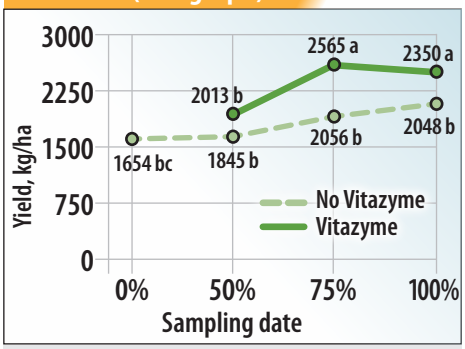
Means followed by the same letter are not significantly different at (P=0.05).

Root Volume



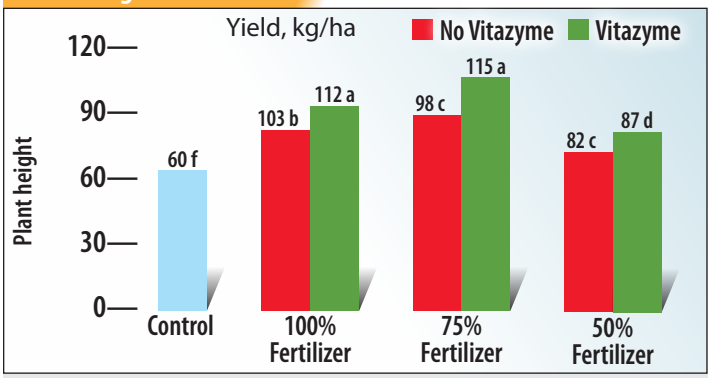
Means followed by the same letter are not significantly different at (P=0.05).

Leaf Yield (line graph)



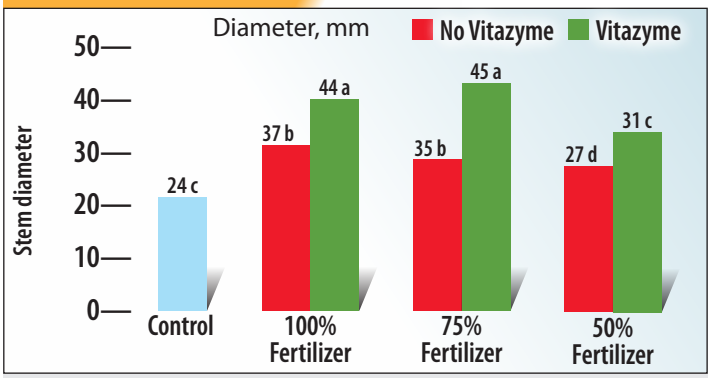
Means followed by the same letter are not significantly different at P=0.05.

Plant Height



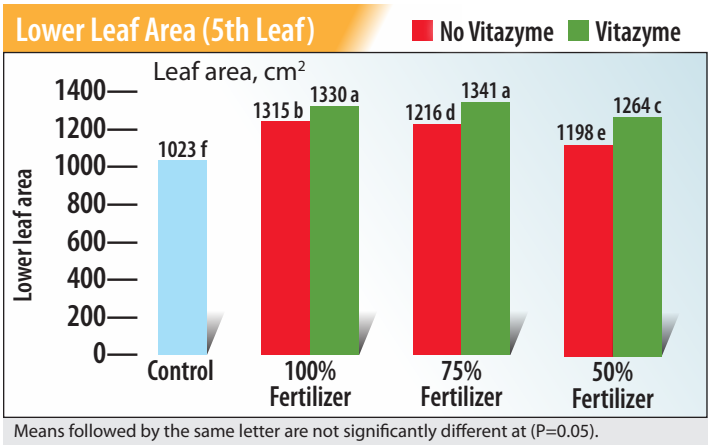
Means followed by the same letter are not significantly different at (P=0.05).

Stem Diameter



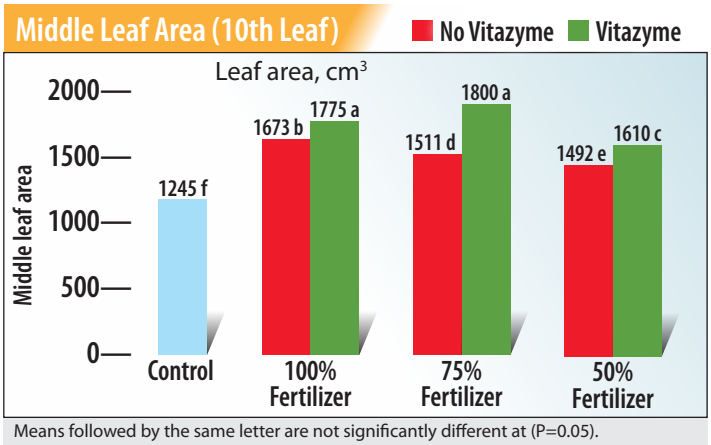
Means followed by the same letter are not significantly different at (P=0.05).

Lower Leaf Area (5th Leaf)

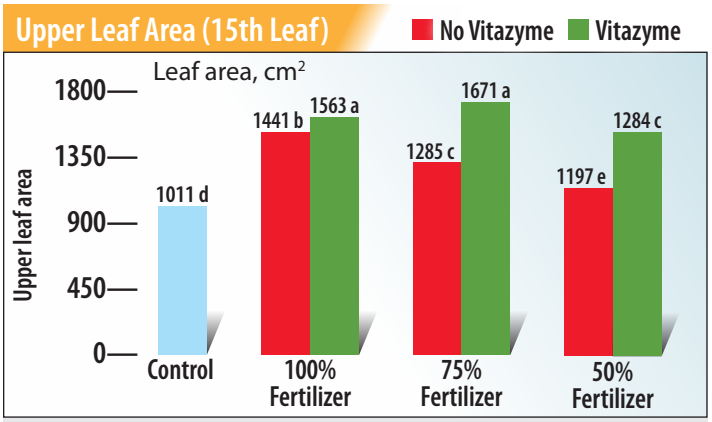


Means followed by the same letter are not significantly different at (P=0.05).

Middle Leaf Area (10th Leaf)



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=0.05).

Increase with Vitazyme [Comparisons with same fertilizer level]			
	100% Fert	75% Fert	50% Fert
Leaf yield	15%	25%	9%
Root volume	25%	50%	28%
Plant height	9%	17%	6%
Stem diameter	19%	29%	15%
Lower leaf area	29%	10%	6%
Middle leaf area	6%	19%	8%
Upper Leaf area	8%	30%	7%

In every comparison between the Vitazyme treatment and control treatment at the same fertilizer level, the Vitazyme treatment outperformed the control, and significantly in all but one case (upper leaf area at 50% fertilizer). These increases were substantial, ranging from 25% for yield at the 75% fertilizer level, to 50% for root volume of the same fertilizer level, to 29% for stem diameter, again at the 75% fertilizer level. Growth and yield increases were the greatest at the 75% fertilizer level, such that the highest overall yield, root volume, height, stem diameter, and leaf areas all exceeded the values for the 100% fertilizer level.

Leaf quality results:

Treatment	Leaf quality					Color distribution			
	1	2	3	4	5	Lemon	Orange	Mahogany	Green
	%					%			
1. Control	**7.8[d]**	17.7	27.9	25.6	10.8	22.0	**14.8[d]**	10.3	0.0
2. 100% Fert	**22.2[b]**	15.1	30.1	29.0	11.3	21.0	**26.6[c]**	10.3	1.2
3. 100% Fert + Vita	**23.5[b] (+6%)**	17.8	29.1	29.8	11.6	16.9	**33.2[b] (+25%)**	11.1	0.0
4. 75% Fert	**23.9[b]**	19.6	21.4	25.9	2.6	25.4	**25.7[c]**	5.1	0.7
5. 75% Fert + Vita	**30.2[a] (26%)**	14.5	23.6	29.1	14.4	17.2	**39.1[a] (+52%)**	6.9	0.4
6. 50% Fert	**16.0[c]**	19.3	27.2	18.6	13.8	24.2	**24.6[c]**	13.7	0.0
7. 50% Fert + Vita	**16.1[c] (+1%)**	17.3	30.9	23.9	11.1	24.3	**24.4[c] (-1%)**	11.8	1.5
CV, %[a]	10.2	54.3	39.4	32.9	62.9	31.4	24.0	73.3	209.1
F - value	0.029	0.972	0.925	0.317	0.534	0.787	0.024	0.960	0.242
LSD[b] 0.05	**5.001**	NS	NS	NS	NS	NS	**5.620**	NS	NS

[a]CV = Coefficient of Variability; [b]LSD = Least Significant Difference. Percentage of change is calculated within each fertilizer level for statistically significant parameters.

Leaf quality improvement

Vitazyme + 75% fertilizer: 26%

Leaf color improvement

Vitazyme + 75% fertilizer: 52%
Vitazyme + 100% fertilizer: 25%

Vitazyme improved leaf quality and color significantly at both the 75% and 100% fertilizer levels. This improvement was on top of yield improvements discussed above.

Income results:

Treatment	Input amounts		Tobacco yield	Gross income[1]	Added income[2]	Vitazyme cost[3]	Vitazyme benefit: cost
	Fertilizer	Vitazyme					
	bags/ha	liters/ha	kg/ha	$/ha	$/ha	$/ha	
2. 100% Fertilizer	10.78	0	2048	5222.40	—	—	
3. 100% Fert + Vita	10.78	27	2350	5992.50	770.10	35.10	**21.9**
4. 75% Fertilizer	8.09	0	2056	4626.00	—	—	
5. 75% Fert + Vita	8.09	27	2565	6540.75	1914.75	35.10	**54.6**
6. 50% Fertilizer	5.39	0	1845	4704.75	—	—	
7. 50% Fert + Vita	5.39	27	2013	5133.15	428.40	35.10	**12.2**

[1]Tobacco price = $2.55/kg. [2]Extra income due to Vitazyme effects at the same fertilizer level. [3]Cost per liter = $13.00.

Conclusions: A tobacco study in Malawi, at two research sites, using replicated small plots revealed that Vitazyme applied at planting as a seedling dip, and two foliar/soil spray applications, greatly and significantly improved tobacco yield and quality at the same fertilizer level, but especially at the 75% fertilizer rate. Yield was increased by 25% at the 75% fertilizer rate, 15% at the 100% fertilizer rate, and 9% at the 50% fertilizer rate. Moreover, root volume, plant height, stem diameter, and areas of lower, middle, and upper leaves were significantly increased with 2.7 liters/ha of Vitazyme during the growth period. Leaf quality and color evaluations also favored Vitazyme applications, especially at the 75% fertilizer rate, where the highest leaf quality was increased by 26% over the 75% fertilizer control. The orange leaf color was increased significantly by Vitazyme at this same 75% fertility level, by 52%. The income evaluation revealed that Vitazyme at all three fertility levels greatly improved returns on investment, by 21.9. 54/6. and 12.2 times at the 100%, 75%, and 50% fertilizer levels, respectively. These results show the great benefit of using Vitazyme for tobacco culture in Malawi.

Benefit: Cost Ratio for Vitazyme

At 100% fertilizer.....21.9
At 75% fertilizer 54.6
At 50% fertilizer 12.2

Vitazyme Field Tests for 2017

Winter Barley *with Vitazyme application*

Researcher: Vadim Plotnikov
Research organization: PJSC "Vin Agro," Ukraine, Plant Designs, New York, USA, and Agro Expert International, Ukraine
Location: Rozdilna District, Odessa Region, Kuchurgan Village, Ukraine
Variety: 9 Val (generation 1)
Seeding rate: 4.0 million seeds/ha
Planting date: November 26, 2016
Previous crop: sunflowers
Soil type: typical Chernozem; humus=4.4%
Soil preparation: plowing to 20-22 cm, harrowing to 4-5 cm
Experimental design: A winter barley field was divided into Vitazyme treated and untreated control areas to determine the efficacy of this product in promoting yield increases.

1 *Control* 2 *Vitazyme*

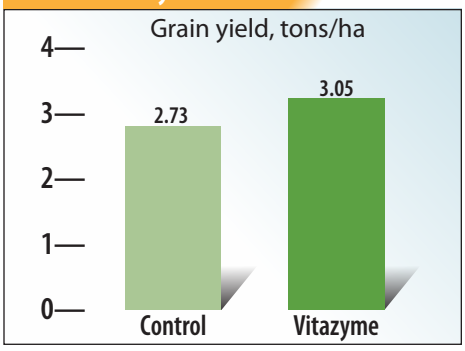
Fertilization: 15-15-15 kg/ha of N-P_2O_5-K_2O as a starter at planting, and 30 kg/ha of N broadcast in the spring
Vitazyme application: 0.5 liter/ha sprayed on the leaves and soil at flower bud formation (July 5), and 0.5 liter/ha sprayed on the leaves at mid-pod development (July 31)
Growing season weather: dry
Yield results:

Treatment	Grain yield	Yield change
	tons/ha	ton/ha
1. Control	2.73	—
2. Vitazyme	3.05	0.32 (+12%)

Increase in grain yield with Vitazyme: 12%

Income results: At a price of $193.75/ton of barley, the added 0.32 ton/ha gave an additional $62/ha income.

Winter Barley Grain Yield



Conclusions: A barley study of farmer-field size was conducted during a very dry year in southern Ukraine. Despite the low yield, a 1 liter/ha Vitazyme application in the spring improved the yield by 0.32 ton/ha (12%), giving an enhanced income of $62/ha, showing the value of Vitazyme as a very useful and profitable barley treatment, even during drought situations.

Winter Barley *with Vitazyme application*

Researcher: Vadim Plotnikov
Research organization: "Svitanok" Farm, Ukraine,Plant Designs, New York, USA, and Agro Expert International, Ukraine
Location: Sarat District, Odessa Region, Nadia Village, Ukraine
Variety: Luran (generation 1)
Seeding rate: 4.0 million seeds/ha
Planting date: October 10, 2016
Previous crop: sunflowers
Soil type: typical Chernozem; humus=3.5%
Soil preparation: disking to 6-8 cm, plowing to 20-22 cm, harrowing to 4-5 cm
Experimental design: A winter barley field was divided into Vitazyme treated and untreated control areas to determine the efficacy of this product in promoting yield increases.

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

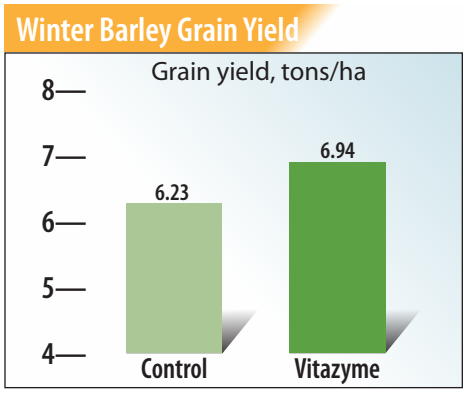
Fertilization: 10-26-26 kg/ha of N-P_2O_5-K_2O as starter at planting, and 65-36 kg/ha N-S broadcast in the spring
Vitazyme application: 1 liter/ha sprayed on the leaves and soil in the spring (April 7, 2017)
Growing season weather: dry

Barley grown in a trial with Vitazyme in Ukraine reveals advanced growth compared to the control. Note the growth stage, plant biomass, and root development.

Yield results:

Treatment	Grain yield	Yield change
	tons/ha	ton/ha
1. Control	6.23	—
2. Vitazyme	6.94	0.71 (+11%)

Increase in grain yield with Vitazyme: 11%



Income results: At a price of $178.87/ton of barley, the added 0.71 ton/ha gave an additional $127/ha income.
Conclusions: This winter barley trial in southern Ukraine revealed that Vitazyme increased the grain yield by 0.71 ton/ha (11%), which provided an income improvement of $127/ha for a single application at 1 liter/ha in the spring. Such results show the great efficacy of this program for barley growers in Ukraine.

Winter Canola *with Vitazyme application*

Researcher: Vadim Plotnikov
Research organization: "Zolota osin" Farm, Ukraine, Plant Designs, New York, USA, and Agro Expert International, Ukraine
Location: Ivanivka District, Odessa Region, Rosiiska Slobidka Village, Ukraine
Variety: ES Artist
Seeding rate: 0.4 million seeds/ha
Planting date: August 15, 2016
Previous crop: wheat
Soil type: typical Chernozem; humus=4.1%
Soil preparation: disking to 10-12 cm, plowing to 20-22 cm, harrowing to 3-4 cm
Experimental design: A winter canola field was divided into Vitazyme treated and untreated control areas to determine the efficacy of this product in promoting yield increases.

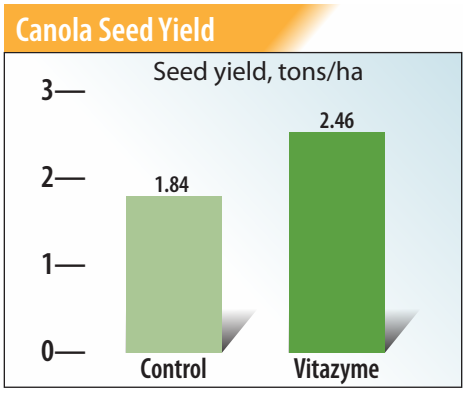
1 ***Control*** **2** ***Vitazyme***

Fertilization: 12-12-12 kg/ha of N-P_2O_5-K_2O as starter at planting, and 52 kg/ha of N broadcast in the spring
Vitazyme application: 0.5 liter/ha sprayed on the leaves and soil at flower bud formation (April 30, 2017)
Growing season weather: dry
Yield results:

Treatment	Seed yield	Yield change
	tons/ha	ton/ha
1. Control	1.84	—
2. Vitazyme	2.46	0.62 (+34%)

Increase in seed yield with Vitazyme: 34%

Vitazyme treatments on canola in Ukraine resulted in excellent growth enhancement for both samples shown on the right side of this photo.



Income results: At a price of $475.81/ton of canola seed, the added 0.62 ton/ha gave an additional $295/ha income.
Conclusions: This winter canola southern Ukraine farm field Vitazyme trial, using one 0.5 liter/ha spray in the spring, proved that this program increased yield by 0.62 ton/ha (34%). This increase provided another $295/ha income, showing that Vitazyme is a highly viable adjunct to farming programs for canola growers in Ukraine.

Winter Wheat *with Vitazyme application*

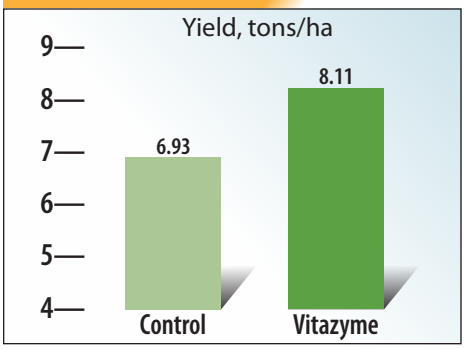
Researcher: Vadim Plotnikov
Research organization: "Dashkivtsi", Ukraine, Plant Designs, New York, USA, and Agro Expert International, Ukraine
Location: Lityn District, Vinnytsia Region, Dashkivtsi Village, Ukraine
Variety: Mulan (generation 2)
Seeding rate: 6 million seeds/ha
Planting date: October 3, 2016
Previous crop: soybeans
Soil type: gray-brown podzolic; humus=2.0%
Soil preparation: disking to 20-22 cm, cultivation to 14-15 cm, pre-sowing cultivation to 5-6 cm
Experimental design: A winter wheat field was divided into a Vitazyme treated area and a untreated control area to determine the effect of this product on grain yield and protein content.

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

Fertilization: 51-52-52-36 kg/ha of N-P_2O_5-K_2O -S broadcast during fall cultivation; 150 kg/ha of N applied in the spring
Vitazyme application: 1 liter/ha sprayed on the leaves and soil on May 3, 2017
Growing season weather: dry
Yield and quality results:

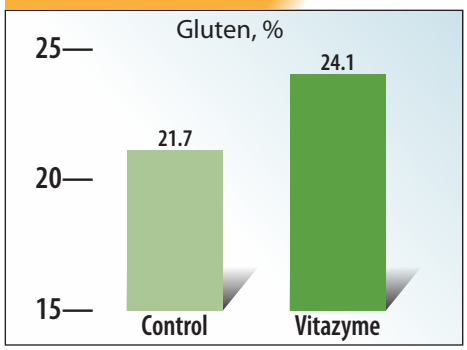
Income results: At a price of about $190.68/ton, the added income from the extra 17% grain produced is $225.
Conclusions: A winter wheat field-scale trial in central Ukraine, using 1 liter/ha foliar applied in the spring, produced an excellent 1.18 ton/ha (17%) yield increase compared to the untreated control. Moreover, grain quality improved, with 24 percentage points more gluten and 1.3 percentage points more crude protein. As a result, the return to the farmer for this one liter application was an impressive $225/ha, showing the great efficacy of this program for wheat farmers in Unkraine.

Grain Yield



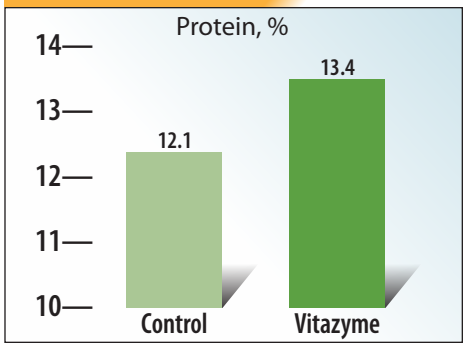
Increase in grain yield with Vitazyme: 17%

Grain Gluten



Increase in grain gluten with Vitazyme: 2.4 percentage points

Grain Crude Protein



Increase in grain crude protein with Vitazyme: 1.3 percentage points

Winter Wheat *with Vitazyme application*

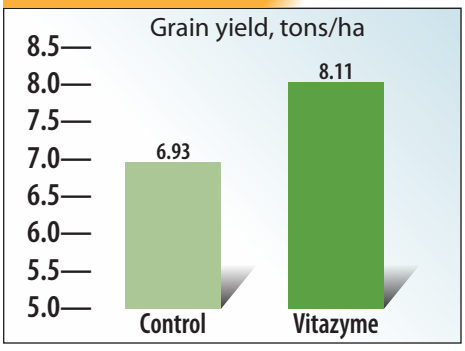
Researcher: Vadim Plotnikov
Research organization: LLC "Dashkivtsi"
Location: Litinsky District, Vinnitsia Region, Dashkivtsi Village
Variety: Mulan (generation 2)
Seeding rate: 6 million seeds/ha
Planting date: October 3, 2016
Previous crop: soybeans
Soil type: ashy gray, humus=2.0%
Seedbed preparation: disking to 20-22 cm, cultivation to 14-15 cm, and a pre-planting cultivation to 5-6 cm
Experimental design: A field of winter wheat was divided into an untreated control area and a Vitazyme treated portion to evaluate the effect of this treatment on the yield and quality of grain.

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

Fertilization: (1) A pre-plant application of 51-52-52-36 kg/ha of N-P_2O_5-K_2O-S, (2) 150 kg/ha of N broadcast in the spring.
Vitazyme application: 1 liter/ha foliar sprayed on May 3, 2017
Growing season weather: dry
Yield results:

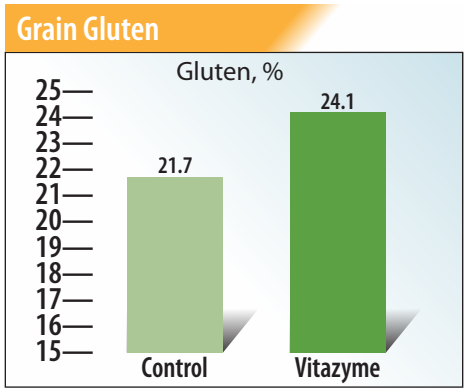
Treatment	Grain yield	Yield change
	tons/ha	ton/ha
1. Control	6.93	—
2. Vitazyme	8.11	1.18 (+17%)

Yield increase of winter wheat with Vitazyme: 17%

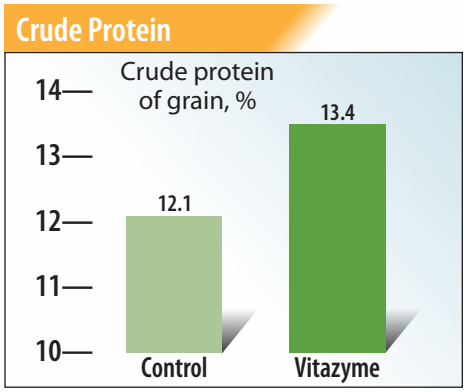


Vitazyme applied to winter wheat in Ukraine produced an excellent yield response of 17%, while increasing grain protein as well.

Grain quality results:



Grain gluten increase in winter wheat with Vitazyme: 2.4% percentage points



Grain protein increase in winter wheat with Vitazyme: 1.3% percentage points

Income results: The yield improvement in this wheat study caused an income increase of $225/ha.
Conclusions: This winter wheat study in Ukraine, using only one application of 1 liter/ha on May 3, produced an excellent yield increase of 17%, while in addition improving the gluten and crude protein by 2.4 and 1.3 percentage points, respectively. Besides, these improvements led to an income increase of $225/ha, proving how effective this program is for wheat growers in Ukraine.

Winter Wheat *with Vitazyme application*

Researcher: Vadim Plotnikov
Research organization: "Oskar" Farm, Ukraine, Plant Designs, New York, USA, and Agro Expert International, Ukraine
Location: Velyka Mikhailivka District, Odessa Region, Kardamychevo Village, Ukraine
Variety: Cubus (generation 3)
Seeding rate: 4.5 million seeds/ha
Planting date: September 21, 2016
Previous crop: sunflowers
Soil type: typical Chernozem; humus=4.3%
Soil preparation: disking to 6-8 cm, harrowing to 4-5 cm
Experimental design: A winter wheat field was divided into Vitazyme treated and untreated control areas to determine the efficacy of this product in promoting yield and grain quality increases.

1 *Control* 2 *Vitazyme*

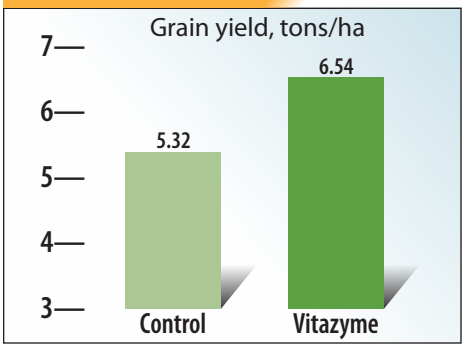
Fertilization: 10-26-26 kg/ha of N-$P_2 0_5$-$K_2 0$ starter at fall planting, and 65-35 kg/ha of N-S broadcast in the spring.
Vitazyme application: 0.5 liter/ha sprayed on the leaves and soil in the fall (October 26, 2016), and 0.8 liter/ha sprayed on the leaves in the spring (April 10, 2017)
Growing season weather: dry
Yield and grain quality results:

Treatment	Grain yield	Yield change
	tons/ha	ton/ha
1. Control	5.32	—
2. Vitazyme	6.54	1.22 (+23%)

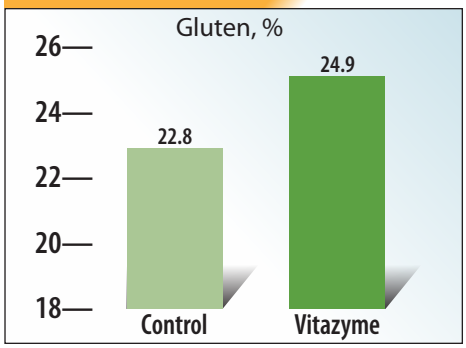
Increase in grain yield with Vitazyme: 34%

Young wheat plants from Ukraine reveal much better early growth when treated with Vitazyme on the seeds. The usual rate applied is 1 liter/ton of seed.

Winter Wheat Yield

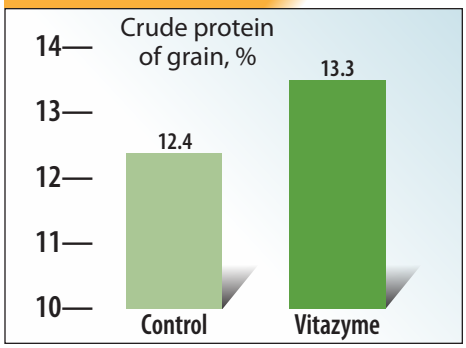


Grain Gluten



Increase in grain gluten with Vitazyme: 2.1 percentage points

Grain Crude Protein

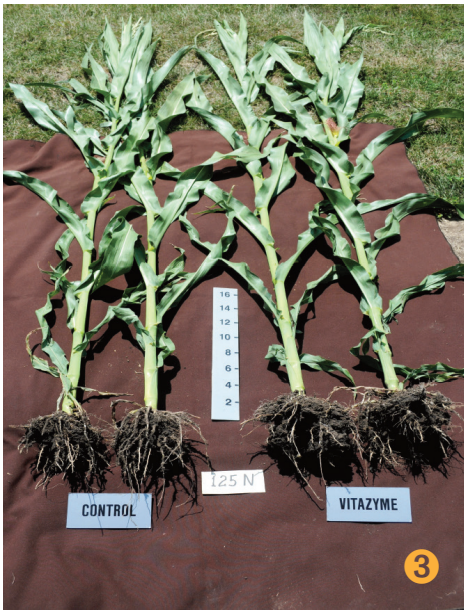


Increase in grain gluten with Vitazyme: 0.9 percentage point

Income results: At a price of $190.98/ton for winter wheat, the added 1.22 tons/ha gave an additional $233/ha income.
Conclusions: A southern Ukranian full-field study using Vitazyme plant and soil supplement, at 0.5 and 0.8 liter/ha in the fall and spring, respectively, resulted in an excellent yield gain of 1.22 tons/ha (23%) compared to the untreated control. Grain gluten also increased (2.1 percentage points), as did crude protein (0.9 percentage point). Farmer income rose by $233/ha, showing the great utility of this program for Ukrainian wheat farmers.

Vitazyme *Improves Nitrogen and Water Efficiency.*

A study conducted by Dr. David Clay and Graig Reicks at South Dakota State University, at the Aurora Research Farm in 2014 ***(photo 1)***, revealed that



Vitazyme improves corn yield, while significantly increasing the efficiency of nitrogen and water utilization. The season was wet and yields in general in the area were high, but even so a typical high nitrogen rate of 125lb/acre produced superior leaf and stalk growth ***(photo2)***, and expanded the root mass considerably above the non - Vitazyme treated control ***(photo 3)***. Ear size was noticeably increased in representative ears sampled at harvest time ***(photos 4 and 5)***. Note the longer and wider ears with Vitazyme treatment. The yield of grain was increased significantly by about 9 bu/acre, and nitrogen efficiency was improved by 0.66 bu/lb of N. Moreover, the yield loss due to water stress was reduced from 14.2 bu/acre in the control to only 5,0 bu/acre with Vitazyme. These results show how a simple addition of this product to the grower's program can improve the yield of grain through improved fertilizer and water utilization.

It is a program designed for corn growers everywhere whose intent is to maximize yields with a minimum of nitrogen use.

Corn yield at 125 lb N/acre

Control..... 161.0 bu/acre
Vitazyme ..... 170.1 bu/acre

Nitrogen efficiency at 125 lb/acre

Control..... 0.400 bu/lb of N
Vitazyme ..... 0.466 bu/lb of N

Yield loss from water stress at 125 lb N/acre

Control..... 14.2 bu/acre
Vitazyme ..... 5.0 bu/acre

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