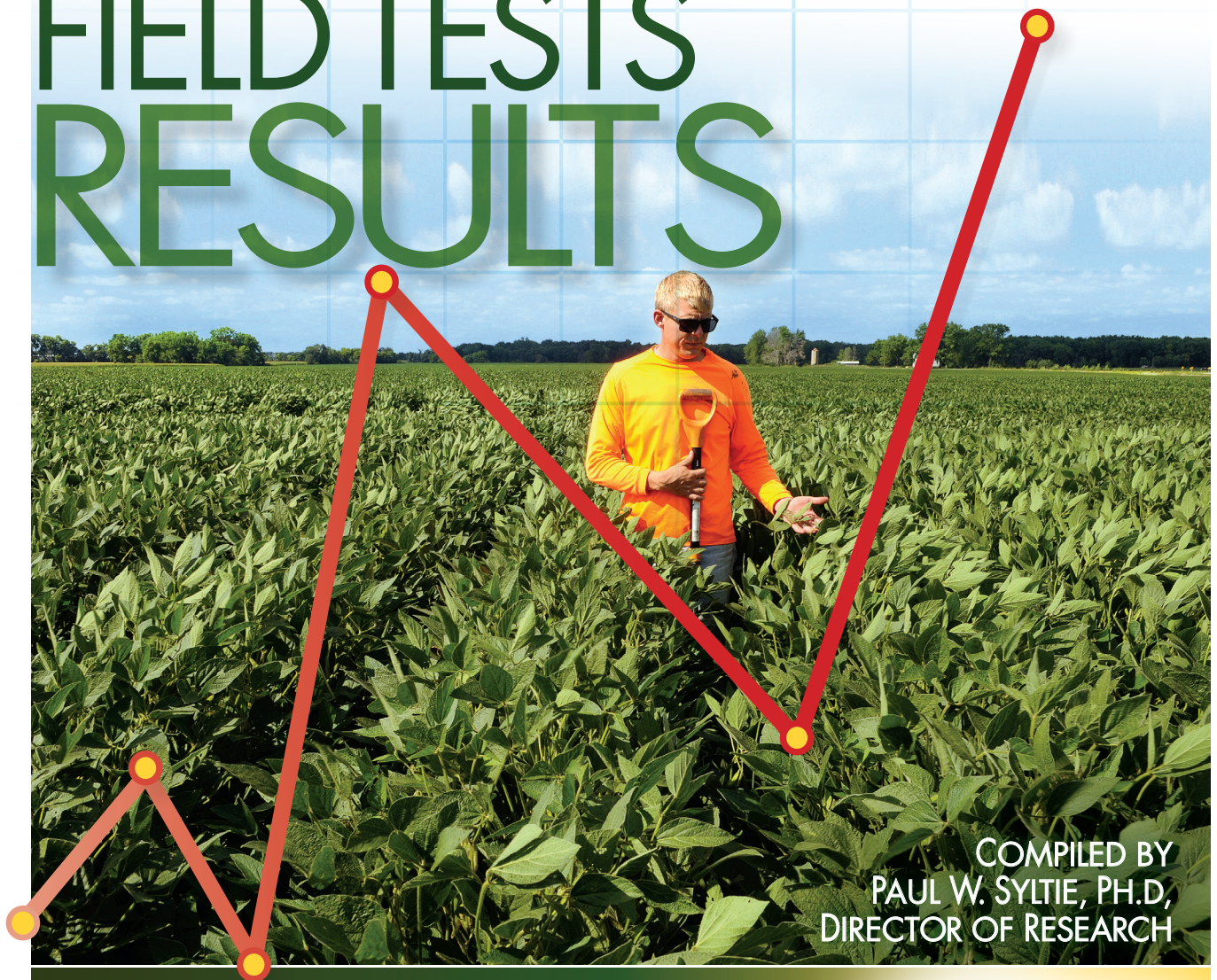




28TH EDITION

A SUMMARY
OF EXPERIMENTS
USING VITAZYME
SOIL, SEED, & PLANT
TREATMENT
ON FIELD,
ORCHARD, &
GREENHOUSE
CROPS

VITAZYME 2023 FIELD TESTS RESULTS



COMPILED BY
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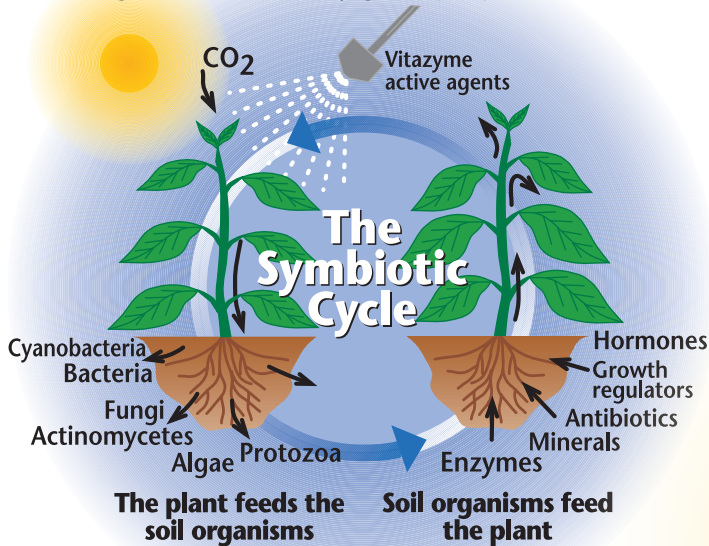
Introduction *How Vitazyme works within the plant-soil system.*

This is the twenty-ninth edition of Vitazyme crop reports, documenting research results from around the world on the successful use of this versatile biostimulant for all soils and climates.

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

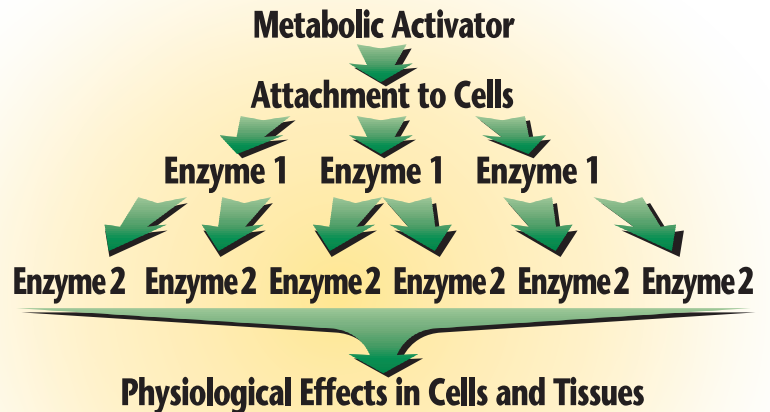
Nitrogen Fertilizer Reduction Guide with Vitazyme

Obtain a score for each of these four items

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	
Add the scores above to find the N-reduction										
Total score			15	14	13	12	11	10	9	8
% of optimum N to apply			← 50-60% →			← 60-70% →			← 70-80% →	

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.
- 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 *Improvement in Fertilizer Efficiency.*

Vitazyme Highlights for 2023

The year 2023 was a trying time for farmers in many parts of the world, with drought, floods, pathogen and pest invasions, frost, and heat taking their toll. In spite of these troubles, Vitazyme continued to show excellent responses in field trials and farmers' fields. With rising fertilizer costs being a major problem for most farmers, there was a concerted effort in 2023 to add to the growing list of studies that show Vitazyme is a major instigator of improved fertilizer efficiency.

This booklet contains the results of three exhaustive fertilizer trials using reduced fertilizer rates to illustrate how Vitazyme improves fertilizer efficiency. A fourth study, at the University of Missouri, is not included because of late submission of the data.

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

2. Vinnitsya, Ukraine. A small-plot study in Ukraine at the Institute of Food and Agriculture in the Podillya Region used a single application of Vitazyme at 1 liter/ha at the 6-7 leaf stage of corn. Two corn varieties were used, one for silage and grain and the other for grain only. Nitrogen applications of 60 and 120 kg/ha were applied to both varieties, and growth, plant characteristics, and grain parameters were measured. It was shown that plant height, leaf number, node number, and leaf area were all significantly increased with both Vitazyme and N; Vitazyme increased these values at both N levels. Silage production increased from 43.47 tons/ha at 60 kg/ha N without Vitazyme to 46.64 kg/ha with Vitazyme applied, to 48.51 tons/ha with 120 kg/ha

of N alone, and 50.84 tons/ha with Vitazyme at this higher N rate. Silage quality was also improved with both N and Vitazyme in terms of protein, fat, ash, NES, and feed value (digestibility). Grain production was likewise improved at both N levels, and Vitazyme increased the grain yield for both varieties at both N levels by 5 to 18%. These increases were a reflection of taller plants having a greater stalk diameter, greater root mass (up to 16%), longer and heavier cobs having slightly more rows, with heavier grain and greater grain density.

3. Fairbank, Iowa. A small-plot corn trial in east-central Iowa compared the effects of Vitazyme, applied at 13 oz/acre (1 liter/ha) in-furrow at planting and again at V 6, with no Vitazyme at fertilizer levels of 100%, 75%, 50%, and 25% of the optimum fertilizer rate for a high yield potential. There were no significant effects for grain test weight, but there was a non-significant positive effect on reducing grain moisture at harvest. Effects of Vitazyme on yield were noted at the 100% fertilizer level (+ 2%), 75% level (+ 9%), and the 25% level (+13%). These results show that the brassinosteroids, 1-triacontanol, B-vitamins, and other components of Vitazyme, applied at very low levels, are very capable of improving fertilizer use at all application levels, especially at low fertilizer rates. In this study, the 25% fertilizer plus Vitazyme treatment increased the yield by 24.1 bu/acre, which, at a price for corn at \$4.75/bu, gives an income increase of \$114.48 for an investment of about \$15.00 in Vitazyme. The cost: benefit is about 7.6:1. The highest yield attained in this study was at the 75% fertilizer level — 23.14 bu/acre — which had received two applications of Vitazyme. Compared to the 75% fertilizer control, a yield increase of 19.2 bu/acre netted \$91.20/acre more income, giving a cost: benefit of about 6.1:1.

4. Memphis Tennessee. A small-plot cotton study in western Tennessee proved that Vitazyme, applied at 13 oz/acre (1 liter/ha) in-furrow at planting and again at 13 oz/acre (1 liter/ha) 34 days after emergence, significantly boosted plant vigor 13 days after planting, a vigor that carried on through the growing season to produce significantly more yield at harvest, at the 50, 75, and 100% fertilizer levels. Lint + seed yield increased by from 9 to 13% for these three levels, and lint alone by from 8 to 13%. These results strongly suggest the ability of Vitazyme biostimulant to improve fertilizer use efficiency in cotton cultivation.



Alfalfa with Vitazyme application

Researcher: Michael Rethwisch

Research organization: University of California Cooperative Extension, Riverside County, Blythe, California

Location: Blythe, California

Variety: unknown

Planting date: fall of 2022

Planting method: flat planted

Soil type: unknown

Irrigation: flood irrigated

Experimental design: An alfalfa field was divided into four replicates of three treatments each, each plot being about 7 acres. The objective of the study was to determine the effect of two products — Vitazyme and Primacy Alpha — on the yield and quality of the alfalfa over several cuttings

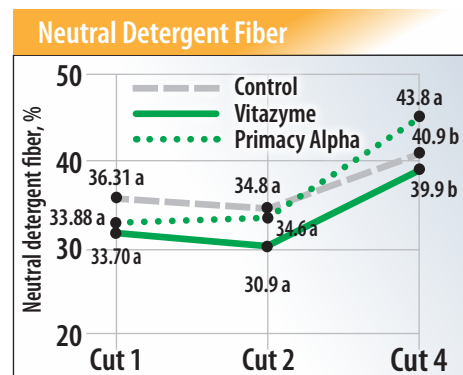
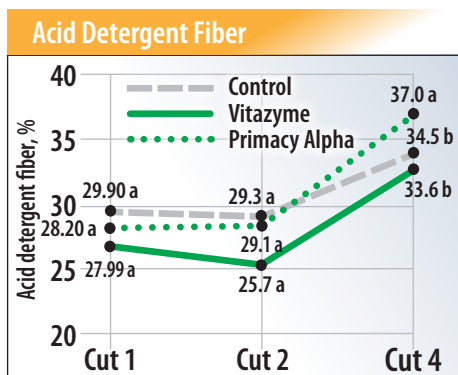
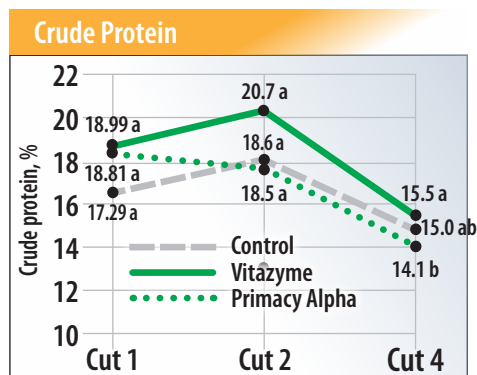
1 Control 2 Vitazyme 3 Primacy Alpha

Vitazyme application: 20 oz/acre (1.5 liters/ha) in four applications: (1) January 14, 2023, at a 10 gallon/acre sprayer volume; (2), (3), and (4) on the cutting dates of four cuttings, applied from the swather during cutting

Primacy Alpha application: 1 quart (32 oz)/acre (2.5 liters/ha) in four applications, in the same manner as the Vitazyme applications. Primacy Alpha is a foliar fertilizer containing 3% N (as NH₄⁺ and NO₃⁻), 7% soluble K (as K₂O), 3% S, 0.1% B, 0.5% Mn-EDTA, and 0.5% Zn-EDTA. It is a product of Verdesian Life Sciences U. S. LLC, Cary, North Carolina, which contains patented technologies discovered by Los Alamos National Laboratories and the University of California at Riverside. Its claims are to catalyze reproductive growth, optimize plant metabolism, encourage rapid plant nutrient uptake, promote plant growth, and enhance consistent crop quality and yield potential.

Yield results: Due to difficulties at harvest, reliable alfalfa weights per plot could not be collected.

Quality results: Each plot had two winrows sampled the day before or the day of baling. One foot of winrow was cut and placed in a large paper bag and delivered to Stanworth Laboratories in Blythe, California, for NIR analyses. No samples were taken for the third cut. Means followed by the same letter in the graphs are not significantly by different at P = 0.05 (Student T Test).



Increase in crude protein with Vitazyme

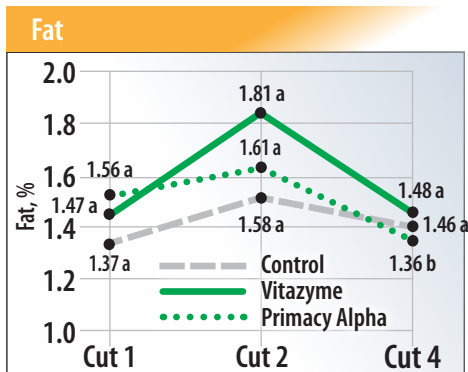
Cut 1 1.70%-points
 Cut 2 2.2%-points
 Cut 4 1.4%-points

Decrease in acid detergent fiber with Vitazyme

Cut 1 1.91%-points
 Cut 2 3.6%-points
 Cut 4 3.4%-points

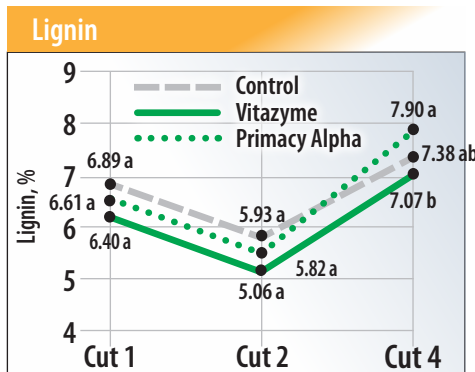
Decrease in neutral detergent fiber with Vitazyme

Cut 1 2.61%-points
 Cut 2 3.9%-points
 Cut 4 1.0%-points



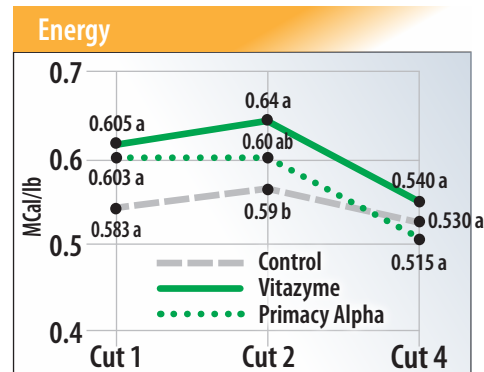
Increase in fat with Vitazyme

Cut 1 0.19%-points
 Cut 2 0.23%-points
 Cut 4 0.02%-points



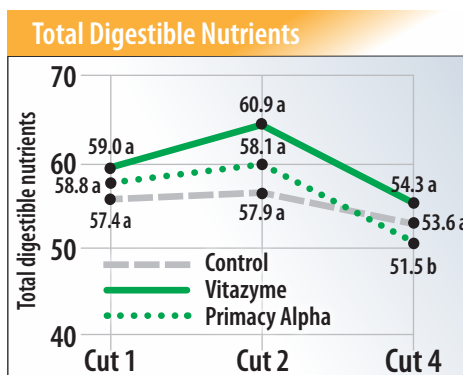
Increase in lignin with Vitazyme

Cut 1 0.49%-points
 Cut 2 0.87%-points
 Cut 4 0.31%-points



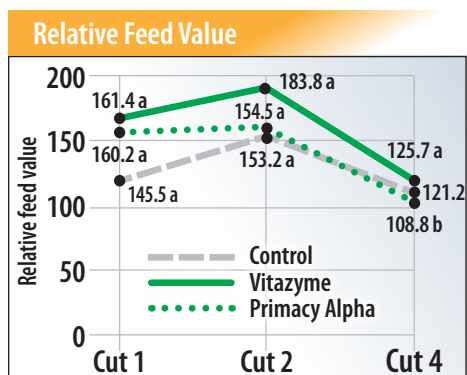
Increase in energy with Vitazyme

Cut 1 0.22 MCal/lb
 Cut 2 0.05 MCal/lb
 Cut 4 0.01 MCal/lb



Increase in total digestible nutrients with Vitazyme (at 100% dry matter)

Cut 1 + 1.6
 Cut 2 + 3.0
 Cut 4 + 0.7



Increase in relative feed value with Vitazyme

Cut 1 + 15.9
 Cut 2 + 30.6
 Cut 4 + 4.5

Conclusions: This field scale alfalfa trial with Vitazyme and Primacy Alpha, applied in the winter and after each cutting in 2023, revealed that Vitazyme increased the important feed-value factors of the forage: protein, fat, energy, total digestible nutrients, and relative feed value, while reducing the non-nutritive acid and neutral fiber, and lignin. The changes were consistent in every case, with crude protein being increased above the control by 2.2%-points for cut 2. Greatest increases in feeding value were for cut 2, and cut 4 had the lowest values. Though many of the changes were not significant at P = 0.05, the trends are highly consistent. Primacy Alpha gave results generally between the control and Vitazyme values. These results suggest that Vitazyme applied at 20 oz/acre (1.5 liters/ha) after alfalfa cuttings will boost the feeding quality of hay. Unfortunately, due to problems of data collection at harvest, it was not possible to evaluate forage yields.



Canola (Winter) with Vitazyme Bio on Winter Canola

Researchers: Vadim V. Plotnikov

Research organization:

Agro Expert International, Kaharlyk, Ukraine, and Plant Designs International, Rochester, New York

Location: Salag Agro LLC, Bolgrad District, Odessa Region, Vesely Kut Village, Ukraine; southern Ukraine (270-350 mm of precipitation per year)

Variety: Hybrivok

Planting date: August 15, 2022

Planting rate: 400,000 seeds/ha

Previous crop: winter wheat

Tillage: disking to 10-12 cm

Planting depth: 2 cm with a Pottinger planter

Soil type: Mollisol (2.5% organic matter)

Experimental design:

A field-scale winter canola trial in southern Ukraine was designed to compare the effect of Vitazyme Bio on canola seed yield. A portion of the field was left untreated while the rest of the field received a biostimulant application.

① Control ② Vitazyme Bio

Fertilization: An in-furrow application of 6 kg/ha of N and 11 kg/ha of P₂O₅ was made at fall planting. Then 40 kg/ha of N was top-dressed in the spring.

Vitazyme Bio application: 0.5 liter/ha sprayed on the leaves and soil at BBCH 59 (bud stage), on April 26, 2023



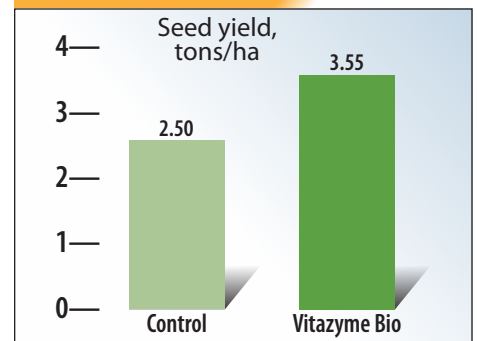
This beautiful field of canola was treated with Vitazyme Bio at the bud stage, and produced a major yield increase of 42% above the untreated control.

Yield results:

Treatment	Yield	Yield change
	tons/ha	tons/ha
1. Control	2.50	—
2. Vitazyme Bio	3.55	1.05 (+42%)

Yield increase with Vitazyme Bio: 42%

Canola Seed Yield



Income results: : With a 1.05 ton/ha (42%) yield increase with Vitazyme Bio, the farmer netted \$388/ha more income.

Conclusions: This winter canola trial, which utilized only 0.5 liter/ha of Vitazyme Bio in part of the field at the bud stage, revealed that the seed yield was improved by a remarkable 42% with this biostimulant. Income was also increased, by \$388/ha. These results prove how profitable Vitazyme Bio use can be for canola farmers in southern Ukraine.



Corn with Vitazyme application

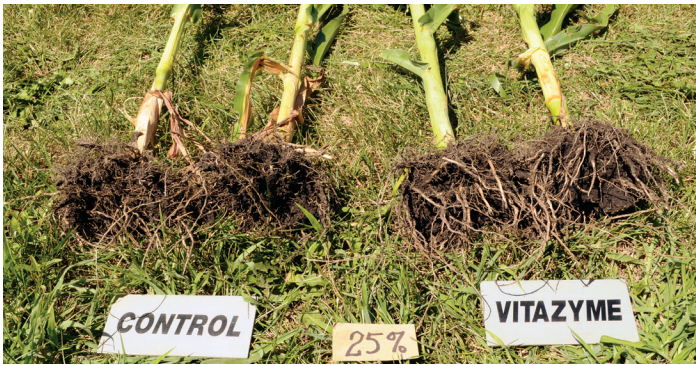
Researcher: Jonathan Jaschen **Research organization:** ACRES Research, Cedar Falls, Iowa
Location: Fairbank, Iowa **Variety:** P0339Q **Planting date:** May 22, 2023 **Planting depth:** 2.5 inches
Row spacing: 30 inches **Planting rate:** 34,000 seeds/acre **Previous crop:** soybeans
Soil: Marshan clay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

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

Fertilization: See the table to the right.

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

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



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



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



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



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

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

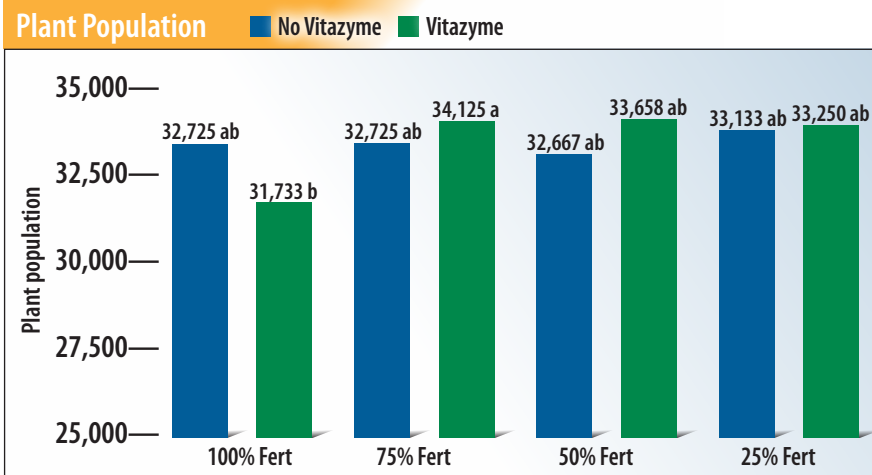


Herbicide applications: Unknown

Growing season weather: favorable throughout the growing season.

Harvest date: October 24, 2023. An MF8 plot combine was used to harvest an area of 5 x 30 feet for each plot.

Plant population results: Plant populations for the eight treatments ranged from 31,733 to 34,125 plants/acre. The values are shown in the graph below.



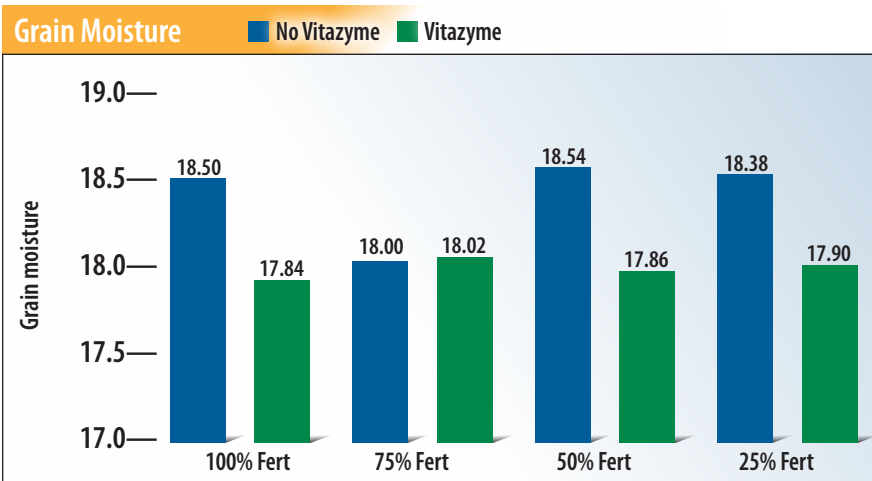
For some unknown reason there was a significant reduction in plant population for the 100% fertilizer + Vitazyme treatment (2). This was significantly less than the 75% fertilizer + Vitazyme treatment (4) by 2,392 plants/acre.

LSD (0.05) = 1,202 plants/acre.

Grain test weight results: There were no significant differences in test weight among the eight treatments.

The weights ranged from 59.34 to 60.50 lb/bu.

Grain moisture content results: The grain moisture content at harvest for the eight treatments did not differ significantly, but there was a definite trend towards dryer grain with the Vitazyme treatments.



Grain moisture change at harvest with Vitazyme

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

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

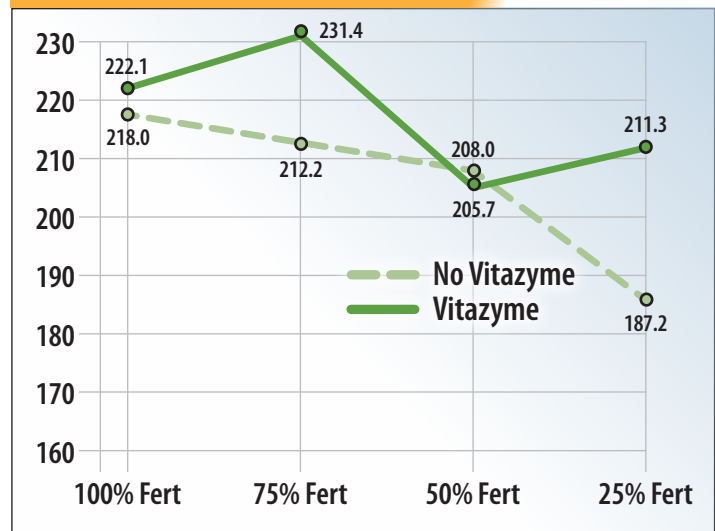
Average reduction in grain moisture content at harvest with Vitazyme: 0.45%

LSD (0.10) = 0.73%.

Grain yield results:

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

Corn Yield



Change in yield with Vitazyme at the same fertilizer level

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

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

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



Corn with Vitazyme application

Researcher: Bruce Kirksey, Ph.D. **Research organization:** AgriCenter International, Memphis, Tennessee
Location: Memphis Tennessee **Variety:** DKC 65-95VT2P **Planting date:** May 26, 2023
Planting depth: 1.5 inches **Planting rate:** 34,000 seeds/acre **Tillage:** conventional
Row spacing: 30 inches **Conditions at planting:** excellent **Row spacing:** 30 inches
Soil traits: Falaya silt loam, 1.3% organic matter, pH 7.3, cation exchange capacity 6.8 meq/100g, good drainage, excellent fertility.

Experimental design: A small-plot corn trial was established using plots that were 10 x 30 feet, with four 30-inch rows per plot. Four replications were used for each treatment. The purpose of the trial was to evaluate the effect of four fertilizer rates, from 25 to 100% of normally applied rates for optimal yield, on the yield of grain, to reveal the effect of Vitazyme, applied in-furrow and foliar, on the efficiency of fertilizer use.

Fertilizer and Vitazyme applications: See the table below.

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

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

Weed control: herbicides

Growing season weather: favorable, with adequate moisture, though summer temperatures were somewhat above normal.

Harvest date: October 20, 2023, with an Almaco plot combine. The harvested area for each plot was two rows (5 feet), 30 feet long, or 0.00344 acre. The center two rows of each plot were harvested, for 30 feet.

Grain moisture results: Grain moisture varied from 12.90% to 14.29%, the highest value for the 100% fertilizer without Vitazyme control.

No differences were significant, however.

Grain Test weight results: Grain test weights varied from 54.8 to 57.7 lb/bu, but were not significantly different among the eight treatments.

Grain yield results:

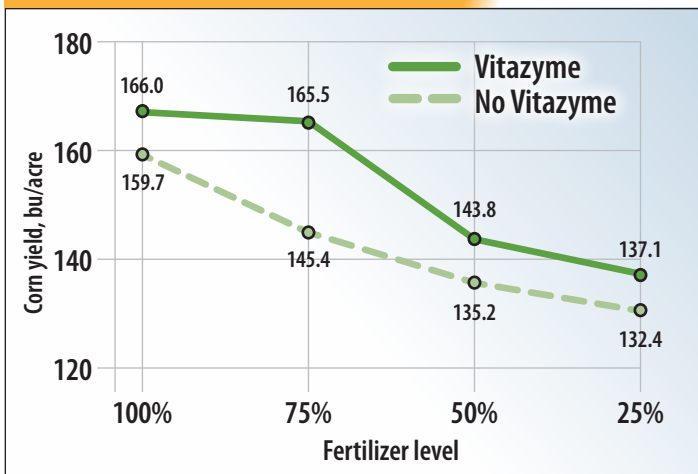
Treatment	Grain yield*	Yield change at the same fertilizer level
	bu/acre	bu/acre
1. 100% fertilizer	159.7 a	—
2. 100% fert + Vitazyme	166.0 a	6.3 (+4%)
3. 75% fertilizer	145.4 b	—
4. 75% fert + Vitazyme	165.5 a	20.1 (+14%)
5. 50% fertilizer	135.2 b	—
6. 50% fert + Vitazyme	143.8 b	8.6 (+6%)
7. 25% fertilizer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

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

Change in yield with Vitazyme at the same fertilizer level

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

Corn Yield



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

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

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



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



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



Corn with Vitazyme application

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

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

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

Climatic zone: forest-steppe

Planting date: May 6, 2022

Seeding rate: 65,000 seeds/ha

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

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

Previous crop: winter wheat

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

Experimental design: A research field at the Vinnytsya Institute of Food and Agriculture was allocated to two replications for each variety in an experiment utilizing Vitazyme Bio, as a foliar spray, at two nitrogen fertilizer rates, to determine the effects of this biostimulant on plant characteristics — especially those relevant to silage production — as well as on grain yield and economic values. Each of the varieties was arranged according to the diagram shown. Each plot covered an area of 44.8 m².



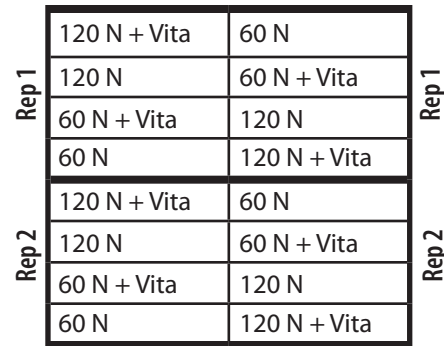
1). DKS 3400



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

Treatment	Corn variety		Fertilizer treatment (NH ₄ NO ₃)		Vitazyme
	DKS 3400	SG 189	60 kg/ha	120 kg/ha	
1	x	—	x	—	—
2	x	—	x	—	x
3	x	—	—	x	—
4	x	—	—	x	x
5	—	x	x	—	—
6	—	x	x	—	x
7	—	x	—	x	—
8	—	x	—	x	x

Plot Diagram



DKS -3400 SG 189

Each plot was 2.8 x 16.0 m, or 44.8 m².

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

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

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

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

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

Silage Production

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

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

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

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

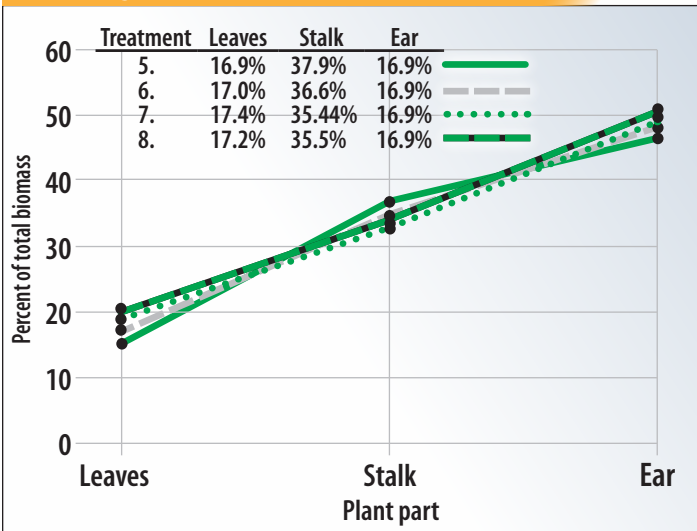
*Means followed by the same letter are not significantly different at P = 0.05 according to the Fisher Test.

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

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

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

Percentage of Plant Biomass with Various Treatments

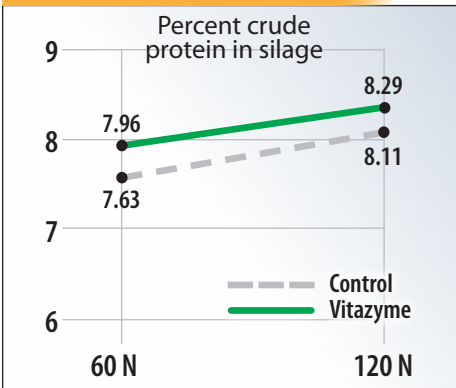


Note that the leaf percentage and ear percentage both increase with N level and Vitazyme, while the stalk percentage decreases for both.

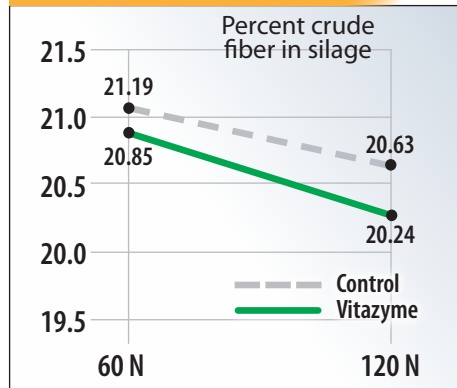
Silage Quality and Feeding Value

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

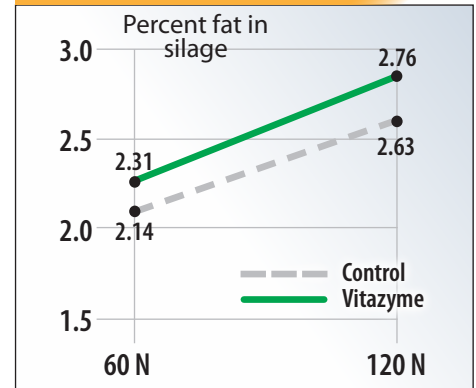
Crude Protein



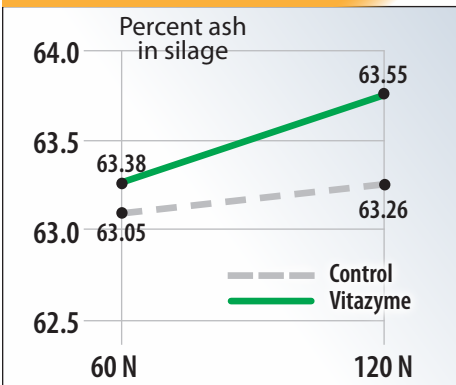
Crude Fiber



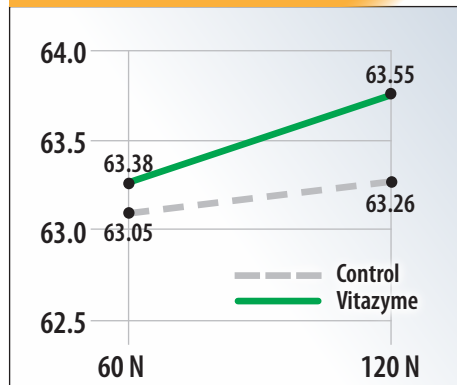
Crude Fat



Ash



NES



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

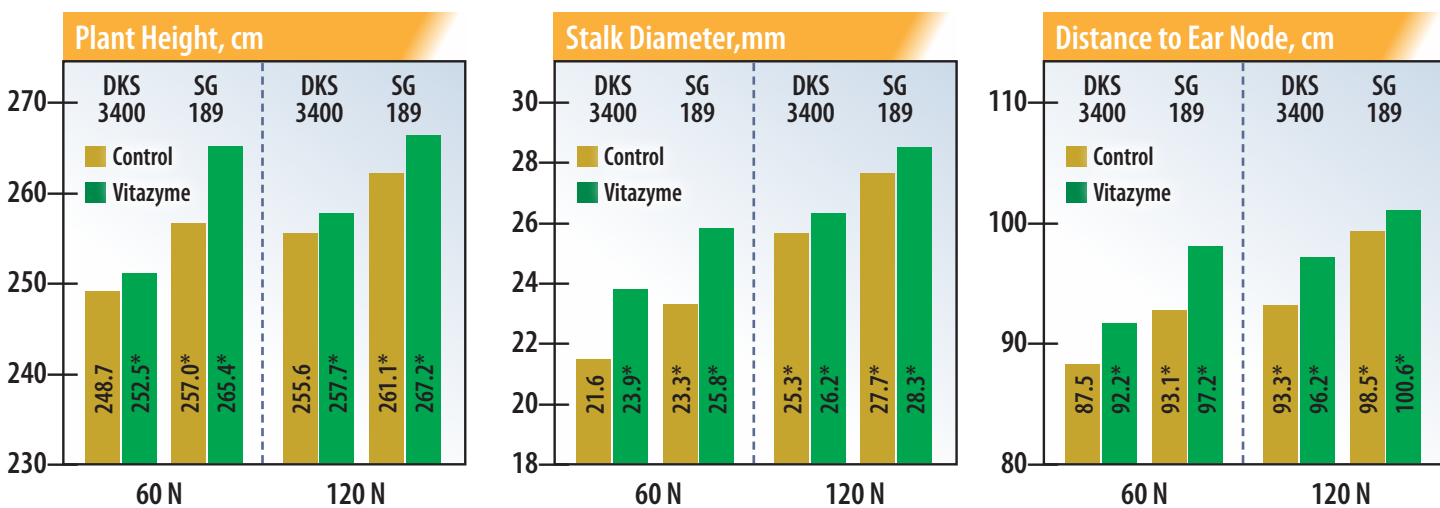
Treatment	Feed units			Crude protein		Digestible protein per food unit
	units/kg of dry matter	tons/ha	tons/ha change	tons/ha	tons/ha change	grams
5.	0.54	8.11	—	1.13	—	71.37
6.	0.57	9.12	+1.01	1.25	+0.12	74.09
7.	0.59	9.71	+1.60	1.34	+0.21	75.26
8.	0.61	10.39	+2.28	1.43	+0.30	76.34

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

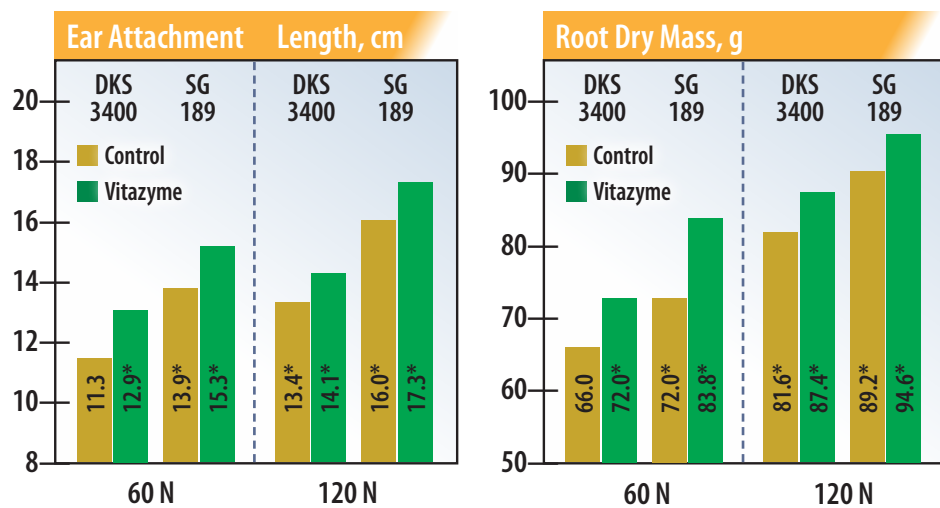
Grain Production

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

Plant characteristics:



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



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

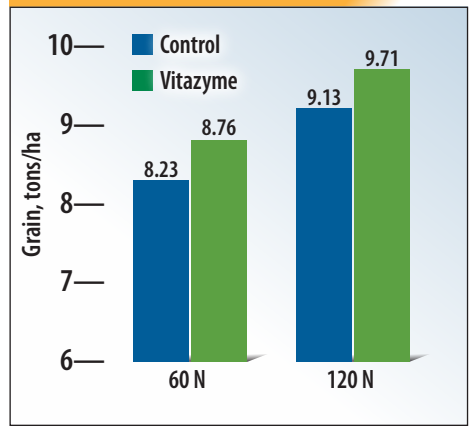
All parameters were significantly increased with Vitazyme application.

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

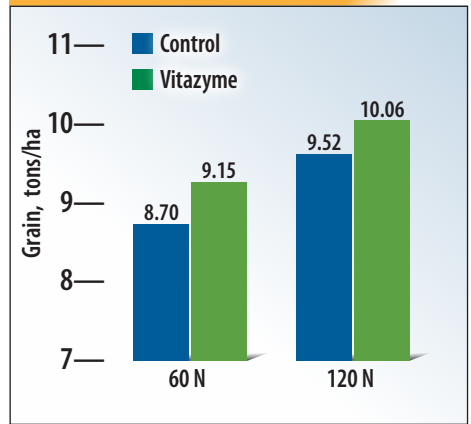
Yield results:

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

Grain Yield — DK 3400



Grain Yield — SG 189



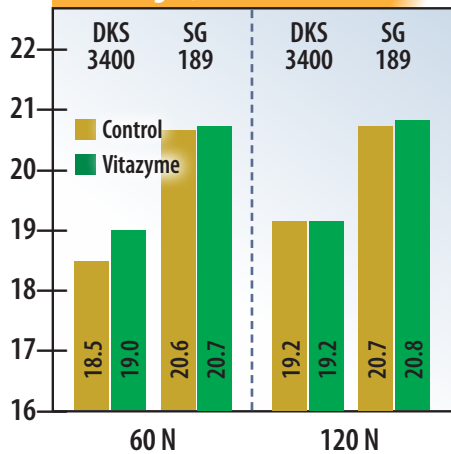
Increased in grain yield with Vitazyme.

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

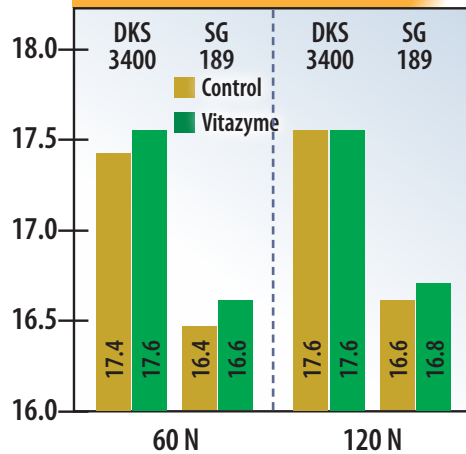
SG 189 — 60 kg/ha +5%
120 kg/ha N +16%

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

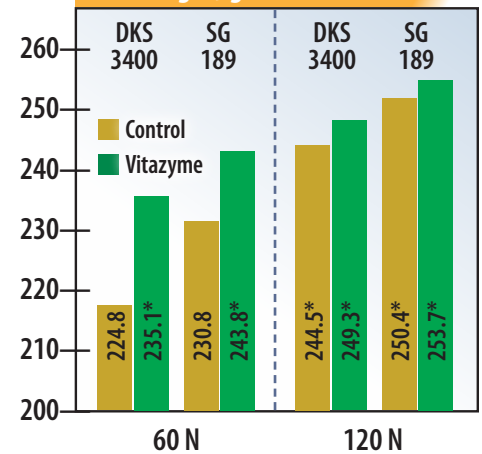
Cob Length, cm

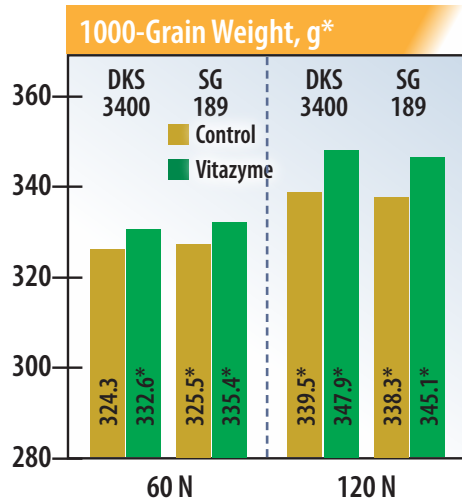
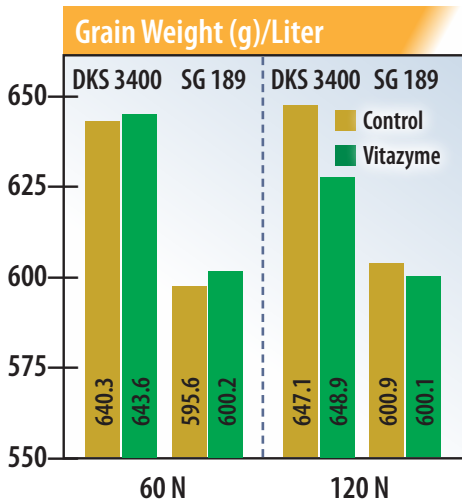


Row Number



Cob Weight, g





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

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

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

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



Cotton with Vitazyme application

Researcher: Bruce Kirksey, Ph.D. **Research organization:** Agricenter International, Memphis, Tennessee
Trial location: Memphis, Tennessee **Variety:** DP2215B3XF **Planting date:** May 26, 2023
Planting rate: 55,000 seeds/acre **Planting depth:** 0.75 inch **Tillage:** conventional **Row spacing:** 38 inches
Soil type: Falaya silt loam, excellent fertility, 6.8 meq/100 g cation exchange capacity, 7.3 pH, good drainage
Experimental design: A small-plot randomized

experiment with cotton was initiated to evaluate the effect of Vitazyme at four fertilizer levels, on the lint and seed yield of cotton. Four replications were used, with plots that were 12.67 x 30 feet (380.1 ft², or 0.00873 acre).



Bolls and squares removed from treated and untreated plants at the 50% fertilizer level reveal that the treated plants had advanced boll development at this stage of growth.

Treatment	Vitazyme*	Fertilizer application		
		N lb/acre	P ₂ O ₅ lb/acre	K ₂ O lb/acre
1. 100% fert	o	80	60	60
2. 100% fert + Vita	x	80	60	60
3. 75% fert	o	60	45	45
4. 75% fert + Vita	x	60	45	45
5. 50%	o	40	30	30
6. 50% fert + Vita	x	40	30	30
7. 25%	o	20	15	15
8. 25% fert + Vita	x	20	15	15

*See the application timing and rates below.

Fertilization: See the table above.

Vitazyme applications: (1) 13 oz/acre (1 liter/ha) acre in-furrow at planting on May 26; (2) 13 oz/acre (1 liter/ha) foliar and soil on July 6, 34 days after planting

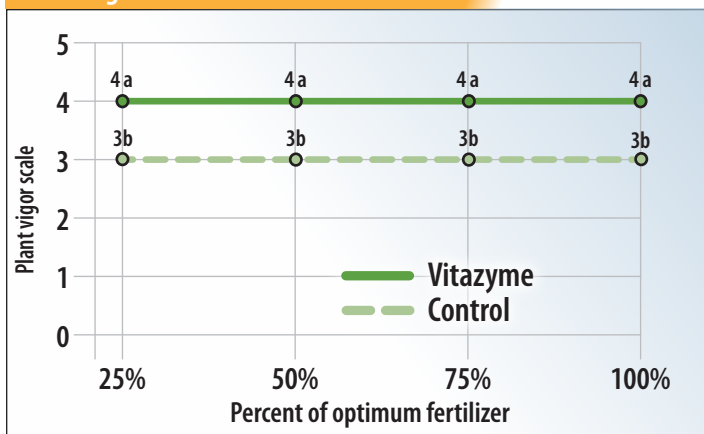
Harvest date: November 30, 2023, using a John Deere 9930 cotton harvester on an area of 6.7 ft (two rows) x 30 ft

Plant vigor results: On June 8 there was a visual evaluation of plant vigor.



Plants dug from the 50% fertilizer treatments reveal how Vitazyme has increased the biomass and root systems of treated plants.

Plant Vigor¹



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



Roots from Vitazyme treated plants (right) at the 50% fertilizer level are larger and better developed than are those from the untreated plants on the left.

At all four fertilizer levels, Vitazyme significantly improved plant vigor at P= 0.05.

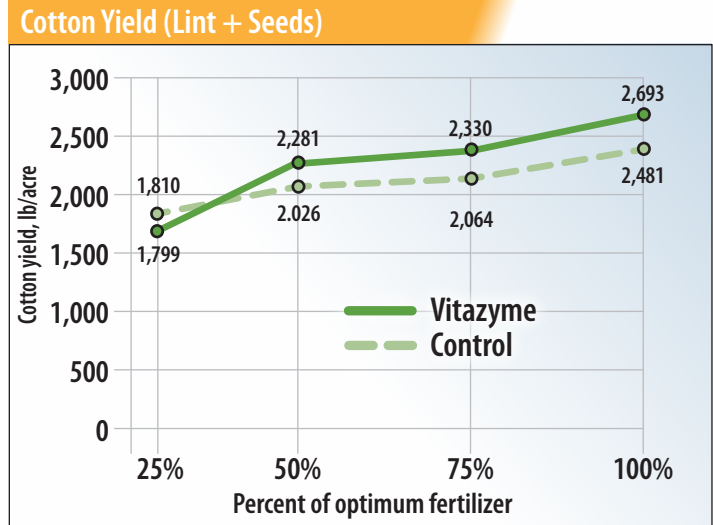
Leaf chlorophyll results: Differences in leaf chlorophyll as measured by a SPAD meter were variable, but at the 100% fertilizer level the Vitazyme treated plants had 5.1 greater SPAD units than did the control. At the 25% fertilizer level, Vitazyme treated plants had 3.6 greater SPAD units than did the control plants.

Cotton yield results (lint + seeds):

Treatment	Cotton yield ¹ lb/acre	Yield change ² lb/acre
1. 100% fert	2,481 b	—
2. 100% + Vita	2,693 a	212 (+9%)
3. 75% fert	2,064 b	—
4. 75% + Vita	2,330 bc	266 (+13%)
5. 50% fert	2,026 d	—
6. 50% + Vita	2,281 e	255 (+13%)
7. 25% fert	1,810 e	—
8. 25% + Vita	1,799 e	-11 (-0.06%)
LSD (P=0.05)	162	
CV	5.04	
Replicate probability (F)	0.1073	
Treatment probability (F)	0.0001	

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

For all three of the higher fertilizer rates, Vitazyme significantly increased the lint + seed yield.

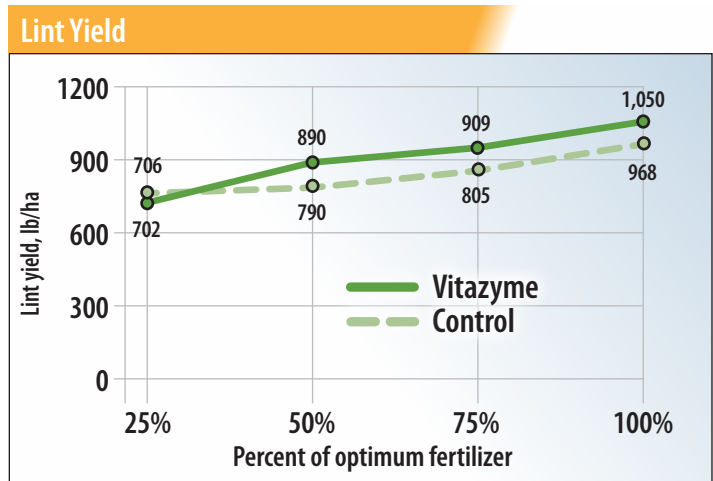


Cotton yield results (lint only):

Treatment	Cotton yield ¹ lb/acre	Yield change ² lb/acre
1. 100% fert	968 b	—
2. 100% + Vita	1,050 a	82 (+8%)
3. 75% fert	805 d	—
4. 75% + Vita	909 bc	104 (+11%)
5. 50% fert	790 d	—
6. 50% + Vita	890 c	100 (+13%)
7. 25% fert	706 e	—
8. 25% + Vita	702 e	-4 (-0.06%)
LSD (P=0.05)	63	
CV	5.04	
Replicate probability (F)	0.1073	
Treatment probability (F)	0.0001	

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

At all three higher fertilizer rates, Vitazyme significantly increased the lint yield. At the 25% fertilizer rate there was no response.



Conclusions: A small-plot cotton study in western Tennessee proved that Vitazyme, applied at 13 oz/acre (1 liter/ha) in-furrow at planting and again at 13 oz/acre (1 liter/ha) 34 days after emergence, significantly boosted plant vigor 13 days after planting, a vigor that carried on through the growing season to produce significantly more yield at harvest, at the 50, 75, and 100% fertilizer levels. Lint + seed yield increased by from 9 to 13% for these three levels, and lint alone by from 8 to 13%. The reason for the 25% fertilizer level not producing a significant yield increase is not known. These results strongly suggest the ability of Vitazyme biostimulant to improve fertilizer (N, P, and K) use efficiency in cotton cultivation in western Tennessee, which should be a very attractive response for cotton growers facing rising fertilizer costs.

Fluorescence Assay of Brassinosteroids in Vitazyme — 2023

A study using fluorometric analysis of Vitazyme has confirmed the presence of brassinosteroids in Vitazyme. This involved the chemical reaction between DAPBA (m-dansylaminophenylboronic acid) and brassinosteroids of all types, and then the analysis of these compounds by fluorometric instrumentation.

Researchers: Rajnish Khanna, Ph.D., Roberto Bugomolni, Robert Reed, and Zhiyong Wang, Ph.D.

Research organizations: i-Cultiver, Inc., Manteca, California, LOVnod Biosciences, Inc., Millbrae, California, and the Department of Plant Biology, Carnegie Institution for Science, Stanford, California

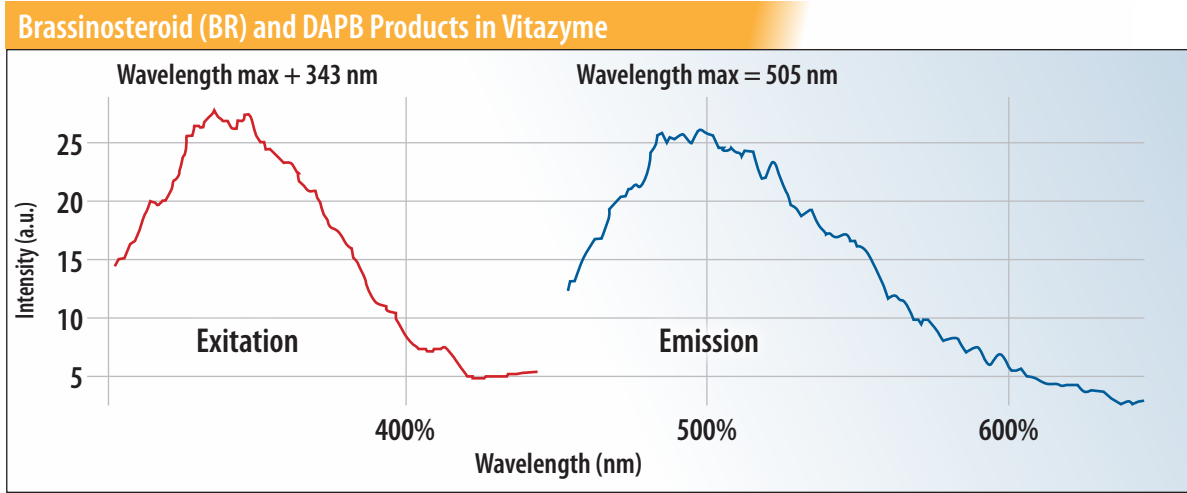
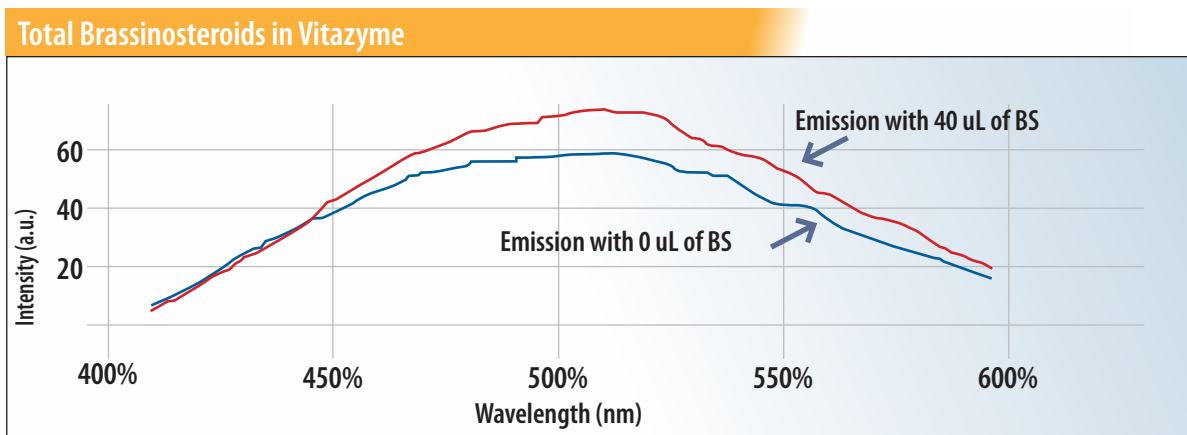


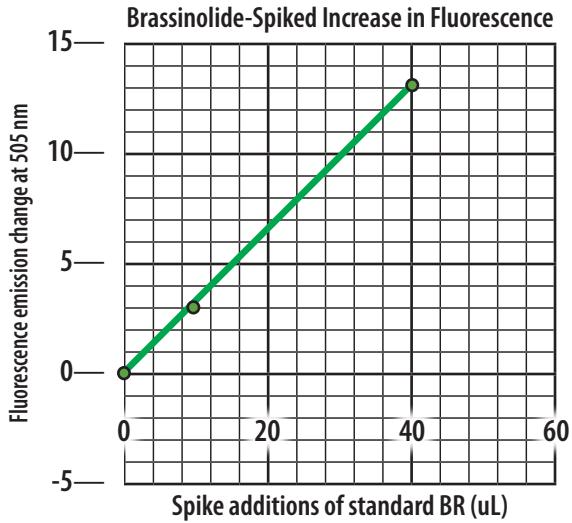
Figure legend: Left trace. Excitation spectrum (produced emission at 505 nm), and right trace emission spectrum (after excitation at 342 nm) of the product of the reaction of 1 mL of Vitazyme with 100 uL of 1mM DABA in 1 mL of phosphate Buffer pH 7.4. The emission wavelength is that expected from a brassinosteroids/DABA reaction product.

Brassinosteroids Spike Reaction



The Vitazyme/DAPBA reaction was spiked with 0, 10, and 40 uL of Brassinolide standard solution (100 uM) The upper trace shows the fluorescence emission scans for 40 uL addition and lower trace for 0 uL addition (10 uL of buffer).

Increase in Fluorescence Intensity at 505 nm After 0, 10, and 40 μ L of Brassinolide are Added



Conclusions: These results with fluorometric analysis of Vitazyme confirm the presence of brassinosteroids in the product. The analysis shows the total brassinosteroids, not just brassinolide. The content is 17 μ M (6ppm) which is less than has been detected by other laboratories using GC/MS analysis. It is expected that different analytic methods will give different results for these very minute quantities, but the presence of the compounds is now confirmed by this analytical method. Further research is ongoing in quantifying brassinosteroids in Vitazyme.



Soybeans with Vitazyme application

Researcher: Jonathan Jaschen **Research organization:** Heritage Ag Research, Fairbank, Iowa
Trial location: Fairbank, Iowa **Variety:** P25A16E **Planting date:** May 13, 2023
Planting depth: 1.25 inches **Row spacing:** 30 inches **Rows per plot:** 6
Planting rate: 1,400,000 seeds/acre **Soil type:** unknown **Tillage:** conventional **Previous crop:** corn
Experimental design: A soybean field was divided into plots of 15 x 30 feet (450 ft²/plot). Five replications of eight treatments using Vitazyme biostimulant were arranged to determine the effect of various timings to effect the greatest yield enhancement of the product.

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

Fertilization: none

Vitazyme applications:

Seed treatment: A 5% Vitazyme solution was applied to the seeds before planting, making sure that the seeds were well-coated.

In-furrow treatment: A 13 oz/acre application was made in-row during planting, on May 13.

Foliar V 3 treatment: A 13 oz/acre spray was applied at the V 3 stage.

Foliar R 1 treatment: A 13 oz/acre spray was applied at the R 1 stage.

Weed control: herbicides for broadleaf and grass weed control

Growing season: warmer and dryer than normal

Plant growth results: Yield results were unable to be collected, but plant growth parameters were evaluated: plant vigor, plant height, and plant weight.

Harvest date: October 3, 2023, using an Almaco plot combine. Two rows in the center of each plot were harvested, for 30 feet (150 ft², or 0.00344 acre).

Crop vigor results: Crop vigor was evaluated on June 8, 2023, using a scale of 0 to 10. All plots received a score of 9, so there were no significant differences among the eight treatments.

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



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



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



Bean test weight results:

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

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

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

Bean yield:

Treatment	Soybean moisture*	Yield change
	bu/acre	bu/acre
1. Control	52.81 b	—
2. Vita on seeds	52.30 b	-0.51 (-1%)
3. Vita in-furrow	53.73b	+0.92 (+2%)
4. Vita foliar early	58.94 a	+6.13 (+12%)
5. Vita foliar late	52.27 b	-0.54 (-1%)
6. Vita seeds + late	51.37 b	-1.44 (-3%)
7. Vita in-furrow + early	53.28 b	+0.47 (+1%)
8. Vita in-furrow + early + late	53.11 b	+0.30 (+1%)
LSD (P = 0.10)	4.26	—
CV	7.41	—
Replicate (F) probability	0.0016	—
Treatment (F) probability	0.1451	—

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

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

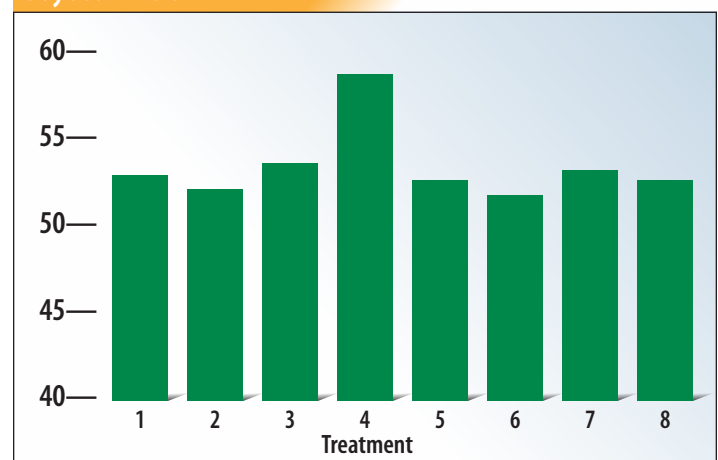
Treatment	Bean moisture*	Moisture change
	%	%
1. Control	8.35 abc	—
2. Vita on seeds	8.40 ab	+0.05
3. Vita in-furrow	8.29 bcd	-0.06
4. Vita foliar early	8.07 d	-0.28
5. Vita foliar late	8.51 a	+0.16
6. Vita seeds + late	8.18 bcd	-0.17
7. Vita in-furrow + early	8.16 bcd	-0.19
8. Vita in-furrow + early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

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

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

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

Soybean Yield



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

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



Soybeans with Vitazyme application

Researcher: V. V. Plotnikov

Research organization: Agro Expert International, Kaharlyk, Ukraine, and Plant Designs International, Rochester, New York

Location: PE Meleshkin, Kozyatyn District, Vinnytsia Region, Zhurbyntsi Village, Ukraine; central Ukraine (440-590 mm of rain per year)

Variety: Kansas, F 2 **Planting date:** May 11, 2023

Planting rate: 550,000 seeds/ha **Previous crop:** winter wheat

Tillage: disking to 8-10 cm, plowing to 23-25 cm, harrowing, cultivation to 4-5 cm

Soil type: podzolic black soil (3.9% organic matter)

Experimental design: A soybean field was selected for the evaluation of the effectiveness of Vitazyme biostimulant on this legume crop. The field was divided into an untreated control and a treated area to evaluate the bean yield differences.

① Control ② Vitazyme

Fertilization: none

Vitazyme application: 1 liter/ha sprayed on the leaves and soil at the fifth trifoliolate leaf stage, on June 23, 2023

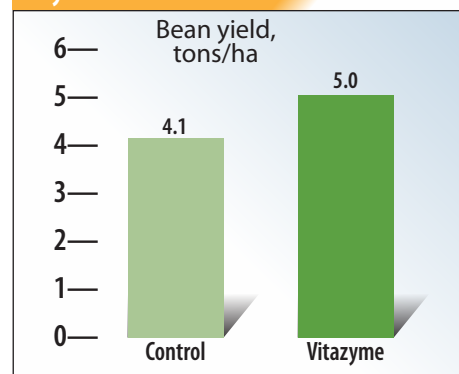
Income results: The 0.9 ton/ha soybean yield increase resulted in a net income increase of \$292/ha.

Yield results:

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

Yield increase in bean yield with Vitazyme: 22%

Soybean Yield



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

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



Spring Barley with Vitazyme Cold Start application

Researcher: V. V. Plotnikov

Research organization: Agro Expert International, Kaharlyk, Ukraine, and Plant Designs International, Rochester, New York

Location: PE Meleshkin, Kozyatyn District, Vinnytsia Region, Zhurbyntsi Village, Ukraine; central Ukraine (440-590 mm of rain per year)

Variety: Sebastian, F 2

Planting date: April 7, 2023

Planting rate: 4 million seeds/ha

Previous crop: soybeans

Tillage: disking to 8-10 cm, plowing to 20-22 cm, harrowing, pre-planting cultivation to 3-4 cm

Soil type: podzolic black soil (3.9% organic matter)

Experimental design: A spring barley field was divided into an untreated control area and a Vitazyme Cold Start treated area, to evaluate the effect of this biostimulant on the yield of barley grain.

① Untreated control ② Vitazyme Cold Start

Fertilization: 30 kg of N per row at planting

Vitazyme Cold Start application: 1 liter/ha sprayed on the leaves and soil on May 6, at BBCH 13

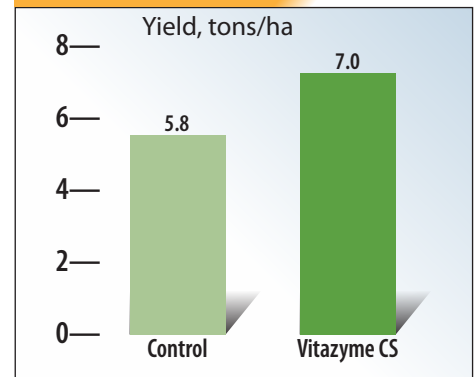
Income results: The 21% yield increase in barley yield resulted in an income increase of \$149/ha.

Yield results:

Treatment	Yield tons/ha	Yield change tons/ha
1. Control	5.8	—
2. Vitazyme Cold Start	7.0	1.2 (+21%)

Increase in barley grain yield with Vitazyme Cold Start: 21%

Grain Yield



The greater head size and plant development on the right can be noted in this Vitazyme Cold Start spring barley trial. The treated barley yielded 21% more than the untreated control side of the field.

Conclusions: A field-scale spring barley trial in central Ukraine, using a single 1 liter/ha spray application of Vitazyme Cold Start at BBCH 13, resulted in an excellent 1.2 ton/ha yield increase (+21%), which increased net farm income by \$149/ha. This result reveals the great value of this program for barley production in central Ukraine.



Sugar Beets *with Vitazyme Bio application*

Researcher: V. V. Plotnikov
Research organization: Agro Expert International, Kaharlyk, Ukraine, and Plant Designs International, Rochester, New York
Location: SE DG Oleksandrivske, Haisyn District, Vinnytsia Region, Oleksandrivka Village, Ukraine; central Ukraine (440-590 mm of precipitation per year)
Variety: LaGioconda
Planting date: March 29, 2023
Planting rate: 120,000 seeds/ha
Previous crop: winter wheat
Tillage: disking to 6-8 cm, plowing to 30-32 cm, harrowing, pre-plant tillage to 2-3 cm with a combined Europack unit
Soil type: Mollisol (4.0% organic matter)



The Vitazyme Bio treated sugar beets are clearly larger at this stage of the growth cycle, which ultimately gave a sugar yield increase of 23% above the untreated control.



The Vitazyme Bio treated sugar beets on the right are darker green and leafier than the control sugar beets on the left, after severe hail damage in July.

Experimental design: A sugar beet field was divided into an untreated control area and a Vitazyme Bio area to evaluate the effects of this biostimulant on the yield of beets and sugar. Because of hail damage in July, crop recovery was also evaluated.

① Control ② Vitazyme Bio

Fertilization: Manure at 60 tons/gas was applied the fall of 2022, giving about 300-150-360 kg/ha of N-P₂O₅-K₂O. Also, 140 kg/ha of N was applied pre-plant.

Vitazyme Bio application: 1 liter/ha sprayed on the leaves and soil at BBCH 34, on June 16, 2023

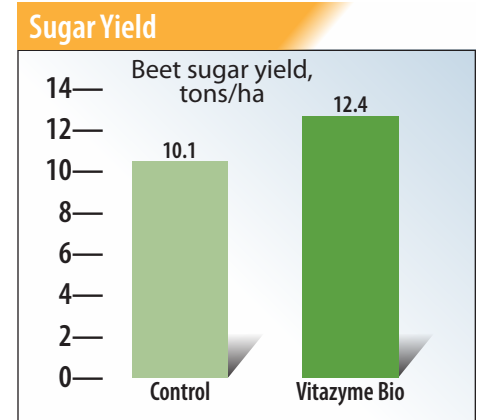
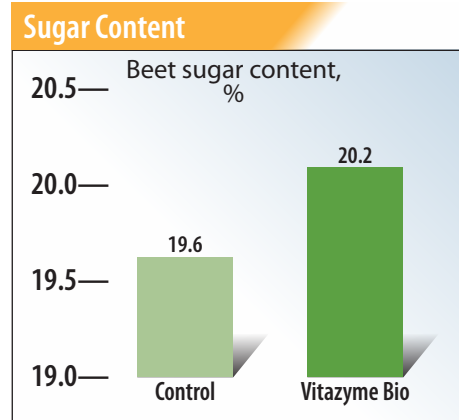
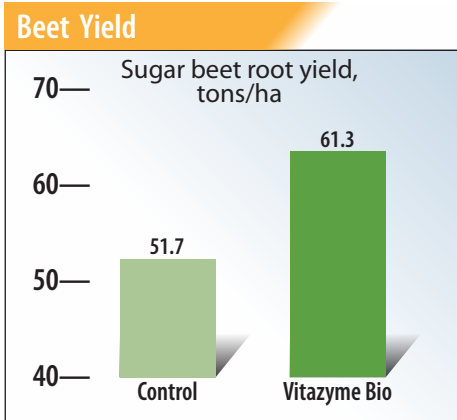
Yield results:

Treatment	Root yield tons/ha	Yield change tons/ha	Sugar content %	Sugar yield tons/ha	Yield change tons/ha
1. Control	51.7	—	19.6	10.1	—
2. Vitazyme	61.3	9.6 (+19%)	20.2	12.4	2.3 (+23%)

Increase in beet root yield with Vitazyme Bio: 19%

Increase in sugar content with Vitazyme Bio: 0.6 percentage-point

Increase in sugar yield with Vitazyme Bio: 23%



Income results: The 2.3 ton/ha (+23%) sugar yield increase netted the farmer \$628/ha more income.

Plant recovery after hail damage: On July 26, 40 days after Vitazyme Bio Application, a severe hail storm destroyed 40% of the leaf surfaces of the plants. An inspection of the plants on August 4, 9 days after the storm, revealed that the Vitazyme Bio treated plants had recovered much better than had the untreated control plants.

Conclusions: A field-scale sugar beet trial in central Ukraine compared an untreated control with Vitazyme Bio applied at the BBCH 34 growth stage at 1 liter/ha. The resulting beet yield was increased by 19% with Vitazyme Bio. Beet sugar and total sugar yield were also increased by Vitazyme Bio (0.6 percentage-point and 23%, respectively). These excellent increases were indicative of the rapid recovery of the hail damaged plants with Vitazyme Bio compared to the untreated plants, showing the great value of this program for sugar beet farmers in central Ukraine.



Sunflowers with Vitazyme application

Researcher: Dumitru Manole, Ph.D. **Research organization:** S.C. Sport Agra, Ltd., Romania
Trial location: Amzacea Village, Constanta County, Romania **Variety:** Corteva P64LE25
Planting date: March 25, 2022 **Planting rate:** 6.5 seeds/m² (65,000 seeds/ha) **Previous crop:** corn
Field preparation: disking to 15-20 cm the fall of 2021; harrowing the spring of 2022
Experimental design: A sunflower field of 49.45 ha was used to apply two treatments: Vitazyme and Dr. Green Energy to plots totaling 1.44 ha. The purpose of the trial was to determine the effect of these two materials on the yield of sunflower seeds.

① Vitazyme ② Dr. Green Energy + Dr. Green Rape

Fertilization: At planting time (March 25), 250 kg/ha of 18-46-0% N-P₂O₅-K₂O; after emergence (April 25), 150 kg/ha of 34.5-0-0 N-P₂O₅-K₂O.

Weed control: herbicides

Vitazyme application: 1.3 liters/ha sprayed on the leaves and soil on May 5

Dr. Green Energy + Dr. Green Rape application: Dr. Green Energy (100 g N; 400 g K₂O) and Dr. Green Rape (245 g SO₃, 5g MgO, 100 g B, 2 g Cu, 25 g Fe, 50 g Mn, 0.5 g Mo, 20 g Zn) were applied to a plot on May 5 at 1 kg/ha and 2 kg/ha, respectively.

Fungicide application: On April 27, Pictor fungicide, comprised of 200 g/liter Boscalid and 200 g/liter Dimoxystrobin, was sprayed at 0.5 liter/ha over the sunflowers.

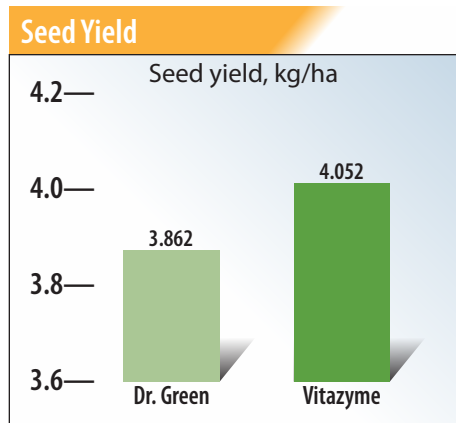
Date of emergence: April 8 to 10

Harvest date: August 15, 2022

Yield results:

Treatment	Seed yield kg/ha	Yield change kg/ha
1. Vitazyme foliar	4.052	—
2. Dr. Green Energy + Dr. Green Rape	3.862	0.190 (+5%)

Increase in seed yield with Vitazyme: 5%



Conclusions: This sunflower trial in Romania, which compared Vitazyme biostimulant with a mineral fertilizer, was not a strict comparison of similar products; it was a comparison of a biostimulant with a mineral fertilizer. Even so, Vitazyme outperformed the Dr. Green Energy + Dr. Green Rape by 0.190 kg/ha, a 5% yield increase. This result shows that Vitazyme improves the uptake of available soil nutrients which the mineral application did not equal.



Winter Wheat with Vitazyme Bio application

Researcher: V. V. Plotnikov

Research organization: Agro Expert International, Kaharlyk, Ukraine, and Plant Designs International, Rochester, New York

Location: Kolyvailo Farm, Vinnytsia District, Vinnytsia Region, Miziakovski Khutory Village, Ukraine; central Ukraine (440-590 mm of rain per year)

Variety: Patricks, F 3 **Planting date:** October 15, 2022

Planting rate: 6 million seeds/ha

Previous crop: sunflowers **Tillage:** disking to 20-22 cm

Planting depth: 3 cm (Horsch Maestro Seeder)

Soil type: gray podzolic (2.0% organic matter)

Experimental design: A winter wheat field was divided into an untreated control as well as a Vitazyme Bio treatment on the seeds to determine the effect of the product on grain yield and quality.

① Untreated control ② Vitazyme Bio

Fertilization: 100 kg/ha of N applied in the spring

Vitazyme Bio application: 1 liter/ton of seed applied on October 12, 2023, three days before planting

Growth results: In the spring of 2023, prolonged cold stress caused yellowing of the leaf tips for the control treatment by early May, but not with Vitazyme Bio. The leaves of the treated plants also contained more chlorophyll.

Yield results:

Treatment	Yield tons/ha	Yield change tons/ha
1. Control	8.0	—
2. Vitazyme Bio	9.1	1.1 (+14%)

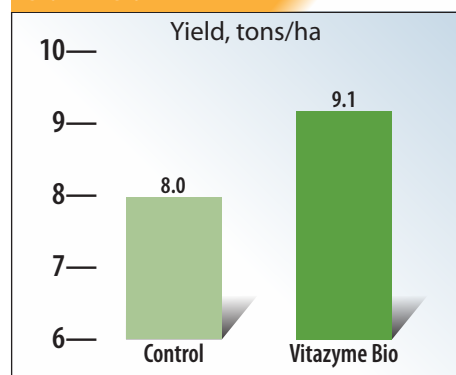
Increase in grain yield with Vitazyme Bio: 14%

Quality results:

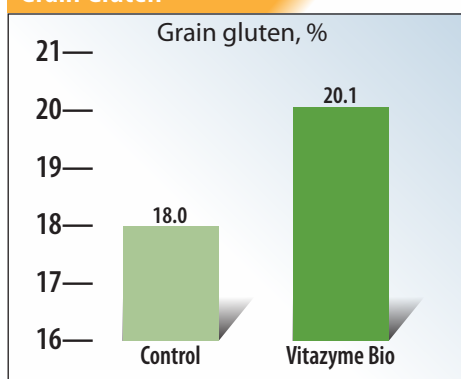


The springtime growth of winter wheat in this Ukraine trial is obviously superior with Vitazyme. A 14% yield increase resulted from this improvement in biomass with Vitazyme Bio.

Grain Yield

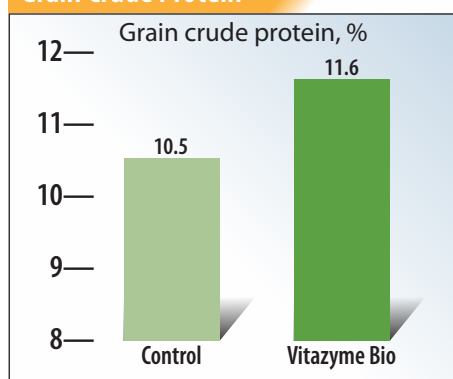


Grain Gluten



Increase in grain gluten with Vitazyme Bio: 2.1 percentage points

Grain Crude Protein



Increase in grain crude protein with Vitazyme Bio: 1.1 percentage points

Income results: A yield increase of 14% resulted in a net profit increase of \$175/ha.

Conclusions: A winter wheat field-scale study in Ukraine, using Vitazyme Bio (the organic version of Vitazyme) as a seed treatment at 1 liter/ton of seed, resulted in a yield increase of 14%, and excellent grain quality increases: 2.1 and 1.1 percentage-point increases for grain gluten and grain crude protein, respectively. This yield increase of 2.1 tons/ha boosted income by \$175/ha. The product reduced cold stress during the spring regrowth period by eliminating leaf tip burn. These results show the great value of Vitazyme Bio as a winter wheat treatment in Ukraine.



Winter Wheat with Vitazyme Cold Start application



Note how much greater is the head density and height of the Vitazyme Cold Start treated winter wheat as compared to the other photo of the untreated wheat. The difference in yield was 21%.



The untreated winter wheat in this Ukraine trial is shown here, with typical head density for the 2023 crop.

Researcher: V. V. Plotnikov

Research organization: Agro Expert International, Kaharlyk, Ukraine, and Plant Designs International, Rochester, New York

Location: Kolyvailo Farm, Vinnytsia District, Vinnytsia Region, Mizyakovski Khutory Village, Ukraine; central Ukraine (440-590 mm of rain per year)

Variety: Patricks, F 3 **Planting date:** November 3, 2022 **Planting rate:** 6 million seeds/ha

Previous crop: sunflowers **Tillage:** disking to 20-22 cm **Planting depth:** 3 cm (Horsch Maestro Seeder)

Soil type: gray podzolic (1.5% organic matter)

Experimental design: A winter wheat field was divided into an untreated control area and a Vitazyme Cold Start seed treated area. The objective of the study was to determine the effect of the product on the yield, quality, and profitability of the winter wheat.

① Untreated control ② Vitazyme Cold Start

Fertilization: 100 kg/ha of N top-dressed in the spring

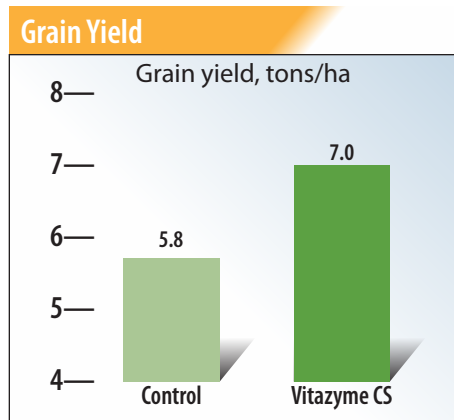
Vitazyme Cold Start application: 1 liter/ton of seed applied on October 31, 2023, three days before planting

Growth results: Due to prolonged cold temperatures in the spring, leaves of the untreated control plants by early May had developed yellow tips. However, the Vitazyme Cold Start treated plants experienced no such yellowing, and were also darker green with more chlorophyll.

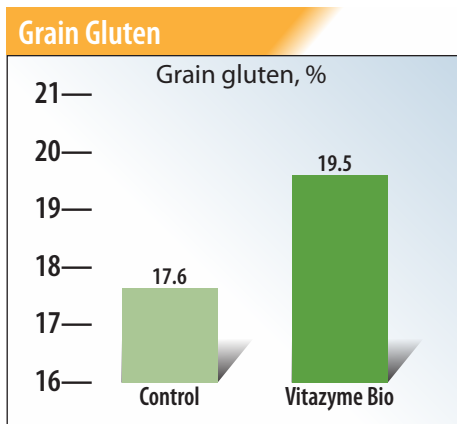
Yield results:

Treatment	Yield tons/ha	Yield change tons/ha
1. Control	5.8	—
2. Vitazyme Cold Start	7.0	1.2 (+21%)

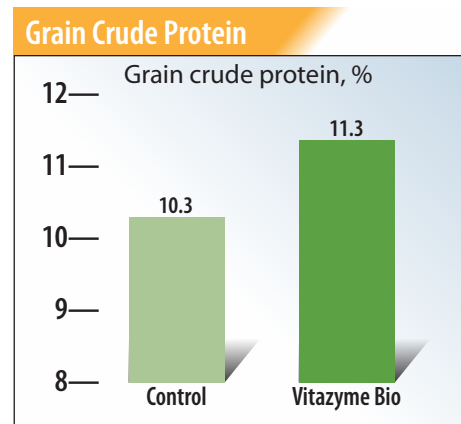
Increase in grain yield with Vitazyme Cold Start: 21%



Quality results:



*Increase in grain gluten with Vitazyme Cold Start
1.8 percentage points*



*Increase in grain crude protein with Vitazyme Cold Start
1.0 percentage point*

Income results: As a result of a 21% yield increase, Vitazyme Cold Start boosted farm income by \$191/ha.

Conclusions: This field-scale winter wheat study in Ukraine, which evaluated the effect of Vitazyme Cold Start as a seed treatment (1 liter/ton of seed), revealed that yield was increased by 21% (1.2 tons/ha), while at the same time grain gluten and crude protein were elevated over the untreated control by 1.8 and 1.0 percentage-points, respectively. The yield increase netted the farmer \$191/ha more income. These excellent results with Vitazyme Cold Start were preceded by reduced spring cold stress and greater leaf chlorophyll. Using this biostimulant for winter wheat production in Ukraine is shown to be highly effective in terms of yield, grain quality, and profitability.



Winter Wheat with Vitazyme Cold Start application

Researcher: V. V. Plotnikov

Research organization: Agro Expert International, Kaharlyk, Ukraine, and Plant Designs International, Rochester, New York

Location: P E Meleshkin, Kozyatyn District, Vinnytsia Region, Zhurbyntsi Village, Ukraine; central Ukraine (440-590 mm of rain per year)

Variety: Jersey, F 2

Planting date: September 10, 2022

Planting rate: 5 million seeds/ha

Previous crop: spring barley

Tillage: disking to 8-10 cm, plowing to 20-23 cm, pre-planting cultivation to 3-4 cm

Soil type: podzolic black soil (3.9% organic matter)

Experimental design: A winter wheat field was divided into an untreated control area and a Vitazyme Cold Start seed and foliar treated area, with the objective being to evaluate the effect of this product on grain yield and quality, and net crop income.

① Untreated control ② Vitazyme Cold Start

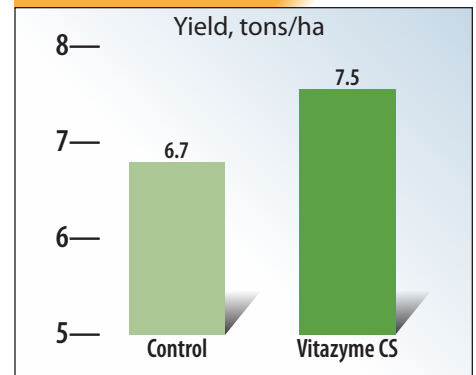
Fertilization: 45 kg of N as a spring top-dressing

Vitazyme Cold Start application: 1 liter/ton of seed applied on September 8, 2023, two days before planting; 0.5 liter/ha sprayed on the leaves and soil at BBCH 37, on May 16, 2023

Yield results:

Treatment	Yield tons/ha	Yield change tons/ha
1. Control	6.7	—
2. Vitazyme Cold Start	7.5	0.8 (+12%)

Grain Yield

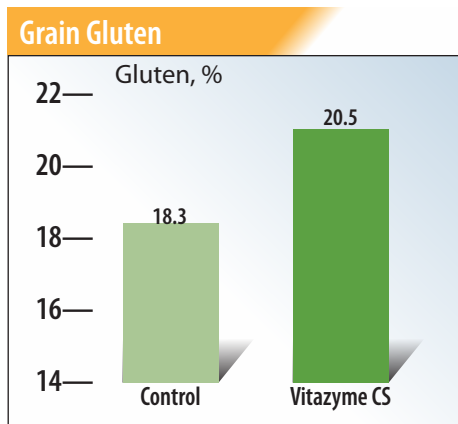


Increase in grain yield with Vitazyme Cold Start: 12%

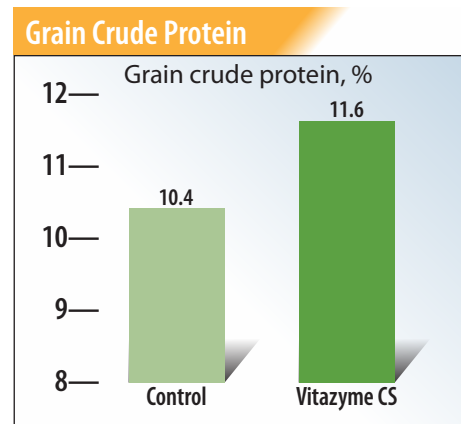


The early spring growth of this winter wheat crop is excellent after Vitazyme Cold Start treatment of the seeds at fall planting. A very fine 12% yield increase was achieved.

Quality results:



*Increase in grain gluten with Vitazyme Cold Start
2.2 percentage points*



*Increase in grain crude protein with Vitazyme Cold Start
1.2 percentage point*

Income results: The Vitazyme Cold Start seed treatment plus spring foliar application produced a yield increase of 0.8 ton/ha (12%), netting the farmer \$114/ha more income.

Conclusions: A field-scale Ukrainian winter wheat study, with Vitazyme Cold Start applied at 1 liter/ton of seed plus 0.5 liter sprayed at BBCH 37, proved that the product improved grain yield by 12% above the untreated control area of the field. Grain quality was also improved, by 2.2 percentage-points for gluten and 1.2 percentage-points for crude protein. Net farm income was also increased, by \$114/ha. These results prove that Vitazyme Cold Start can significantly enhance the yield, quality, and income of winter wheat grown in central Ukraine.



A Photo Review of Field Trial Results with Vitazyme in Hokkaido, Japan—August, 2023

The photos shown here are pre-harvest samplings from a number of fields with Vitazyme treatment versus untreated controls. SYJ-345 is Vitazyme. Harvest results from these trials are proprietary for the testing company.

Notice the superior leaf and root development, leaf chlorophyll content, stem diameter, pod number, tuber yield, and yield potential for the Vitazyme (SYJ-345) treated plants.



Hokkaido, Japan

Field Trial Results with Vitazyme in Hokkaido, Japan—August, 2023



Field Trial Results with Vitazyme in Hokkaido, Japan—August, 2023





Vitazyme Improves Fertilizer Efficiency, Proven by Studies Since 1995

Many replicated field studies on several crops since 1995 have shown that Vitazyme, applied to seeds, soils, or leaves, will improve fertilizer use efficiency, especially with nitrogen. Here is a small selection from those studies. A detailed summary of these studies is available on request from Vital Earth Resources.

Crop	Location	Fertilizer Enhancement with Vitazyme
Barley	Ukraine	● Trials in 2012 and 2013 gave yield increases with Vitazyme of 14 to 18% above the untreated controls. Grain protein was increased, and diseases were reduced.
Corn	Iowa	● During a dry year, yields at 80 lb/acre of N were increased by 27.6 bu/acre (22%), and at 120 lb/acre of N by 10.4 bu/acre (7%) with Vitazyme.
Corn	Iowa	● At 80 lb/acre of N, corn yield with Vitazyme was the same as at 160 lb/acre.
Corn	Iowa	● The 50% N application plus Vitazyme improved the yield by 10.8 bu/acre above the 100% N treatment.
Corn	North Carolina	● At North Carolina State University, over several N levels, corn yield was improved with Vitazyme at one site an average of 9%, and at another site by 15%. Blight resistance was also improved.
Corn	Ontario	● The 60 kg/ha N rate plus Vitazyme produced a yield equal to the yield at 120 kg/ha of N.
Corn	South Dakota	● South Dakota State University trials over several years showed corn yields at 75 lb/acre of N plus Vitazyme equalled yields at 125 lb/acre of N. Nitrogen efficiency was improved from 40.3% for untreated seeds versus 58% for treated seeds.
Cotton	Texas	● At Texas A&M University, the 50% N rate plus Vitazyme produced a lint yield equal to the 100% N rate, and plant and fiber parameters were improved.
Lettuce	Philippines	● At Los Banos, the 50% fertilizer rate plus Vitazyme produced 32% more lettuce yield than did the 100% fertilizer rate without it.
Rice	Cuba	● Rice yields at 75% and 100% fertilizer were increased by Vitazyme up to 52%.
Sugar beets	Ukraine	● Several studies showed yield increases with Vitazyme of up to 26% at the same N level, plus higher sugar percentages.
Rice	Cuba	● At all fertilizer levels, Vitazyme improved both cane and sugar yields, reduced levels giving yields as high as the maximum fertilizer rates.
Wheat	Ukraine	● At the same fertilizer rates, Vitazyme increased the yield in several studies from 12 to 24%, plus boosting grain protein and reducing diseases.



This corn trial in eastern South Dakota proved how Vitazyme (left side) can dramatically improve nitrogen utilization.



SOME DRAMATIC EFFECTS OF VITAZYME ON FERTILIZER EFFICIENCY





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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