



VITAZYME [®]

2004 Field Trial Results

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

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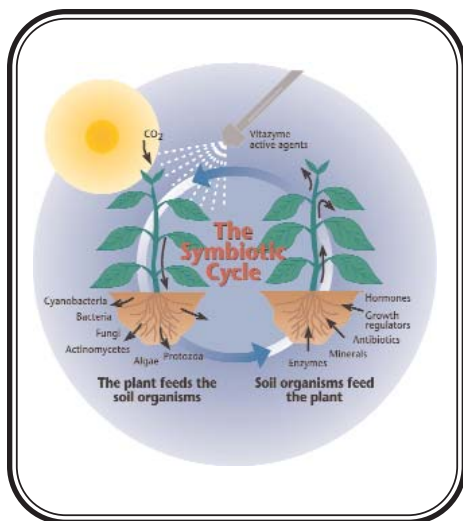
2004 Vitazyme Field Trial Results

For the tenth consecutive year a summary of Vitazyme field trials is presented to convey the great value of this crop biostimulant to enhance crop production. Over a wide variety of crops, soils, and climactic conditions various production programs involving Vitazyme have performed extremely well across the United States and in many foreign countries. The consistency of crop responses has been noteworthy.

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 up to 25% or more of its energy, fixed in the leaves as carbohydrates, amino acids, and other compounds, into the root zone to feed these 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

Vitazyme should be used within the context of a complete crop management system, never by itself. Vitazyme will optimize your existing program by enabling the plant to grow better, thus increasing productivity. Follow this easy-to-use five-point program.

- 1 If possible, analyze the soil at a reputable laboratory and correct mineral deficiencies and imbalances with expert consultation.
- 2 Reduce nitrogen fertilizer applications for non-legumes using this test:

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:			15	14	13	12	11	10	9	8	7	6	5
Apply this % of optimum N:			← 50-60% →		← 60-70% →		← 70-80% →						

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.

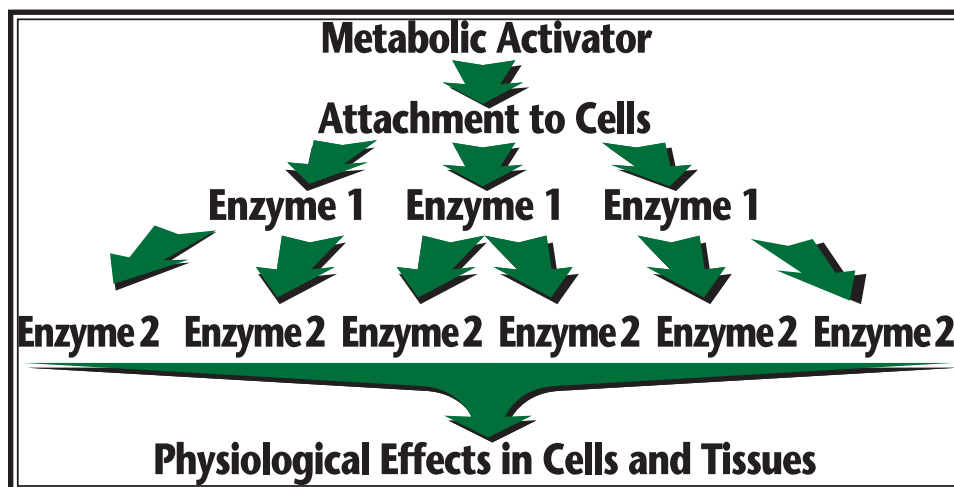
In short, Vitazyme enables the plant to better express its genetic potential by reducing the stresses that repress that expression.

Reduce the application each time the fertilizer normally is applied. Legumes normally need no added nitrogen. Vitazyme will accelerate legume nitrogen fixation.

- 3 Treat the seeds or transplant roots, if possible at planting. Treat seeds with a dilute Vitazyme solution, such as 1 liter of a 5% solution for every 50 kg of seed. Mix the seeds thoroughly in a seed or cement mixer or on a tarp. **For excellent results apply the solution directly on the seed row with a planting attachment. Dip or spray transplant roots with a 1% or 2% solution.**

- 4 Apply Vitazyme to the soil and/or foliage. Follow instructions for each crop. In most cases from 10 to 20 oz/acre can be applied per application at one to three times during the cropping cycle. A fall application on stubble is effective to accelerate residue breakdown.

- 5 Integrate other sound, sustainable management practices into a total program. Use crop rotations, minimum tillage, soil conservation practices, and adapted plant varieties.



Vitazyme Highlights for 2004

Growing conditions for 2004 across the United States were generally quite favorable for most crops. Record corn and soybean harvests resulted from good rainfall and temperature patterns across the Corn Belt, although other areas of the country, such as the Northeast, were cold and wet during the spring which hampered planting and crop maturation. The West remained dry, but in nearly all cases Vitazyme performed extremely well in tests in all areas, as well as in actual on-farm production. The results in this booklet speak for themselves.

Some Highlights for 2004

1 Cuba continued to be a bright spot for the program as more test results rolled in. Sugar cane trials showed excellent sugar production increases, in some cases up to 38%. Some of these increases were with only 50% of the normal fertilizer, which outdid the normal program in spite of input reductions. Income increases were outstanding. Rice responses to Vitazyme were most excellent as well, in one case the yield increase being 52% with

a 25% fertilizer reduction. Other results with bananas, lettuce, peppers, watermelons, and other crops can be found in this booklet.

2 Potatoes responded beautifully to Vitazyme in both Maine and Colorado. Tuber yield was increased in most cases, and the size distribution was more uniform and skewed towards the more valuable 9 to 18 ounce range. It has been a tough year economically for potato growers, but Vitazyme is helping them maximize the returns from their inputs.

3 Corn yields have responded dramatically to the program this year. An Iowa study gave a 20.3 bu/acre yield increase from two applications. In North Carolina, a university study produced significant yield increases of 14.4 to 18.7 bu/acre.

4 Efforts to improve the efficacy of Vitazyme have shown some promise. One additive produced a consistent reduction in corn grain moisture at harvest of 1.5 percentage points at two widely separated locations, although yield was not always

enhanced. These trials will continue to confirm whether this or any other changes in formulation are truly beneficial.

5 Tests on apples in New York produced excellent increases in fruit size and quality, even during a particularly good production year.

6 Both raisin and wine grapes responded very well to the program in California. A 46% yield increase in Cabernet Sauvignon grapes produced wine that appeared to be as high in quality as the untreated control. In about a year a wine tasting panel will evaluate the quality of the wine produced from the two treatments.

Continuing the consistent responses of Vitazyme on a number of crops, the results shown in this booklet reveal the great efficacy of this product to the farmer. Across all types of soils and climatic conditions, this product and its associated program have provided excellent results in North America as well as on other continents.

Vitazyme Field Tests for 2004

Alfalfa

Vitazyme and Rhizobium Bacteria Compatibility

Location: Vital Earth Resources Research Greenhouse, Gladewater, Texas

Soil type: fine sandy clay loam

Planting rate: thinned to 12 plants/pot

Variety: common

Pot size: 1 gallon

Planting date: December 30, 2002

Treatment	Vitazyme*	Rhizobium*
1	O	O
2	O	X
3	X	O
4	X	X

* Pure, undiluted product

** "Nitragin" inoculant [*Rhizobium meliloti*] for alfalfa; expiration date December 31, 2004

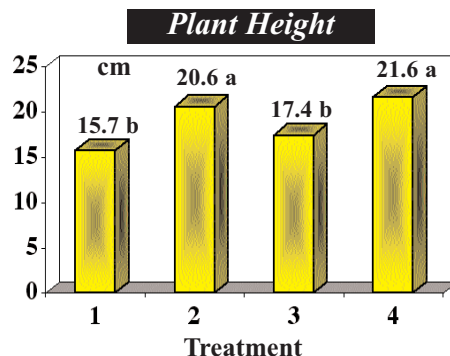
Experimental design: A greenhouse study was arranged with four treatments and seven replicates, using 1 gallon commercial plastic pots. The study was designed to evaluate if Vitazyme, premixed with rhizobium bacteria inoculant before planting, will inactivate the bacteria. Analyses of parameters were made using analysis of variance with CoHort software.

Vitazyme and Rhizobium treatments: Treatment 2, a slurry was made of the rhizobium and alfalfa seeds, and soaked for 1 hour before planting; Treatment 3, alfalfa seeds were soaked for 1 hour in undiluted Vitazyme before planting; Treatment 4, alfalfa seeds were soaked with undiluted Vitazyme and rhizobium for 1 hour before planting.

Harvest date: February 24, 2004, 89 days after planting

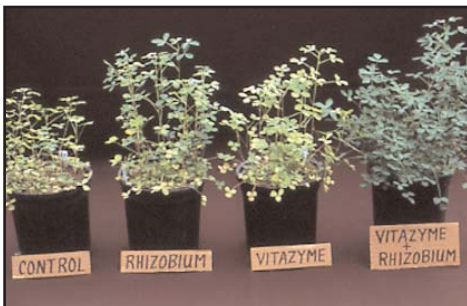
Harvest results: At harvest all roots were washed free of soil, and the plants were laid out and measured for height, leaf chlorophyll, fresh nodule weight, nodule type, and then dried in a drying oven at 115°F for 20 hours to evaluate dry weight.

Plant height: Both Vitazyme + rhizobium (Treatment 4) provided the best growth to give the tallest plants, followed by rhizobium alone, which was significantly as

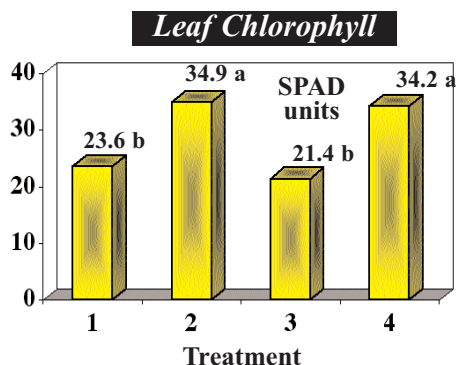


*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls Test. LSD_{0.10}=3.1 cm.

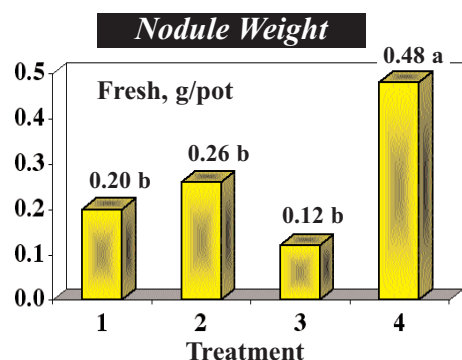
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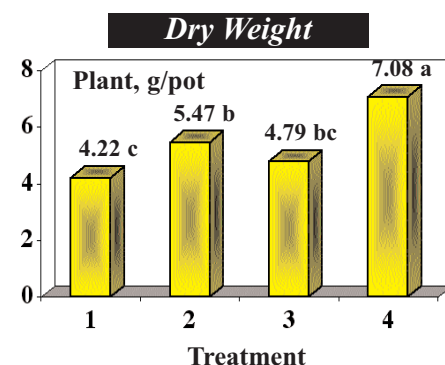
Note how rhizosphere bacteria plus Vitazyme on the right produce vigorous alfalfa growth.



*An average of seven values per pot, using a Minolta SPAD chlorophyll meter. Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls Test. LSD_{0.10}=3.9 SPAD units.



*Nodules were carefully removed from the roots for each plant. Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls Test. LSD_{0.10}=0.19 g.



*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls Test. LSD_{0.10}=1.21 g.

tall as Treatment 4. Without rhizobium nitrogen fixation to encourage growth, plant growth was significantly less.

Leaf chlorophyll: Both treatments receiving rhizobium (2 and 4) had the highest chlorophyll values, since these symbiotic bacteria fixed more nitrogen for chlorophyll synthesis. Lower chlorophyll for Vitazyme alone (Treatment 3) resulted from stimulated plant growth (carbon fixation) without commensurate adequate nitrogen fixation to maintain high-nitrogen chlorophyll levels.

Nodule weight: Total fresh nodule weight was by far the greatest for Treatment 4 (Vitazyme + rhizobium), while Treatment 2 (rhizobium alone) gave the second highest nodule weight. Without added rhizobium bacteria the nodule weights were the least.

Nodule Type: There were clearly two types of nodules detected during this investigation, one very white colored that was apparently a native, wild type present in the soil. These were seen especially in Treatments 1 and 3 where no rhizobium was applied. Treatments 2 and 4 had quite different rose-colored rhizobium nodules besides the white native species. It was apparent that the rose-colored nodules were derived from the introduced rhizobium bacteria, which fixed abundant nitrogen, since the plants having these nodules in their root zones were uniformly darker green — having more chlorophyll — and contained an abundance of red-colored leghemoglobin, the compound present in rapidly nitrogen-fixing molecules. The proportions of the two nodule types for the four treatments are shown in the table above.

Treatment	Native nodules	Change
	---- % of total nodules ----	
1	100	0
2	28	72
3	100	0
4	33	67

Dry weight: Vitazyme plus rhizobium (Treatment 4) caused by far the greatest dry matter increase (+68%), while rhizobium alone gave the second largest increase ... 30% above the control. Vitazyme alone (Treatment 3) was statistically equal to the rhizobium treatment, and was also equal to the control (Treatment 1).

Conclusions: This greenhouse study on alfalfa with Vitazyme and rhizobium bacteria revealed the following points:

1. Vitazyme had a strongly positive synergism with rhizobium bacteria in this alfalfa study, exceeding the control treatment in terms of dry weight (+68%), plant height (+38%), leaf chlorophyll (+45%), and nodule weight (+140%). All of these values, except for leaf chlorophyll, exceeded the other three treatments.
2. Added rhizobium bacteria had a strong positive effect in boosting plant height, leaf chlorophyll, nodule weight, and plant dry weight, especially with Vitazyme.
3. The added *Rhizobium meliloti* inoculant was much more effective at increasing nitrogen fixation for alfalfa plants than was the native rhizobium species.
4. There was no negative interaction between Vitazyme and rhizobium bacteria when they were mixed prior to seeding. Rather, there was a positive interaction between the two products during the course of the experiment.

- **Increase in height (Vitazyme + Rhizobium): 38%**
- **Increase in leaf chlorophyll (Vitazyme + Rhizobium): 45%**
- **Increase in nodule weight (Vitazyme + Rhizobium): 140%**
- **Increase in dry weight (Vitazyme + Rhizobium): 68%**

Apples

Researcher: Jeff Alicandro, Agr. Assistance, North Rose, New York

Location: Sodus, New York

Variety: Gala

Population: 800 trees/acre

Tree age: 8 years

Rootstock: M9

Experimental design: A commercial apple orchard was divided into Vitazyme treated and untreated sections; the west rows were treated. The objective of the study was to evaluate effects of this product on apple yield and quality.

1. Control

2. Vitazyme

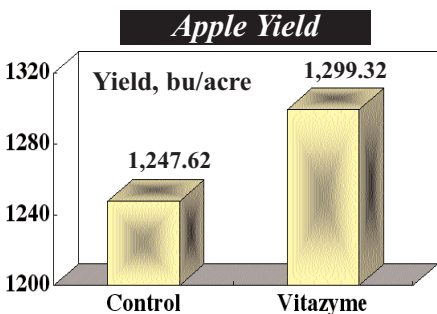
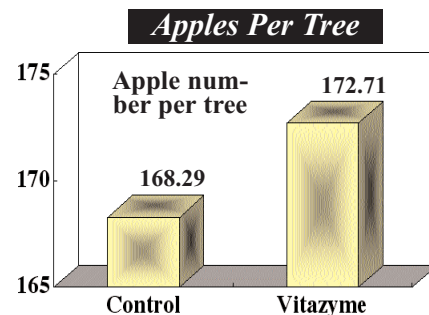
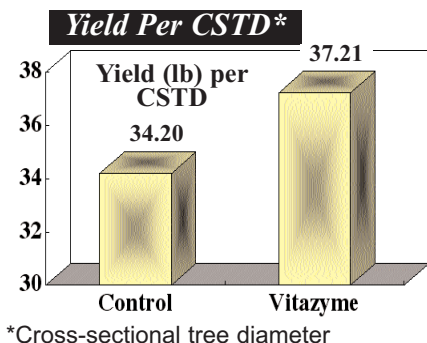
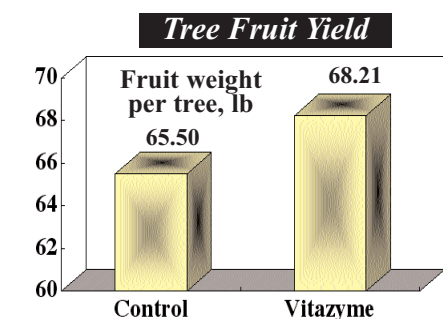
Vitazyme application: 16 oz/acre at first cover, and once again at second cover, with an orchard sprayer in 100 gallons of water per acre

Weather for 2004: cool and wet, giving rise to excellent yields

Fertilization: unknown

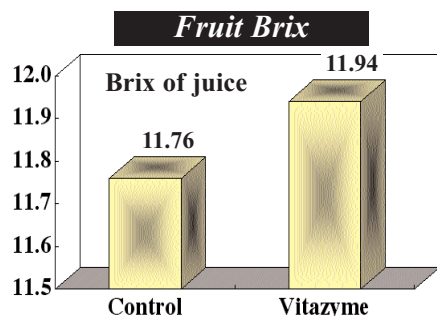
Midseason growth: On July 26, the Vitazyme treated foliage was visibly more aggressive and had a darker green color.

Yield results: At harvest on September 6, seven trees of similar size and crop load were used for evaluating the two treatments. Vitazyme caused an increase in fruit yield of 4%, and also increases in all measured parameters including individual tree yield (+4%), yield per cross-sectional tree diameter (+9%), and apples per tree (+3%).



Fruit grade results: All fruit was sized by categories, and the weights of the fruit for each category were added and evaluated to determine the percentage weight of each grade. Vitazyme produced more fruit in the >3.0" category than the control, and fewer fruit in the lighter categories. The mean fruit size was increased by 4% with Vitazyme, from 6.23 to 6.32 oz. See the line graph below for the size distribution.

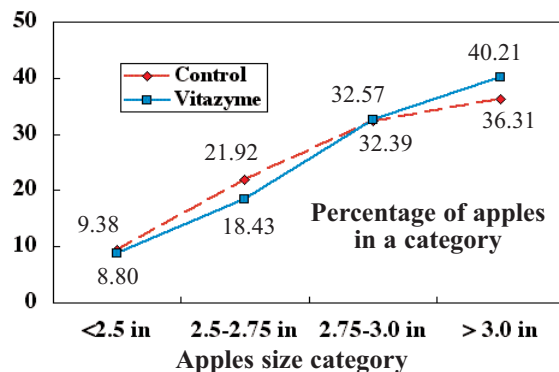
Fruit quality results: Ten apples from each treatment were selected to evaluate fruit pressure, fruit brix, and red color. Differences between the two treatments in fruit psi and red color were minor, but the brix for the Vitazyme treated apples was 0.18 unit greater.



Mean Fruit Size

Treatment	Fruit size	Change
	oz	oz
Control	6.23	—
Vitazyme	6.63	0.25 (+ 4%)

Income results: Prices for Gala apples were approximated for each of the size ranges: \$2.00/bu for <2.5 in, \$4.00/bu for 2.5-2.75 in, \$7.50/bu for 2.75 -3.0 in, and \$10.00/bu for >3.0 in. By multiplying these values by the percentage of fruit within each size range, an average value per bushel of apples was calculated for both



treatments. The value of the crop was then able to be calculated,

Conclusions: This western New York Gala apple trial revealed that Vitazyme boosted yield by a sizable 4% (51.7 bu/acre), and increased mean fruit weight by 4%, moving average size towards the >3-inch category. In addition, the brix level was slightly increased. Moreover, the average per bushel apple price was increased by \$0.25 with Vitazyme due a higher percentage of the more valuable larger sizes, and income per acre was increased by a sizable \$693.45, this with only two of the recommended four Vitazyme applications. The return on investment in Vitazyme for this orchard, was around 55:1.

According to the researcher, "In this evaluation the two mid-season Vitazyme applications resulted in slight increases in Gala fruit size and in somewhat higher yields. A slight trend toward improvement in soluble solid levels (brix) was also measured in the Vitazyme treatment."

- Increase in apple yield: + 4%
- Increase in apples/tree: + 3%
- Increase in yield/CSTD: + 9%
- Increase in mean fruit size: + 1.4%
- Increase in fruit weight: + 4%
- Increase in income: + \$693.45/acre
- Increase in apple price: + \$0.25/bu

Apples

Researcher: Jeff Alicandro, Agr. Assistance, North Rose, New York

Location: Sodus, New York

Variety: Macoun

Population: 450 trees/acre

Trellis: Y-trellis

Tree age: 10 + years

Rootstock: Mark

Experimental design: A commercial apple orchard was divided into Vitazyme treated and untreated sections; Block 28 was treated. The objective of the study was to evaluate effects of this product on apple yield and quality.

1. Control

2. Vitazyme

Vitazyme application: 24 oz/acre at pink, again at petal fall, a third time at first cover, and once again 30 days before harvest, with an orchard sprayer in 100 gallons of water per acre

Retain PGR application: All rows were treated with Retain Plant Growth Regulator 30 days before harvest to delay fruit maturity, improve fruit size, and reduce fruit drop.

Weather for 2004: cool and wet, giving rise to excellent yields

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Fertilization: unknown

Midseason growth: On July 26, the Vitazyme treated foliage was visibly more aggressive and had a darker green color. Chlorophyll readings were taken with a Minolta SPAD Chlorophyll Meter on 30 leaves of each treatment, which revealed a significant advantage for the treated block.

Yield results: At harvest on October 9, seven trees of similar size and crop load were used for evaluating the two treatments. Vitazyme caused an increase in fruit yield (+ 7%), as well as apples per tree versus the untreated control.

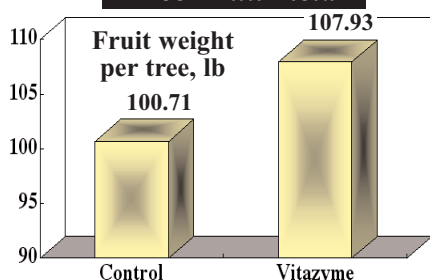


These Macoun apples near Sodus, New York, received no Vitazyme.

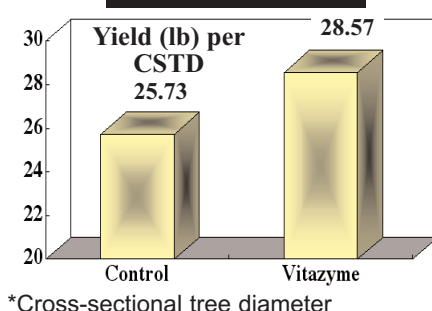


With Vitazyme, the Macoun apples displayed much better chlorophyll, and more branches, and leafiness, plus higher yield and quality of fruit.

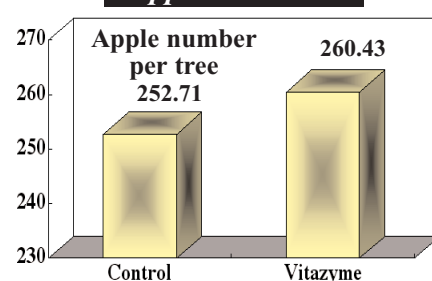
Tree Fruit Yield



Yield Per CSTD*



Apples Per Tree



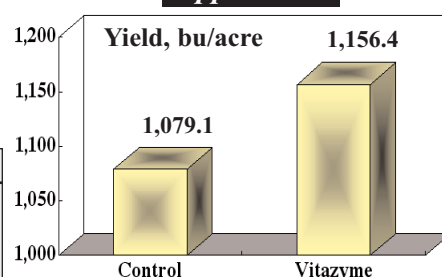
Fruit grade results: All fruit was sized by categories, and the weights of the fruit for each category were added and evaluated to determine the percentage weight of each grade. Vitazyme produced more fruit in the >3.0" category than the control, and fewer fruit in the lighter categories. The mean fruit size was increased by 4% with Vitazyme, from 6.38 to 6.63 oz. See the line graph below and to the right.

Fruit quality results: Ten apples from each treatment were selected to evaluate fruit pressure, fruit brix, and red color. Changes in fruit psi, brix, and red color were all minor, but were in all cases in favor of the Vitazyme treatment.

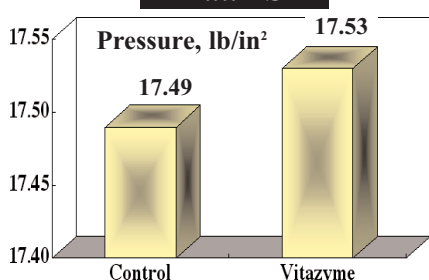
Mean Fruit Size

Treatment	Fruit size	Change
	oz	oz
Control	6.38	—
Vitazyme	6.63	0.25 (+ 4%)

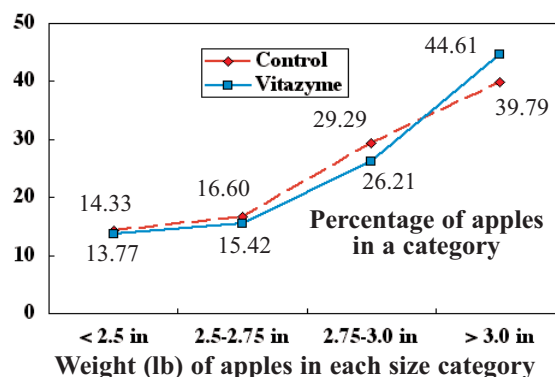
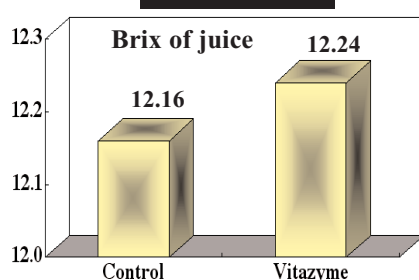
Apple Yield



Fruit PSI



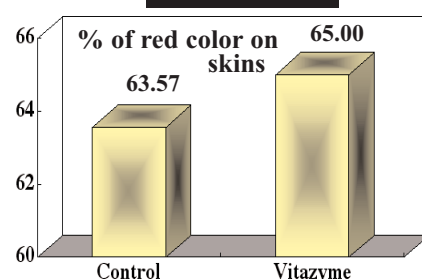
Fruit Brix



Income results: Prices for Macoun apples were approximated for each of the size ranges: \$2.00/bu for <2.5 in, \$4.00/bu for 2.5-2.75 in, \$7.50/bu for 2.75 -3.0 in, and \$10.00/bu for >3.0 in. By multiplying these values by the percentage of fruit within each size range, an average value per bushel of apples was calculated for both treatments. The value of the crop was then able to be calculated.

Treatment	Apple yield	Bushel value	Apple value	Increase
	bu/acre	\$/bu	\$/acre	\$/acre
Control	1,079.1	7.13	7,693.98	—
Vitazyme	1,156.4	7.33	8,476.41	782.43

Red Color



Conclusions: This western New York Macoun apple trial revealed that Vitazyme boosted yield by a sizable 7% (77.3 bu/acre), and increased mean fruit weight by 4%, moving average size towards the >3-inch category. In addition, quality parameters such as brix, red color, and fruit PSI were slightly increased, revealing that in all cases the effects of Vitazyme on apple yield and quality were positive. Moreover, the average per bushel apple price was increased by \$0.20/bu with Vitazyme due a higher percentage of the more valuable larger sizes, and income per acre was increased by a sizable \$782.43. The return on investment in Vitazyme for this orchard

exceeded 20:1.

According to the researcher, "In this evaluation the Vitazyme treatment resulted in larger Macoun fruit size, higher yields, and an increase in the percentage of 3-inch-plus diameter fruit."

- **Increase in chlorophyll: + 2.3 SPAD units**
- **Increase in income: +782.43/acre**
- **Increase in apples/tree: +3%**
- **Increase in yield/CSTD: +11%**
- **Increase in mean fruit size: +4%**
- **Increase in apple yield: +6%**
- **Increase in apple price: \$0.20/bu**

Apples

Researcher: Jeff Alicandro, Agr. Assistance, North Rose, New York

Location: Sodus, New York

Variety: Empire (Royal)

Population: 600 trees/acre

Tree age: 8 years (full-bearing)

Fertilization: unknown

Rootstock: M9

Experimental design: A Vitazyme test in a commercial apple orchard was continued for the second year, comparing this product to an untreated control. The objective of the study was to evaluate the effects of the product on fruit yield and quality.

1. Control

2. Vitazyme

Vitazyme application: 24 oz/acre at pink, again at petal fall, a third time at first cover, and once again 30 days before harvest, with an orchard sprayer in 100 gallons of water per acre

Weather for 2004: cool and wet, giving rise to excellent yields

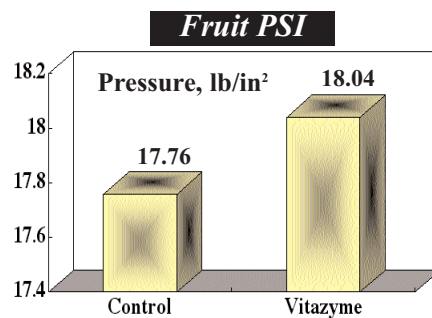
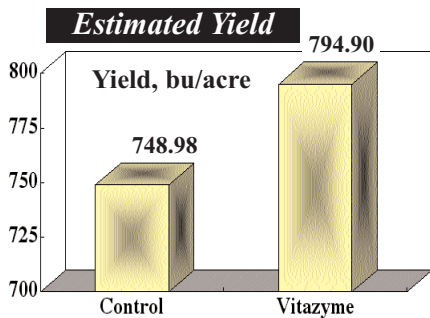
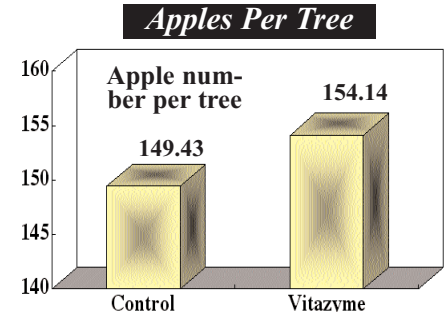
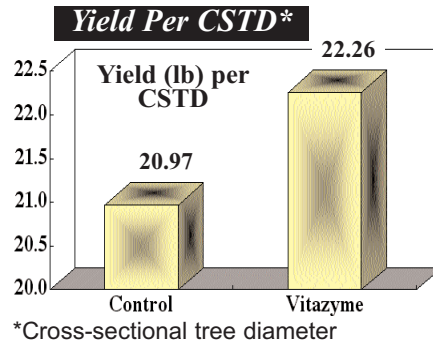
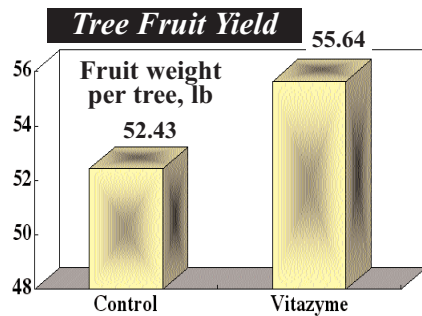
Midseason growth: Only July 26, the Vitazyme treated foliage was a bit darker green, indicating more chlorophyll, and thus photosynthesis was occurring to produce more photosynthate for a higher potential yield. Readings were taken with a Minolta SPAD Chlorophyll Meter, using 30 leaves from each treatment.

Yield results: At harvest on September 25, seven trees of similar size and crop load were used for evaluating the two treatments.

Vitazyme increased all yield parameters, the estimated yield by a sizable 6% while apples per tree were also increased.

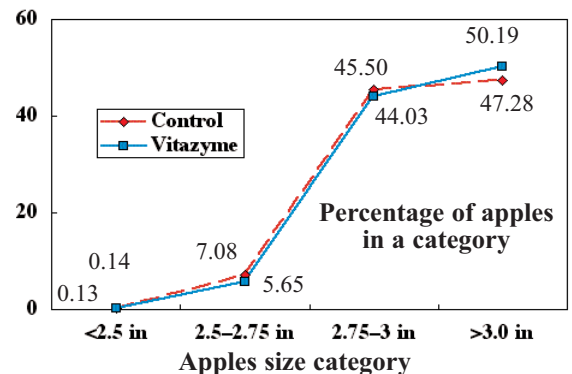
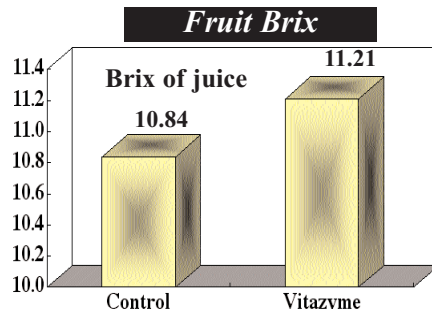


Well-colored, high brix, firm, high yielding fruit result from Vitazyme applications to apples.



Treatment	Fruit size	Change
	oz	oz
Control	5.61	—
Vitazyme	5.78	0.17 (+3%)

Fruit grade results: All fruit was sized by categories, and the weights for each category were added and percentages for each category were determined. Vitazyme produced larger fruit in general, increasing the sizes above 3.0" and reducing all smaller sizes versus the control treatment. In addition, the mean fruit size increased by 3%, from 5.61 to 5.78 oz. See the line graph to the right. Change in both fruit psi and brix were positively influenced by Vitazyme.



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Income results: Prices for Empire apples were approximated for each of the size ranges: \$2.00/bu for <2.5 in, \$4.00/bu for 2.5-2.75 in, \$6.00/bu for 2.75 -3.0 in, and \$8.00/bu for >3.0 in. By multiplying these values by the percentage of fruit within each size range, an average value per bushel of apples was calculated for both treatments. The value of the crop was then able to be calculated,

Conclusions: This western New York Empire apple trial, in its second year, revealed that Vitazyme improved the yield of apples significantly (+ 6%) while increasing average apple size. Fruit quality and income were also improved. The return:cost was more than 10:1. According to the researcher, "Vitazyme treated rows produced somewhat larger fruit size, higher yield, and an increase in percent of 3"-plus fruit. Vitazyme-treated fruit were also somewhat firmer (by 0.28 psi) and had slightly higher brix levels (by 0.37 brix) than untreated trees."

Treatment	Apple yield	Bushel value	Apple value	Increase
	bu/acre	\$/bu	\$/acre	\$/acre
Control	748.98	6.79	5,085.57	—
Vitazyme	794.90	6.89	5,476.86	391.29

- Increase in apple yield: + 6%
- Increase in yield/CSTD: + 6%
- Increase in apples/tree: + 3%
- Increase in mean fruit size: + 3%
- Increase in income: + 391.29/acre
- Increase in chlorophyll: + 1.7 SPAD units
- Increase in fruit weight: + 6%
- Increase in fruit brix: + 3.4%
- Increase in fruit PSI: + 1.6%
- Increase in apple price: \$0.10/bu

Bananas – In Vitro Transplants

Location: Biofabrica, Pinar del Rio Province, Cuba

Variety: FH1A-18

Potting soil: unknown

Experimental design: A study was made to determine the effects of Vitazyme on the growth and development of newly planted in vitro-propagated banana plants. A total of 400 plants were used, half of them treated with Vitazyme and half left as controls. All other treatments were identical for each.

Soil type: unknown

Pot size: unknown

Fertilization: unknown

Vitazyme treatment: The Vitazyme treated plants were immersed in a 5 ml/liter (0.5%) solution at transplanting, and also received a 5 ml/liter (0.5%) foliar application at five days after transplanting.

Growth results: At some time after transplanting, measurements were made on the roots, stems, and leaves.



Vitazyme gave a phenomenal response on banana transplants in Cuba.

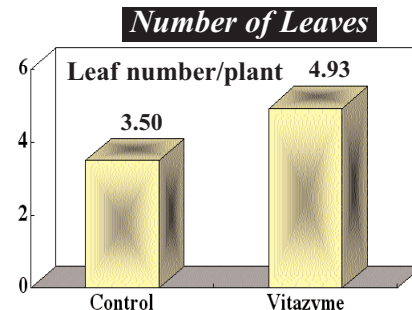
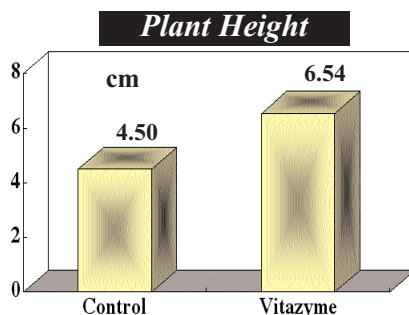
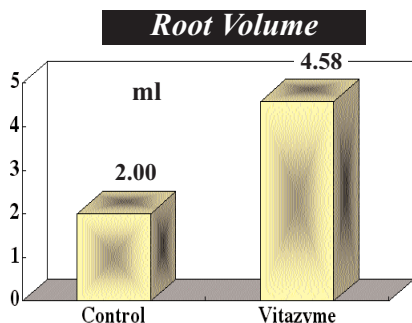
1. Control

2. Vitazyme

Fertilization: unknown

Vitazyme treatment: The Vitazyme treated plants were immersed in a 5 ml/liter (0.5%) solution at transplanting, and also received a 5 ml/liter (0.5%) foliar application at five days after transplanting.

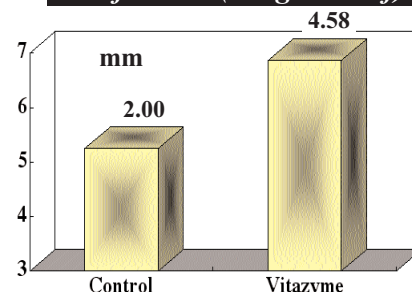
Growth results: At some time after transplanting, measurements were made on the roots, stems, and leaves.



Conclusions: These in vitro-raised banana plants, transplanted to small pots, responded very well to Vitazyme applied to the roots, and later on the leaves. Root volume increased 129%, plant height 45%, leaf number 41%, and leaf width 31%, showing the great efficacy of this product with banana transplants.

- Increase in root volume: + 129%
- Increase in plant height: + 45%
- Increase in leaf number: + 41%
- Increase in leaf width: + 31%

Leaf Width (Largest Leaf)



Black Beans

Vegetable Study by the Cuban Tobacco Institute

Location: near Havana, Cuba

Planting rate: unknown

Experimental design: A field of black beans was treated with Vitazyme except for one portion of the field, the purpose of the test being to discover possible positive effects of this biostimulant on black bean production.

1. Control 2. Vitazyme

Fertilization: unknown

Vitazyme application: 1 liter/ha (13oz/acre) at flower initiation

Growth effects: At an unknown date various growth parameters were measured. Ten average plants were measured for each parameter.

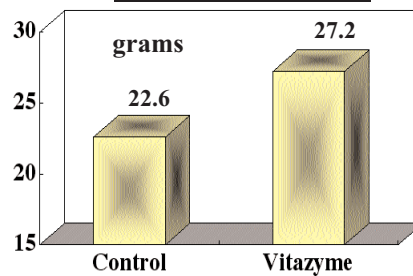
Variety: unknown

Planting date: unknown

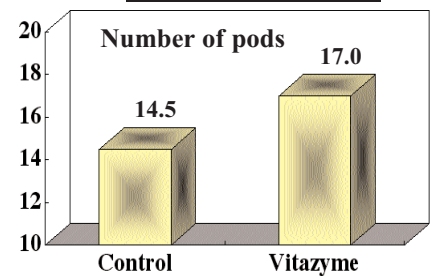
Soil type: unknown

Seeding rate: unknown

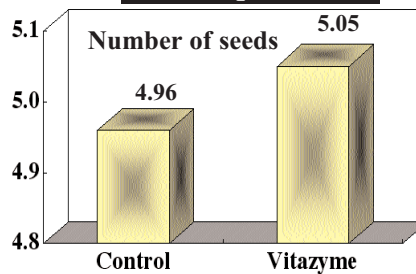
Weight per Plant



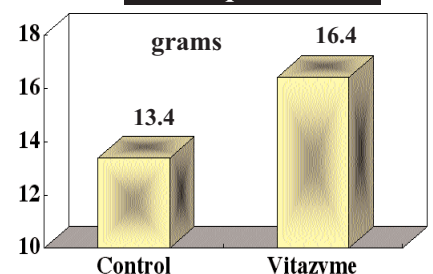
Pods per Plant



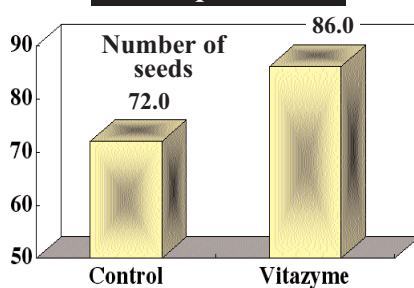
Seeds per Pod



Yield per Plant



Seeds per Plant



• **Increase in weight per plant: + 20%**

Conclusions: Vitazyme applied only one time to black beans in this Cuban test caused about 20% increases in plant growth (weight, pods, seeds, and yield per plant), while the seeds per pod were nearly the same for both treatments. Vitazyme is shown to be an excellent amendment to increase black bean yield in Cuba.

• **Increase in seeds per plant: + 22%**

• **Increase in pods per plant: + 17%**

• **Increase in seeds per pod: + 2%**

• **Increase in yield per plant: + 20%**

Boston Ferns

Location: Vital Earth Resources Research Greenhouse, Gladewater, Texas

Species: Boston fern [*Nephrolepis exaltata*, var. *Bostoniensis*]

Planting date: March 21, 2003; a fern root mass was divided into six equal-sized portions

Planting media: Vital Earth Ultra-Blend

Pot size: 2 gallons

Experimental design: The potted ferns were placed in the greenhouse in a replicated pattern (3 reps); three pots treated with Vitazyme periodically during the duration of the study to investigate effects on fern growth.

1. Control
2. Vitazyme

Fertilization: 0.5 tsp of a 21-7-12 + micronutrients Carl Pool fertilizer, applied about every 4 months to each pot and watered in

Vitazyme application: (1) At planting, the pots were saturated with water, and the Vitazyme treated pots received 100 ml of a 1% solution. (2) Vitazyme was applied periodically during the test period, usually as a soil drench of 200 ml of a 0.1% solution every 3 to 4 months, but on March 5, 2004, as a 3% Vitazyme spray on the leaves of the appropriate plants.

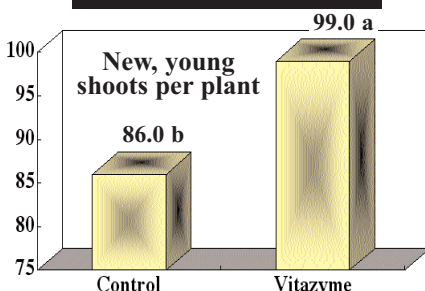
Growth results: On August 11, 2004, measurements were taken of total plant and pot weight, plus young shoot growth, of each pot.

Conclusions: This greenhouse fern study with



With Vitazyme the ferns were more full and growthy, giving a nicer appearance to the consumer.

New Plant Growth*



*All shoots and leaves of whatever size (including newly emerging leaves) were counted for each pot that were above the horizontal plane, and were not hanging below it. Means followed by the same letter are not significantly different according to the Student-Newman-Keuls Test ($P = 0.1$). $LSD_{0.1} = 6.1$ shoots.

Continued on the next page

Vitazyme revealed that the product caused a small (5%) but nonsignificant increase in total leaf and root mass, but the number of young leaves and emerging fronds was significantly greater (+15%) with the Vitazyme treatment. Not measured but noted visually in this study were the following items:

- (1) Vitazyme produced fuller leaves and a more attractive, balanced leaf canopy.
- (2) The leaves of Vitazyme treated ferns were, in general, darker green, containing more chlorophyll for greater growth potential.

▪ **Increase in new leaf growth: + 15%**

Plant and Pot Weight

Treatment	Plant/Pot weight*	Change
	lb	lb
Control	10.69 a	—
Vitazyme	11.21 a	0.52 (+5%)

* The pots were saturated with water and allowed to drip until dripping ceased, insuring there were no differences in weight due to differences in evapotranspiration. Differences in soil volume for pots could not be accounted for by weighing the entire pot, but all pots were quite uniform, and differences were slight. Means followed by the same letter are not significantly different according to the Student-Newman-Keuls Test (P = 0.1).

Cabbage

Location: Santiago de Cuba Experiment Station, Dos Rios, Palma Soriano, Santiago de Cuba, Cuba

Farm: Alfride Vazquez

Variety: unknown

Soil type: Leptic haplustert

Transplanting date: unknown

Row spacing: unknown

Experimental design: Two treatments were set up in a cabbage field to evaluate the effects of Vitazyme on growth and yield. Several growth parameters were measured in addition to final yield.

1. Control 2. Vitazyme

Fertilization: unknown

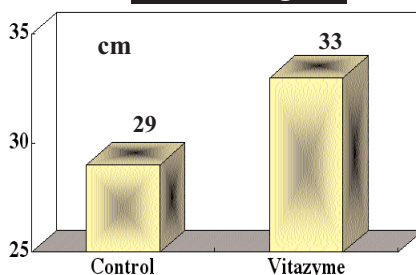
Vitazyme treatment: unknown

Growth and yield results: The parameters shown here were measured at harvest. There was no difference in leaf width for the two treatments. Each averaged 21 cm in width.

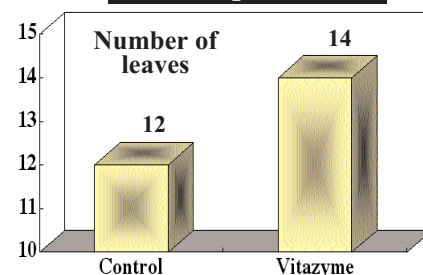
Conclusions: Vitazyme applied to cabbages in this Cuban study caused excellent responses in growth parameters (height, +14%; leaves per plant, +17%), as well as yield values. The average cabbage size was increased by 18%, and yield increased by 18% as well. Vitazyme is shown to be a highly effective adjunct to cabbage cultivation in Cuba.

▪ **Increase in plant height: 14%**

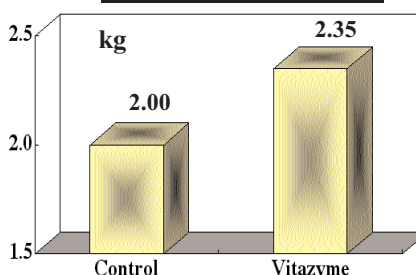
Plant Height



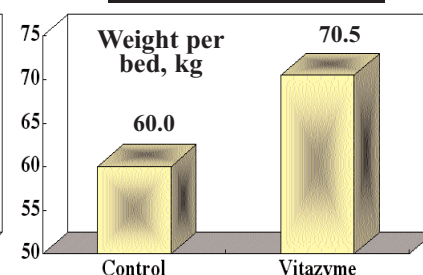
Leaves per Plant



Weight per Cabbage



Cabbage Yield



▪ **Increase in leaves per plant: + 17%**

▪ **Increase in cabbage yield: + 18%**

▪ **Increase in weight per cabbage: + 18%**

Corn

North Carolina State University

Location: Clarkton, North Carolina

Population: 33,000 seeds/acre

Previous crop: soybeans

Experimental design: A plot area of 18,000 ft² (180 x 100 ft) was divided into individual plots of 400 ft² (40 x 10 ft), with four replicates. The objective of the study was to evaluate the potential of Vitazyme biostimulant to improve grain yield at five nitrogen rates.

Variety: DKC69-71 RRH62

Row width: 30 inches

Tillage: conventional

Planting date: April 24, 2004

Control

1. No N
2. 56 lb/acre
3. 112 lb/acre N
4. 224 lb/acre N
5. 280 lb/acre N

Vitazyme

6. No N
7. 56 lb/acre
8. 112 lb/acre N
9. 224 lb/acre N
10. 280 lb/acre N

Fertilization: 10 gal/acre of 19-19-0 %N-P₂O₅-K₂O in a 2x2 band on April 24 after broadcasting 30% UAN and a 10-34-0 fertilizer on April 19

Herbicide application: Lariat (3 qt/acre) on April 19, broadcast pre-plant

Insecticide application: Counter 20CR (7 lb/acre) on April 21, T-banded on April 21

Vitazyme application: 13 oz/acre on the seeds at planting, and 13 oz/acre broadcast at knee height

Harvest date: September 23, 2004

Yield Results:

Treatment	N-level	Yield	Change ¹	NCLB rating ²	Change ¹	GLS rating ³	Change ¹
	lb/acre	bu/acre	bu/acre				
Control	0	153.9	—	9.25	—	8.88	—
	56	170.2	—	9.38	—	8.88	—
	112	145.9	—	9.63	—	9.00	—
	224	159.3	—	9.75	—	9.38	—
	280	139.7	—	10.00	—	9.50	—
	Average		153.8	—	9.60	—	9.13
Vitazyme	0	181.6	27.7* (+18%)	9.38	0.13 (+1%)	8.88	0 (0%)
	56	162.6	(-) 7.6 (-4%)	9.75	0.37* (+4%)	9.25	0.37* (+4%)
	112	166.8	20.9* (+14%)	9.88	0.25* (+3%)	9.50	0.50* (+6%)
	224	178.6	19.3* (+12%)	9.88	0.13 (+1%)	9.63	0.25* (+3%)
	280	151.2	11.5 (+8%)	10.00	0 (0%)	9.50	0 (0%)
	Average		168.2	14.4* (+9%)	9.78	0.18 (+2%)	9.35
LSD _{0.05}		14.3		0.19		0.15	

¹ Differences are compared with the same N level for control and Vitazyme

²NCLB = Northern Corn Leaf Blight: 1 = leaves covered with lesions, 10 = no disease.

³GLS = Gray Leaf Spot: 1 = leaves covered with lesions, 10 = no disease.

*Significant difference vs. the control at P=0.05.

Vitazyme significantly boosted grain yield across all N levels, by 14.4 bu/acre (9%), and especially at the 0 N level (+18%), the 112 lb/acre N level (+14%), and the 224 lb/acre N level (+12%). Residual N levels and seasonal N release were apparently quite high, since the highest yield was with no added N plus Vitazyme (181.6 bu/acre), and yields in general tapered off as N levels increased, the lowest yields being at the 280 lb/acre N rate for both treatments. The yield response thus exhibited some N excess at the higher N rates.

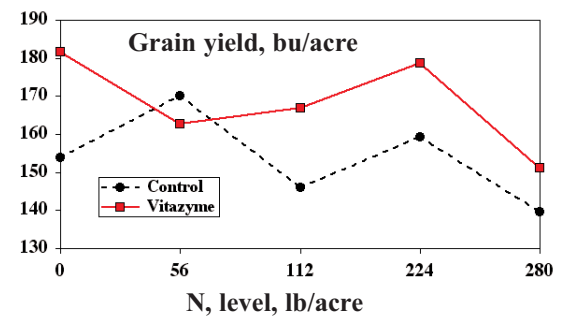
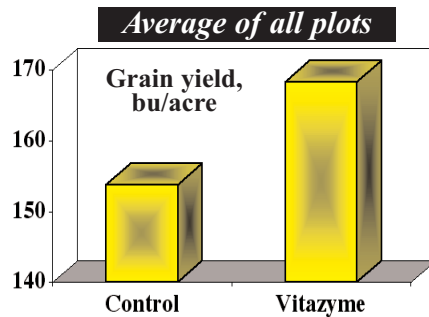
Leaf pathogen results: Vitazyme reduced the Northern Corn Leaf Blight rating significantly across nearly all plots, and did so at the 56 and 112 lb/acre N rates. At all N rates, Vitazyme treated corn reduced NCLB incidence compared to the control.

At all levels of N except at 0 and 280 lb/acre, Vitazyme reduced the incidence of grey leaf spot. This reduction was significant at 56, 112, and 224 lb/acre of N, and also for the overall average of all plots.

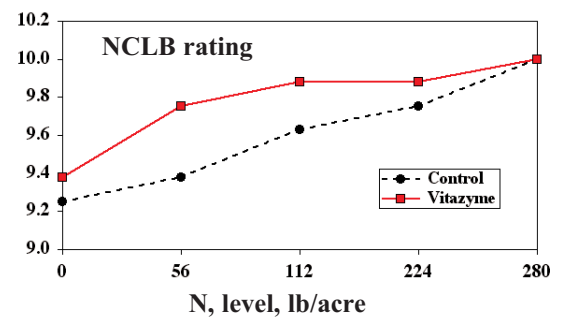
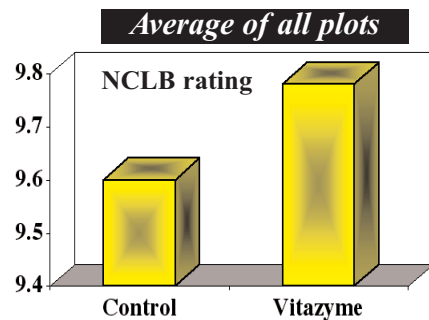
Conclusions: In this North Carolina State University replicated corn study, Vitazyme increased corn grain yields at all N levels except at 56 lb/acre N. The average overall yield was increased by Vitazyme by 9%, which was significant at P=0.05. Resistance to both Northern Corn Leaf Blight and Grey Leaf Spot were also significantly (P=0.05) increased over several N levels, and was significantly greater for Vitazyme over all N levels for NCLB. This product shows excellent promise in promoting higher yields with greater disease resistance under North Carolina conditions.

**Average yield increase:
9% (14.4 bu/acre)**

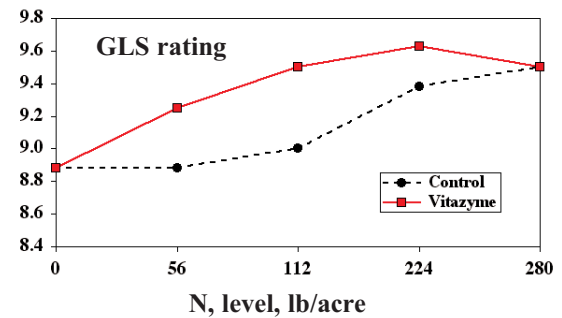
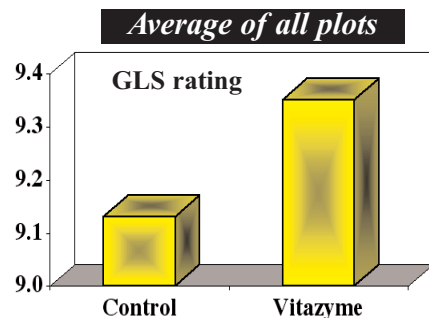
Corn Grain Yield



Northern Corn Leaf Blight Rating



Grey Leaf Spot Rating



Corn

North Carolina State University

Location: Elizabeth City, North Carolina

Population: 33,000 seeds/acre

Previous crop: soybeans

Experimental design: A plot area of 15,400 ft² (220 x 70 ft) was divided into individual plots of 400 ft² (40 x 10 ft), with four replicates. The objective of the study was to evaluate the potential of Vitazyme biostimulant to improve grain yield and reduce disease incidence at five nitrogen rates.

Variety: DKC69-71 RRH62

Row width: 30 inches

Tillage: conventional

Planting date: April 21, 2004

Control

1. No N
2. 56 lb/acre
3. 112 lb/acre N
4. 224 lb/acre N
5. 280 lb/acre N

Vitazyme

6. No N
7. 56 lb/acre
8. 112 lb/acre N
9. 224 lb/acre N
10. 280 lb/acre N

Fertilization: 10 gal/acre of 19-19-0 %N-P₂O₅-K₂O in a 2x2 band on April 21 after broadcasting 30% UAN and a 10-34-0 fertilizer before planting

Herbicide application: Atrazine (2 qt/acre) with Banvel (0.5 pt/acre) plus Accent on May 27

Insecticide application: Counter 20CR (15 lb/acre), T-banded on April 21

Vitazyme application:

13 oz/acre on the seeds at planting, and 13 oz/acre broadcast at knee height

Harvest date: unknown

Yield Results: Vitazyme caused a substantial increase in yield over the untreated control at all N levels except at 112 lb/acre N; most of these yield differences were significant. The average yield difference was 18.7 bu/acre in favor of Vitazyme, a significant increase over the control of 15%.

Leaf pathogen results: At all N levels the Vitazyme treatment produced significantly reduced NCLB infection than did the control. This led to an average 39% reduction in NCLB lesions over all treatments.

As for Northern Corn Leaf Blight ratings, Grey Leaf Spot ratings were significantly better for Vitazyme at all N levels. This differences led to a significant average difference of 12% over all plots for each treatment.

Conclusions: This corn study in North Carolina revealed that Vitazyme increased grain yield significantly, by an average of 18.7 bu/acre (+15%) over all plots ... and especially at the 0 N level, where yield was improved by 44.5 bu/acre (+82%) above the control. Both Northern Corn Leaf Blight and Grey Leaf Spot were also significantly reduced by Vitazyme at all N levels, the average reduction being 39% for NCLB and 12% for GLS. These data show that Vitazyme apparently improves plant immunity to common corn pathogens, and concur-

Treatment	N-level lb/acre	Yield bu/acre	Change ¹ bu/acre	NCLB rating ²	Change ¹	GLS rating ³	Change ¹
Control	0	54.0	—	3.25	—	6.13	—
	56	118.3	—	3.75	—	6.13	—
	112	157.8	—	3.88	—	6.38	—
	224	150.0	—	4.25	—	6.63	—
	280	139.9	—	4.13	—	6.75	—
	Average	124.0	—	3.85	—	6.40	—
Vitazyme	0	98.5	44.5* (+82%)	4.88	1.63* (+50%)	6.50	0.37 (+6%)
	56	138.4	20.4* (+17%)	5.13	1.38* (+37%)	6.88	0.75* (+12%)
	112	155.6	(-)2.2 (-1%)	5.13	1.25* (+32%)	7.25	0.87* (+14%)
	224	159.4	9.4 (+6%)	5.88	1.63* (+38%)	7.38	0.75* (+11%)
	280	161.5	21.6* (+15%)	5.75	1.62* (+39%)	7.88	1.13* (+17%)
	Average	142.7	18.7* (+15%)	5.35	1.50* (+39%)	7.18	0.78* (+12%)
LSD _{0.05}	15.0	0.40					

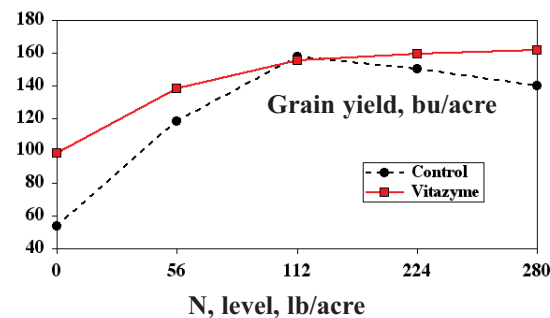
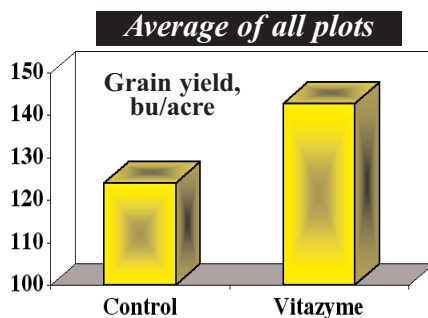
¹ Differences are compared with the same N level for control and Vitazyme

²NCLB = Northern Corn Leaf Blight: 1 = leaves covered with lesions, 10 = no disease.

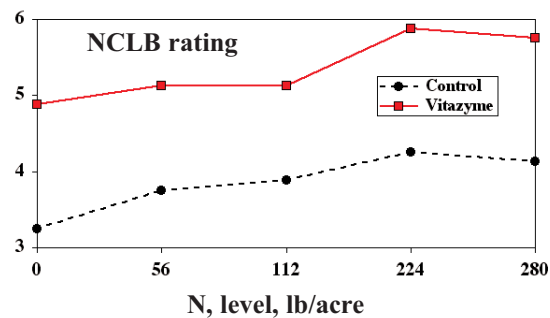
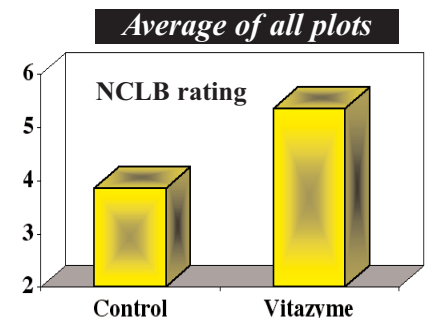
³GLS = Gray Leaf Spot: 1 = leaves covered with lesions, 10 = no disease.

*Significant difference vs. the control at P=0.05.

Corn Grain Yield

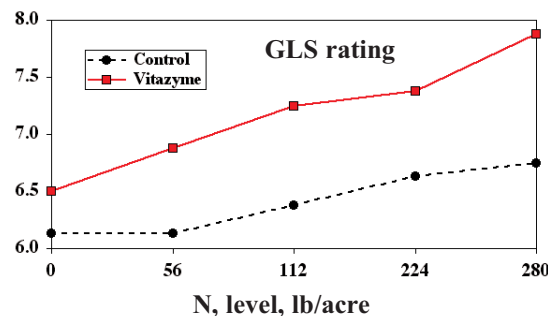
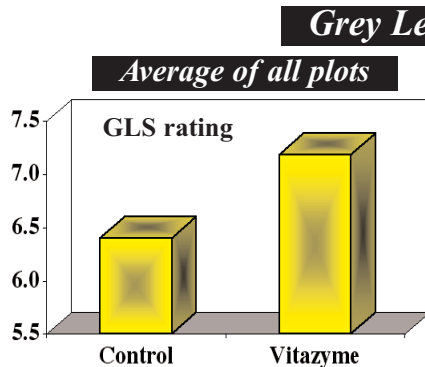


Northern Corn Leaf Blight Rating



rently boosts the yield potential of the crop, especially when N is limiting. The optimum N application in this study was 112 lb/acre; corn yields increased only slightly with Vitazyme with higher N rates, although without Vitazyme the yields fell somewhat.

**Average yield increase:
15% (18.7 bu/acre)**



Corn

Location: Austin, Texas

Soil type: silty clay loam

Population: 24,000 plants/acre

Experimental design: A 110-acre field was divided into two parts, 30 acres treated with Vitazyme and the rest of the field left untreated. All other treatments were the same across the entire field.

1. Control

2. Vitazyme

Fertilization: anhydrous ammonia and a mixed N-P-K fertilizer

Vitazyme application: 13 oz/acre added to the seeds with a liquid starter fertilizer at planting

Growth observations: An examination of corn plants from each treatment at midseason revealed a noticeable size advantage for the treated plants.

Variety: Golden Acre 2850RR

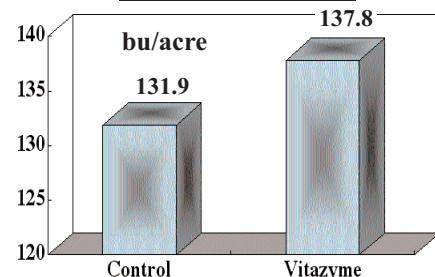
Row spacing: 30 inches

Planting date: March 28, 2204



Vitazyme treated corn at planting gave an excellent root and leaf response in this study.

Grain Yield



Yield results: On August 27, 2004, one-acre areas of each treatment located close to each other were measured and blocked off. The one-acre areas were harvested and unloaded into a truck, and weighed individually.

Conclusions: This south Texas corn study revealed that Vitazyme applied in the seed row at planting increased the yield by 4.5% (5.9 bu/acre). There was little change in grain quality due to Vitazyme application. If a \$3.00/bushel corn price is used, this yield increase is a profitable \$17.70/acre.

Increase in grain yield: 4.5%

Corn – New Product Evaluation

Agricultural Custom Research and Education Services

Location: Cedar Falls, Iowa

Soil type: Floyd loam (pH 6.8, organic matter 4.2%, CEC 15.7, good fertility)

Planting depth: 1.5 inches

Tillage: conventional

Experimental design: A Latin-square design with six replicates

Variety: Pioneer 34M98 non-GMO

Row spacing: 30 inches

Previous crop: soybeans

Planting rate: 29,900 seeds/acre

Planting date: May 4, 2004



This Cedar Falls, Iowa, replicated study produced excellent yield responses for Vitazyme and two new potential product additives.

was established with plots 15 (6 rows) x 40 feet (0.0138 acre), to discover the effects of Vitazyme, a new variant of Vitazyme

(Product X), and a possible synergistic product with Vitazyme (Product Y). Six treatments were used, as outlined below, and an analysis of variance utilized the Student-Newman-Keuls method to separate treatment means.

Fertilization: 100 lb/acre of N as a 28-0-0 solution; all other nutrients were adequate

Vitazyme application: 13 oz/acre applied at planting on the seeds, and again at knee-height on June 15 (6-leaves)

Harvest date: October 21

Treatment	Product	Vitazyme rate
1	Control	0
2	Vitazyme	13 oz/acre x 2
3	Product X	13 oz/acre x 2
4	Product Y	13 oz/acre x 2
5	Vitazyme + Product Y	13 oz/acre x 2 each
6	Product X + Product Y	13 oz/acre x 2 each

Continued on the next page

Yield results: The center two rows of each plot were harvested with a plot combine, and the grain was weighed with an electronic scale. Grain weight per plant was based on harvest weight and the counts of all plants in the harvested rows. Vitazyme, Product X, and Product X + Product Y increased yield by about 20 bu/acre, which was a significant increase above the untreated control. Product Y alone and Product X + Product Y also significantly increased grain yield, but the increase was somewhat less.

Treatment	Grain yield** bu/acre	Change bu/acre	Moisture** %	Change %	Grain/Plant** lb/plant	Change lb/plant
1. Control*	163.0 b	—	17.51 ab	—	0.488 b	—
2. Vitazyme	183.3 a	20.3 (+12%)	17.00 ab	0.51 (-3%)	0.506 b	0.018 (+4%)
3. Product X	183.0 a	20.0 (+12%)	16.02 b	1.49 (-9%)	0.516 b	0.028 (+6%)
4. Product Y	178.1 a	15.1 (+9%)	16.70 ab	0.81 (-5%)	0.515 b	0.027 (+6%)
5. Vita + Prod Y	179.1 a	16.1 (+10%)	17.00 ab	0.51 (-3%)	0.533 ab	0.045 (+9%)
6. Prod X + Prod Y	182.6 a	19.6 (+12%)	18.47 a	0.96 (+5%)	0.553 a	0.065 (+13%)

* Average of three control treatments.

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

Yield Changes

Vitazyme.....+12%
 Product X.....+12%
 Product Y.....+9%
 Vita + Prod Y....+10%
 Prod X + Prod Y..+12%

Moisture Changes

Vitazyme.....-3%
 Product X.....-9%
 Product Y.....-5%
 Vita + Prod Y.....-3%
 Prod X + Prod Y...+5%

Grain/Plant Changes

Vitazyme.....+4%
 Product X.....+6%
 Product Y.....+6%
 Vita + Prod Y.....+9%
 Prod X + Prod Y..+13%

All treatments but Product X + Product Y reduced grain moisture at harvest; that treatment increased grain moisture by nearly 1 percentage point. On the other hand, Product X reduced grain moisture by 1.5 percentage point. All five product treatments increased the grain weight per plant, especially Product X + Product Y, which boosted per plant grain weight by 13%; this extra weight per plant did not give the highest total grain yield, however.

Income results: A \$2.00/bu price for corn is used for these calculations.

Conclusions: In this replicated Iowa corn study, **Vitazyme and all other products and combinations produced statistically greater corn yields than the control.** This increase amounted to a very profitable gross income increase of over \$40 for Vitazyme alone. **The grain moisture at harvest was reduced by 1.5 percentage point by Product X;** all of the other treatments except Product X + Product Y — which resulted in nearly a 1 percentage point increase — also reduced grain moisture. Grain per plant was significantly higher than the control for all of the treatments, especially for Product X + Product Y, which gave a significant 13% increase.

Treatment	Grain increase bu/acre	Extra income \$/acre
2. Vitazyme	20.3	40.60
3. Product X	20.0	40.00
4. Product Y	15.1	30.20
5. Vita + Prod Y	16.1	32.20
6. Prod X + Prod Y	19.6	39.20

The reduced grain moisture caused by Product X, and the high grain/plant of Product X + Product Y, are noteworthy in this investigation and deserve further study. Vitazyme alone appears to give its usual excellent yield response that was not excelled by any other product or treatment in this study.

Corn – New Product Evaluation



At Gasport, New York, a new component added to Vitazyme stimulated additional root and leaf growth, plus higher yield and faster dry down, compared to regular Vitazyme.

However, chlorophyll levels were the same for both products.

Yield and grain moisture results: On December 1, one-acre areas of each treatment located very close to each other were harvested with an 8-row combine. The grain for each treatment was loaded into a truck and weighed.

There was a dead furrow in the area that was harvested for the regular Vitazyme, so the 13.1 bu/acre increase for the Vitazyme variant was too large. However, yields

Location: Gasport, New York

Soil type: Hilton loam

Population: 29,000 plants/acre (final)

Experimental design: A corn field received strips of a new Vitazyme variation in order to evaluate its efficacy to improve corn yield and quality. All of the rest of the field received regular Vitazyme plus all other treatments that the experimental treatment did.

Variety: Pioneer Liberty Link

Row spacing: 30 inches

Planting date: June 15, 2204

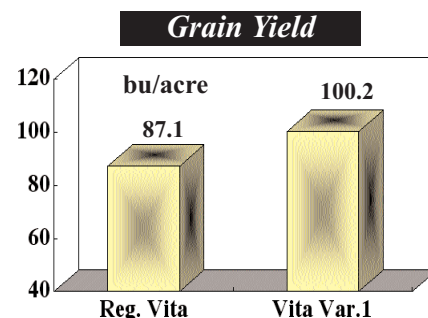
1. Vitazyme Variant 1

2. Regular Vitazyme

Fertilization: 5 gal/acre of 9-18-9 (%N-P₂O₅-K₂O) in the seed row at planting; 100 lb/acre (NH₄)₂SO₄, 100 lb/acre pelleted lime, and 50 lb/acre of KCl pre-plant, and 25 gal/acre of 32% N side-dressed

Vitazyme application: 13 oz/acre added to the seeds with the 9-18-9 liquid starter fertilizer at planting

Growth observations: An examination of corn plants from each treatment on July 21 revealed a noticeable size advantage for the plants treated with the



across the regular Vitazyme areas of the field were in the range of 90 bu/acre, so the difference in yield was probably 9 to 10 bu/acre, or about 11%.

Conclusions: This New York corn trial revealed that Vitazyme Variant 1 increased corn yield about 10% over the regular Vitazyme, while greatly reducing grain moisture at harvest (1.5%). This variant shows potential to upgrade the response of Vitazyme to the farmer.

• **Increase in grain yield: 10%**

• **Decrease in grain moisture: 1.5 percentage points**

Corn – New Product Evaluation

Location: Cecilia, Kentucky
Soil type: Crider silt loam
Population: 20,000 plants/acre
Tillage: no-till

Variety: NK 65M7 (non-GMO)
Row spacing: 30 inches
Planting date: April 21, 2204

Experimental design: A 4-acre field was divided into eight plot areas of equal size, with four treatments replicated twice. The test was designed to evaluate the effect of a new variant of Vitazyme on corn yield and development. All other treatments were the same except for no starter on Treatments 1 and 2.

- | | |
|------------------------------------|-----------------------------|
| 1. Control, no Vitazyme or Starter | 3. Starter only |
| 2. New Vitazyme only, no Starter | 4. New Vitazyme and Starter |

Fertilization: 70 lb/acre of N, 90 lb/acre of P₂O₅, and 90 lb/acre of K₂O broadcast as a blended fertilizer before planting (in early April); a 5-20-5 % N-P₂O₅-K₂O starter fertilizer applied in the seed row at planting for Treatments 3 and 4; 1000 lb/acre N as urea + Agritone (urease inhibitor), broadcast at 14-inch height in early June

New Vitazyme application: 13 oz/acre added to the seeds with the liquid starter fertilizer at planting



In this study, the effects of Vitazyme applied at planting can be seen right to the test boundary.

Treatment	Grain yield	
	bu/acre	Change bu/acre
1. Control	151.3	—
2. New Vita only	152.7	1.4 (+1%)
3. Starter only	158.4	7.1 (+5%)
4. Vita + Starter	162.2	10.9 (+7%)



Note the excellent, aggressive rooting of the Vitazyme treated corn plants from the above test.

Yield results: Harvest occurred on October 4, 2004. The corn was very dry at harvest so no dry-down differences were able to be measured. The Vitazyme without starter increased the grain yield by only 1.4 bu/acre, but with starter the increase was 10.9 bu/acre above the control.

Conclusions: This Kentucky corn study revealed that the new Vitazyme applied in the seed row at planting without starter fertilizer increased the yield only slightly. When applied with starter, however, the yield increased by 10.9 bu/acre (7%) over the control, which was 3.8 bu/acre over the starter alone. This increase in yield for the new Vitazyme + starter gave an added income to the farmer, above the no-starter control, of \$21.80/acre, at \$2.00/bu of corn.

Increase in grain yield
New Vitazyme only: 1%
Starter only: 5%
New Vitazyme+Starter: 7%

Corn – New Component Evaluation

Location: Vital Earth Resources Research Greenhouse, Gladewater, Texas
Pot size: 1 gallon
Planting date: February 26, 2004
Growing conditions: 60° to 85°F

Soil type: fine sandy clay loam
Variety: Hickory King
Seeding rate: 8 seeds/pot, thinned to 3 plants/pot
Watering: as needed

Experimental design: One-gallon pots (0.217 ft²/pot) were filled with soil and arranged in a randomized complete block design. Four replicates were utilized. A series of dilutions of a certain organic component (Product 3) was prepared and applied to the pots, with Vitazyme added to one treatment, to evaluate effects of Product 3 with and without Vitazyme.

Fertilization: none
Vitazyme and Product 3 applications: Dilutions were prepared, and 100 ml of each product were added to the soil surface of each treatment after planting. Treatment 1 received only water.

Harvest date: March 31, 2004, after 34 days of growth

Growth results: The roots were washed clean from attached soil, and the plant heights were measured. Then all plants were dried in a drying oven for 24 hours at 120°F before being weighed to the nearest 0.01 gram.

Product 3 did not increase plant height significantly at any concentration, but rather slightly decreased height. When combined with Vitazyme at 0.01% Product 3, the reduction in height was significant. Vitazyme at 0.1% contained too high a concentration of active agents to increase corn height above the control, and in combination

Treatment	Product 3*	Vitazyme**
1	0	0
2	0	0.1%
3	0.1%	0
4	0.01%	0
5	0.01%	0.1%
6	0.001%	0
7	0.0001%	0

*Applied in 100 ml of the dilutions at planting.

**Added to the same 100 ml of solution with Product 3.

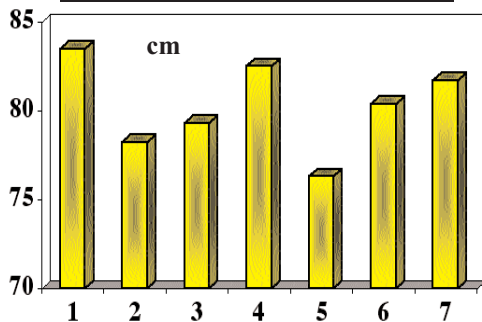
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with Product 3 provided excessive levels of certain active agents to inhibit certain enzyme pathways.

No significant differences in dry weight means were detected for any of the treatments except for the 0.0001% Product 3 treatment versus the 0.01% Product 3 + Vitazyme treatment. Vitazyme was applied at levels too high to elicit normal positive responses.

Conclusions: In this greenhouse corn study to evaluate the efficacy of Product 3, with or without Vitazyme, to promote corn height and dry weight accumulation, no significant effects of Product 3 were detected. It is concluded that this material would not be a good, positive addition to Vitazyme to improve its activity. Vitazyme was applied at levels too high to achieve normal growth enhancement in this study.

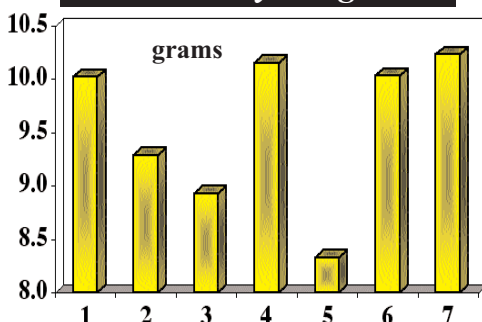
Plant Height



Treatment	Plant height*	Change
	cm	cm
1 (Control)	83.5 a	—
2 (0.1% Vita.)	79.2 ab	(-) 4.3 (-5%)
3 (0.1% Prod. 3)	81.7 ab	(-) 1.8 (-2%)
4 (0.01% Prod. 3)	82.5 ab	(-) 1.0 (-1%)
5 (0.01% Prod. 3 + Vita.)	76.3 b	(-) 7.2 (-9%)
6 (0.001% Prod. 3)	80.4 ab	(-) 3.1 (-4%)
7 (0.0001% Prod. 3)	81.7 ab	(-) 1.8 (-2%)

*Means followed by the same letter are not significantly different according to the Student-Newman-Keuls Test. LSD_{0.10}=5.9 cm.

Plant Dry Weight



Treatment	Dry weight*	Change
	cm	cm
1 (Control)	10.02 ab	—
2 (0.1% Vita.)	9.29 ab	(-) 0.94 (-9%)
3 (0.1% Prod. 3)	8.93 ab	(-) 1.30 (-13%)
4 (0.01% Prod. 3)	10.15 ab	0.13 (+1%)
5 (0.01% Prod. 3 + Vita.)	8.33 b	(-) 1.69 (-17%)
6 (0.001% Prod. 3)	10.03 ab	0.01 (0%)
7 (0.0001% Prod. 3)	10.23 a	0.21 (+2%)

*Means followed by the same letter are not significantly different according to the Student-Newman-Keuls Test. LSD_{0.10}=1.32 grams.

Corn – New Component Evaluation



Ongoing greenhouse research on new components will help direct further improvements in the Vitazyme formula.

Location: Vital Earth Resources Research Greenhouse, Gladewater, Texas

Variety: Hickory King

Soil type: fine sandy clay loam

Seeding rate: 8 seeds/pot, thinned to 3 plants/pot

Planting date: February 4, 2004

Pot size: 1 gallon

Growing conditions: 60° to 85°F

Watering: as needed

Experimental design: One-gallon pots (0.217 ft²/pot) were filled with soil and set up in a randomized complete block design, with six replicates. A specially prepared fermented product (Product 2) was diluted to different concentrations and applied to the soil of various pots alone and with Vitazyme.

Treatment	Product 2*	Vitazyme**
1	0	0
2	0	0.1%
3	1%	0
4	0.1%	0
5	0.01%	0
6	0.01%	0.1%
7	0.001%	0
8	0.0001%	0

*Applied in 100 ml of this dilution.

**Added to Product 2 dilutions so a total of 100 ml was applied.

Fertilization: none

Vitazyme and Product 2 applications: Dilutions were prepared, and 100 ml of each product (and of the combined products), were applied to the soil surface of each treatment after planting. Treatment 1 received only water.

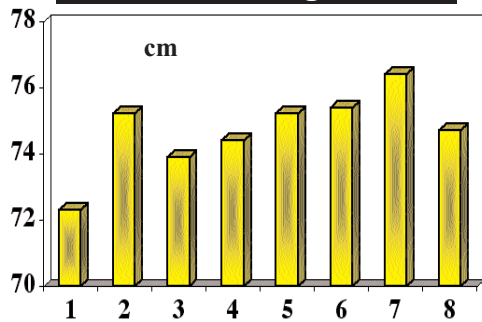
Harvest date: March 18, 2004, after 43 days of growth

Growth results: The roots were washed free of soil, and the heights of the plants were measured. Then the plants were dried in a drying oven at 120°F for 24 hours, and weighed to the nearest 0.01 gram.

While only the 0.001% application of Product 2 significantly exceeded the control in plant height, there was a trend for all treatments to exceed the control.

There are no significant differences in dry weight amongst

Plant Height



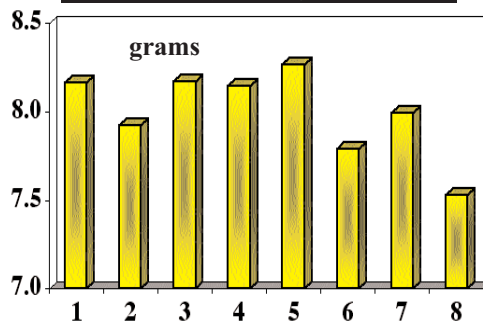
Treatment	Plant height*	Change
	cm	cm
1 (Control)	72.3 b	—
2 (0.1% Vita.)	75.2 ab	2.9 (+4%)
3 (1% Prod. 2)	73.9 ab	1.6 (+2%)
4 (0.1% Prod. 2)	74.4 ab	2.1 (+3%)
5 (0.01% Prod. 2)	75.2 ab	2.9 (+4%)
6 (0.01% Prod. 2 + Vita.)	75.4 ab	3.1 (+4%)
7 (0.001% Prod. 2)	74.7 ab	2.4 (+3%)
8 (0.0001% Prod. 2)	74.7 ab	2.4 (+3%)

*Means followed by the same letter are not significantly different according to the Student-Newman-Keuls Test. LSD_{0.1}=3.7 cm.

the eight treatments in this study.

Conclusions: In this study on corn in the greenhouse, Product 2, with or without Vitazyme, and at different concentrations, did not significantly increase plant dry weight. Plant height was significantly increased above the control only at the 0.001% Product 2 level. This product is likely not an appropriate additive to improve Vitazyme.

Dry Weight



Treatment	Dry weight*	Change
	grams	grams
5 (0.01% Prod. 2)	8.26 a	0.10 (+1%)
3 (1% Prod. 2)	8.17 a	0.01 (0%)
1 (Control)	8.16 a	—
4 (0.1% Prod. 2)	8.14 a	(-) 0.02 (0%)
7 (0.001% Prod. 2)	7.99 a	(-) 0.17 (-2%)
2 (0.1% Vita.)	7.92 a	(-) 0.24 (-3%)
6 (0.01% Prod. 2 + Vita.)	7.79 a	(-) 0.37 (-5%)
8 (0.0001% Prod. 2)	7.53 a	(-) 0.63 (-8%)

*Means followed by the same letter are not significantly different according to the Student-Newman-Keuls Test. LSD_{0.1}=0.91 gram.

Corn – New Component Evaluation

Location: Vital Earth Resources Research Greenhouse, Gladewater, Texas

Soil type: fine sandy clay loam

Planting date: February 3, 2004

Seeding rate: 8 seeds/pot, thinned to 3 plants/pot

Growing conditions: 60° to 85°F

Experimental design: A series of one-gallon pots (0.217 ft²) was prepared and set up in a randomized complete block design, using four replicates. A series of dilutions of a certain substance (Product 1) was applied to the pots, with Vitazyme added to some of the treatments, to evaluate effects of Product 1 alone and with Vitazyme.

Fertilization: none

Vitazyme and Product 1 applications: Dilutions were prepared, and 100 ml of each product were added to the soil surface of each treatment after planting. Treatment 1 received only water.

Harvest date: March 17, 2004, after 43 days of growth

Growth results: The roots were washed free of soil and debris, the plant heights were measured, and then all plants were dried in a drying oven at 120°F for 24 hours. Plants were weighed to the nearest 0.01 gram after drying.

Product 1 alone at 0.001% produced the tallest plants, which was significantly greater than the 0.01%, 0.1%, and 1% applications. Vitazyme did not improve Product 1 performance, and was most likely applied at levels too high for optimum performance.

Product 1 at 0.001% increased the dry weight of corn plants by 21% over the control, the greatest increase of any treatment. No other treatment was significantly greater than the control, and the 1% appli-

Variety: Hickory King

Pot size: 1 gallon

Watering: as needed

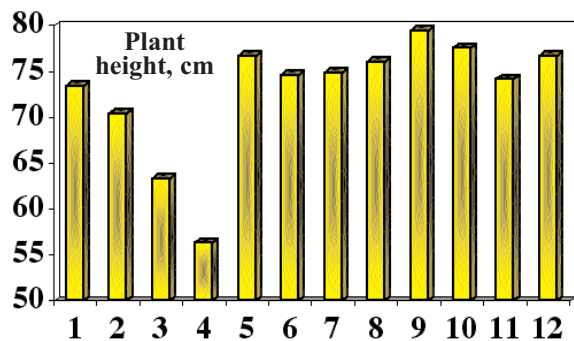
Treatment	Product 1*	Vitazyme*
1	0	0
2	0	0.1%
3	1%	0
4	1%	0.1%
5	0.1%	0
6	0.1%	0.1%
7	0.01%	0
8	0.01%	0.1%
9	0.001%	0
10	0.001%	0.1%
11	0.0001%	0
12	0.0001%	0.1%

*Applied in 100 ml of this dilution at planting.

Plant Height

Treatment	Plant height*	Change
	cm	cm
9 (0.001% Prod. 1)	79.4 a	6.0 (+8%)
10 (0.001% Prod. 1 + Vita.)	77.5 ab	4.1 (+6%)
12 (0.0001% Prod. 1 + Vita.)	76.7 ab	3.3 (+4%)
5 (0.1% Prod. 1)	76.6 ab	3.2 (+4%)
8 (0.01% Prod. 1 + Vita.)	76.0 ab	2.6 (+4%)
7 (0.01% Prod. 1)	74.8 b	1.4 (+2%)
6 (0.1% Prod. 1 + Vita.)	74.6 bc	1.2 (+2%)
11 (0.0001% Prod. 1)	74.1 bc	0.7 (+1%)
1 (Control)	73.4 bc	—
2 (0.1% Vita.)	70.4 c	(-)3.0 (-4%)
3 (1% Prod. 1)	63.3 d	(-)10.8 (-15%)
4 (1% Prod. 1 + Vita.)	56.3 e	(-)17.1 (-23%)

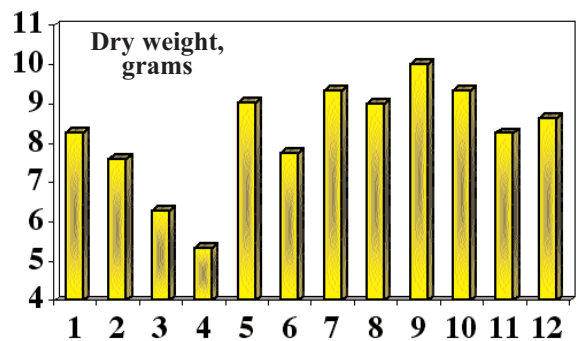
*Means followed by the same letter are not significantly different according to the Student-Newman-Keuls Test. LSD_{0.1}=4.5 cm.



Plant Dry Weight

Treatment	Dry weight*	Change
	cm	cm
9 (0.001% Prod. 1)	10.00 a	1.73 (+21%)
10 (0.001% Prod. 1 + Vita.)	9.33 ab	1.06 (+13%)
7 (0.01% Prod. 1)	9.33 ab	1.06 (+13%)
5 (0.1% Prod. 1)	9.03 ab	0.76 (+9%)
8 (0.01% Prod. 1 + Vita.)	9.01 b	0.74 (+9%)
12 (0.0001% Prod. 1 + Vita.)	8.63 bc	0.36 (+4%)
1 (Control)	8.27 bc	—
11 (0.0001% Prod. 1)	8.25 bc	(-)0.02 (0%)
6 (0.1% Prod. 1 + Vita.)	7.74 c	(-)0.53 (-6%)
2 (0.1% Vita.)	7.58 c	(-)0.69 (-8%)
3 (1% Prod. 1)	6.28 d	(-)1.99 (-24%)
4 (1% Prod. 1 + Vita.)	5.33 d	(-)2.94 (-36%)

*Means followed by the same letter are not significantly different according to the Student-Newman-Keuls Test. LSD_{0.1}=0.98 gram.

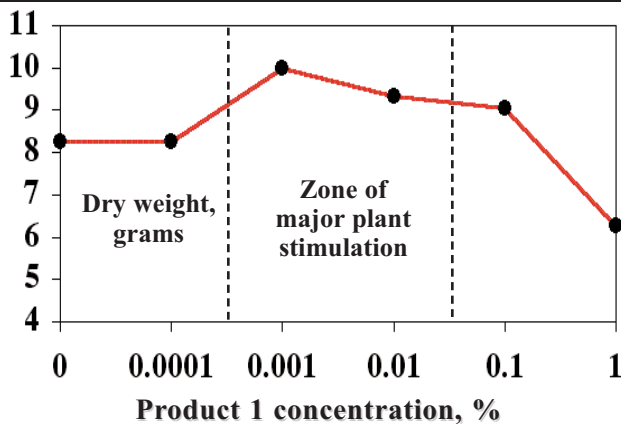


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cations (Treatments 3 and 4) greatly reduced dry matter production. Vitazyme was applied too heavily to properly boost dry matter increases, and did not differ significantly from the control.

Conclusions: Product 1 significantly increased plant height and dry weight accumulation by corn at the 0.001% application level, though the 0.01% and 0.1% application levels were statistically equal to this increase. The 0.0001% and 1% levels of applications were definitely lower in response than the other applications. Vitazyme was applied at rates too high for a significant growth response, and did not produce significant interactions when applied with Product 1. It is presumed that the stimulation of plant metabolism by the two products' active agents together was in excess of enzyme saturation to produce positive effects, but rather inhibition occurred to some extent, especially for Treatment 4 (1% of each product). Product 1 deserves serious scrutiny as a plant metabolic activator and should be tested further in the field.

Effect of Product 1 Concentration On Corn Dry Weight



Eggplant

Location: Santiago de Cuba Experiment Station, Dos Rios, Palma Soriana, Santiago de Cuba

Variety: unknown

Soil type: Leptic haplustert

Planting date: late 2003

Experimental design: An area of 10 m² for each treatment was used to evaluate the growth of eggplants, and then a yield estimate was made based on those growth parameters. Each plot had 50 plants. A Vitazyme and a control treatment were used.

1. Control

2. Vitazyme

Fertilization: unknown, but based on soil tests and recommendations

Vitazyme application: 1 liter/ha (13 oz/acre) on December 22, 2003, and January 22, 2004

Growth results: Plants were evaluated on January 21, February 3, and February 9, 2004, for the various growth parameters that follow using random sampling of plants and leaves. The experimental design for this study is unknown, so only basic statistics have been calculated.

Plant Height

January 21, 2004

February 9, 2004

Sample	Control	Vitazyme
	cm	cm
Mean	29.4	35.3 (+20%)

Sample	Control	Vitazyme
	cm	cm
Mean	46.3	56.7 (+24%)

Leaf Area (February 3, 2004)

Control

Sample	Length	Width		Mean width	Leaf area
		Lobe 1	Lobe 2		
		cm			cm ²
Mean	17.9	13.2	12.7	13.0	223.8

Vitazyme

Sample	Length	Width		Mean width	Leaf area
		Lobe 1	Lobe 2		
		cm			cm ²
Mean	19.7	17.8	14.2	16.0	314.4

Parameter	Control	Vitazyme
Fruit weight	200g	400g
Fruit yield*	40kg/plot	80 kg/plot

*Based on 50 plants per plot and four fruits per plant

Yield results (estimated): A formula was used to calculate estimated fruit weight and final yield of the eggplant crop, based upon previous field studies.

Conclusions: This eggplant study in Cuba proved that Vitazyme is an excellent stimulator of plant growth and development when applied twice during the growing season. Plant height was increased by 20 to 40%, and leaf area by 40%, with Vitazyme, leading to a doubling of estimated eggplant yield.

- Increase in plant height (Jan. 21): 20%
- Increase in plant height (Feb. 9): 24%
- Increase in leaf area: 40%

Grapes (for Raisins – second year)

operating party: David Morgan, Tulare Ag Products, Tulare, California **Location:** LDS Fresno Raisin Vineyard, Madera, California

Variety: Thompson seedless

Soil type: very sandy to light clay

Experimental design: This test is a continuation of the raisin study begun in 2003, with treatments being essentially on the same rows as in 2003. An 80-acre raisin vineyard was divided into four treatments in a randomized fashion, assisted by University of California personnel. The 112 rows were arranged as 4-row reps for three treatments, and 16 row reps for the combined Ethrel and Vitazyme treatment. The objective of the study is to compare effects of Vitazyme, Ethrel, and a combination of the two on grape development and yield for raisin production.

1. Control

2. Ethrel

3. Vitazyme + K

4. Vitazyme + K + Ethrel

Fertilization: nothing in addition to adequate N, P, and K from well water



Grapes treated with Vitazyme give bigger bunches filled to the tips, with higher brix as well.

Vitazyme application: (1) 13 oz/acre at pre-bloom cluster stretch, (2) 13oz/acre at post-bloom berry set, (3) 13 oz/acre at berry softening, and (4) 13 oz/acre 14 to 21 days before harvest, all applied by airblast sprayer. Some potassium was added with the Vitazyme.

Ethrel application: Ethrel [(2-Chloroethyl) phosphonic acid], also known as Ethepon, is a synthetic plant growth regulator that releases ethylene into the plant system. The effect of ethylene is to hasten sugar production so harvest can occur earlier,



Individual grapes are generally larger, and higher in brix in spite of their size, with stronger skins.

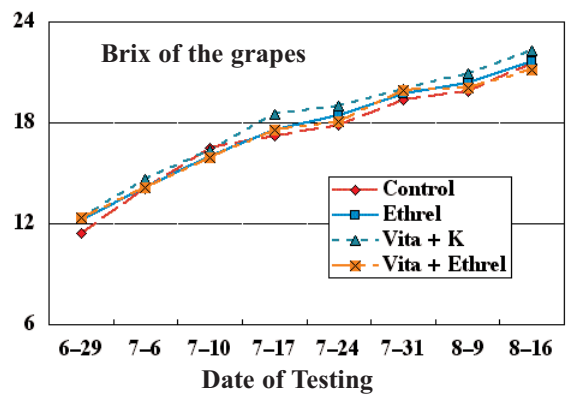
er, and more total sugars accumulate in the grapes. The product was sprayed once, on June 18 at berry softening. **Grape sugar results:** Grapes from selected rows and locations for all four treatments were analyzed with a refractometer to determine brix. Bunches were marked, and grapes from just below the shoulder were analyzed at each date from these same bunches. These data are shown to the right, and in the graph that follows. The control treatment in all cases, except at the last determination on 8/16, produced the least sugar, while Vitazyme + K, on every day except 7/10, produced the most sugar. Ethrel and Vitazyme + K + Ethrel tended to produce grapes having a higher sugar content than the control.

Grape size results: Grape weights were determined by University of California personnel on seven dates from 6/24 to 8/5, but variations in values were rather erratic and hard to explain. These results are therefore not included in this report. **Harvest date:** 80% completed on August 21, and 100% completed on August 28 **Yield results:** All grapes were harvested by volunteer labor and placed on paper trays between the rows. They were left to dry for 3 to 4 weeks before being picked up and delivered to the Sunmaid raisin packing plant. The raisins were graded at the Sunmaid raisin processing facility, and all light or inferior raisins were removed. Those retained for the weights given here are C grade or better. No gross raisin weights are reported, since grades were similar for all treatments. The gross weight of all treatments was 445,010 lb, and the net weight was 394,271 lb, a loss of 50,739 lb or 11% of the gross weight. This loss was very low compared to 2003, when weather conditions combined to produce grapes with a low sugar content. Losses that year averaged 21%.

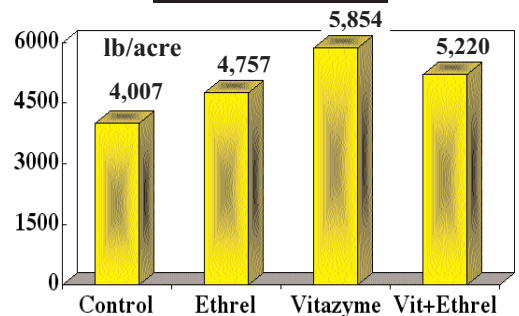
Income results: An estimated price of raisins for 2004 is \$1,210/ton. **Conclusions:** In the second year of a continuing study of Vitazyme + K and Ethrel effects on grape (raisin) yields, Vitazyme + K again outproduced the Ethrel treatment, by a 30% margin in 2004 versus a 6% margin in 2003. This increase in yield meant an extra \$1,117.43/acre income above the control. In contrast, Ethrel produced a 19% yield increase, giving \$453.75 extra income above the control. The extra income of Vitazyme + K above the Ethrel treatment was \$663.66/acre. In contrast, the combined Vitazyme + K + Ethrel produced a yield and income response intermediate to the other two treatments, although, according to the vineyard manager, if the timing of Ethrel application in relation to Vitazyme + K application had been better, this combination treatment may have been superior to Vitazyme + K. Continuing studies at the some location in 2005 will hopefully answer this question.

Grape Sugar Content

Treatment	6/29	7/6	7/10	7/17	7/24	7/31	8/9	8/16
----- brix -----								
1. Control	11.45	14.05	16.50	17.20	17.85	19.37	19.87	21.52
2. Ethrel	12.20	14.17	16.00	17.55	18.40	19.70	20.35	21.62
3. Vitazyme + K	12.37	14.65	16.35	18.50	19.00	20.02	20.92	22.30
4. Vitazyme + Eth.	12.35	14.51	15.95	17.60	18.05	19.95	20.07	21.12



Net Raisin Yield



Treatment	Raisins total lb	Area* acres	Raisins lb/acre	Increase lb/acre
1. Control	44,516	11.11	4,007	—
2. Ethrel	51,186	10.76	4,757	750 (+19%)
3. Vitazyme + K	65,033	11.11	5,854	1,847 (+ 46%)
4. Vitazyme + K + Eth.	222,952	42.71	5,220	1,213 (+ 30%)

• **Yield increase with Vitazyme: 46%**

• **Yield increase with Vitazyme (+ K) + Ethrel: 30%**

• **Income increase with Vitazyme: \$1,117.43/acre**

Grapes (for Wine)



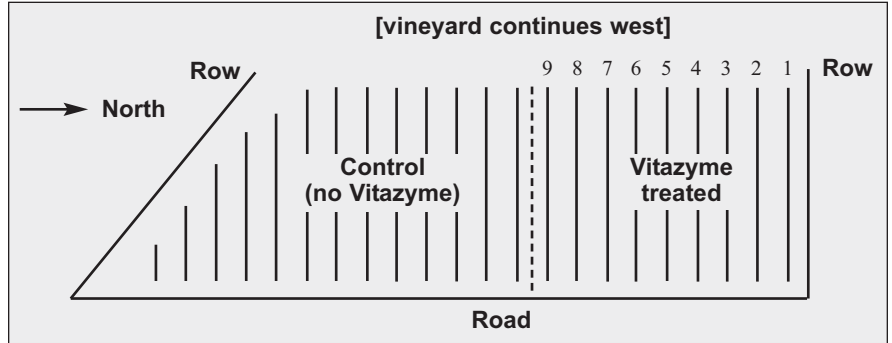
The untreated Cabernet Sauvignon grapes show the normal bunch development and density one would expect near the California coast.



Only a few rows away from the control grapes, Vitazyme produced bigger, more abundant bunches having as high a brix level as the control.

ineyard: Mondello Vineyards
Variety: Cabernet Sauvignon
Row spacing: 12 feet between rows, 6 feet in-row
Grafting: none (self-rooted)
Grape plant age: 4 years (first harvest)
Soil type: loam, high-calcium subsoil, low organic matter
Experimental design: A vineyard of grapes of equal age was partially treated with Vitazyme during the growing season to evaluate effects on grape yield and winemaking quality; all other treatments were identical. Both treatments were to be evaluated for overall effects on grape and wine quality by following through the preharvest period, and on to the actual wine itself after fermentation and aging. Eventually a taste panel will evaluate the quality of the two wines after sufficient aging.

Location: San Miguel, California
Irrigation: drip
Bunch thinning: none



Irrigation: begun the end of March and ended by late August; 21 gallons/week/plant in three applications

Fungicides: applied as needed

Fertilization: 200 lb/acre (NH₄)₂SO₄ broadcast in March before bud break; 9-18-9 or 3-18-18 (+ micronutrients) applied every two to three weeks at 2 to 3 gallons/acre during much of the growing season, usually with sulfur after veraison; a blue-green algae solution applied in the irrigation water periodically

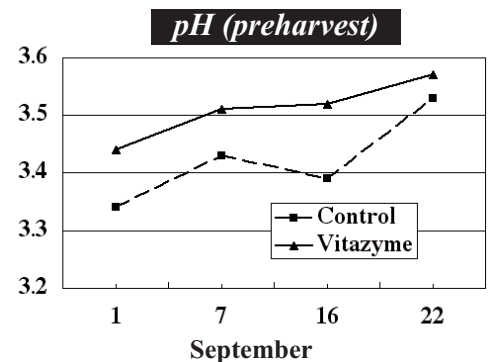
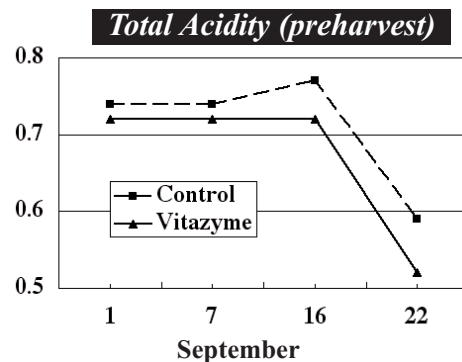
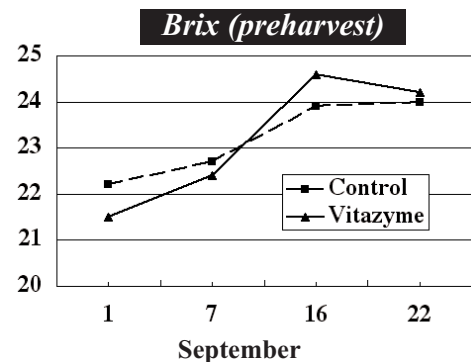
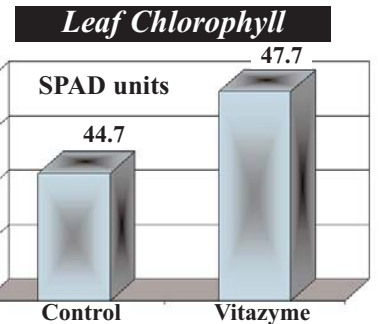
Vitazyme application: (1) 13 oz/acre with 9-18-9 fertilizer sprayed at bud break; (2) 13 oz/acre with 9-18-9 fertilizer + sulfur sprayed at BB-sized fruit; (3) 13 oz/acre with 19-18-9 fertilizer + sulfur sprayed at veraison

Harvest date: September 25, 2004

Chlorophyll content: On August 15, 30 random leaf samples from each treatment were analyzed with a Minolta SPAD chlorophyll meter to determine leaf chlorophyll levels. These levels relate directly to the ability of the plants to fix carbon and sunlight energy into plant structural and reproductive (grape) tissue.

Vine growth: According to the researcher, the Vitazyme treated vines had perhaps 33% more growth of leaves and vines than the untreated control plants.

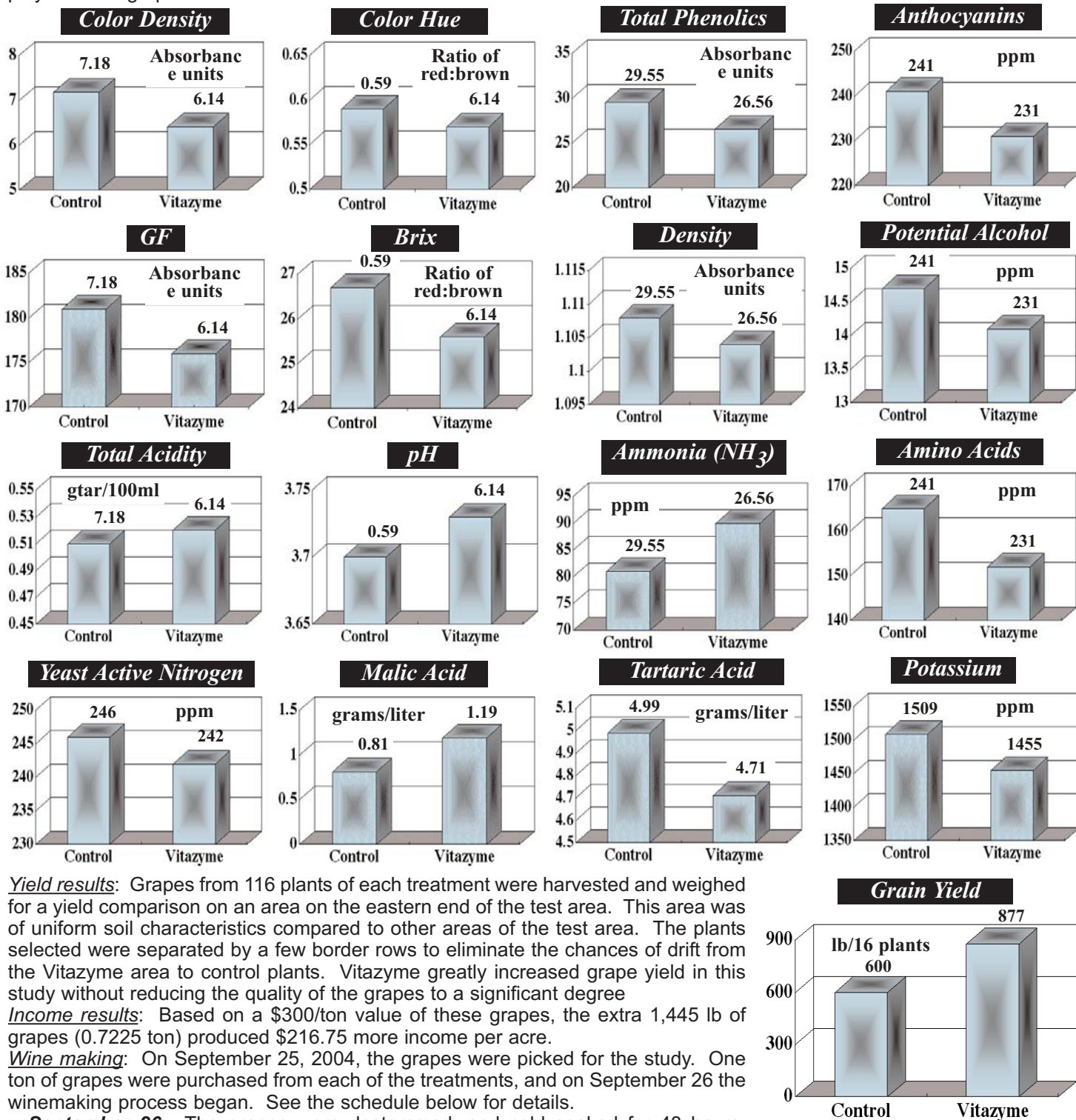
Preharvest to harvest grape and grape juice quality: Grapes from each treatment were randomly collected at four dates prior to harvest: September 1, 7, 16, and 22. These samples were crushed, and the juice was analyzed for brix (sugar and soluble solids), total acidity, and pH at Baker Wine and Grape Analysis, Paso Robles, California.



Neither of the two treatments yielded grapes that were very different in terms of brix, acidity, or pH. What is remarkable is that the Vitazyme treated grapes produced values of all three parameters that were very close in value to the untreated control grapes, showing that these plants were photosynthesizing adequately, and taking up soil minerals rapidly enough, to support a 46% greater grape load. The sugar and pH levels were nearly the same for both treatments, and total acidity was only slightly lower for the Vitazyme treatment.

Of special interest was the observation that the Vitazyme treated grapes were more full and less “raisined” (dried out) than the control grapes. This indicated (1) that the roots of the treated plants were actively taking in more groundwater later in the season, and (2) the cell walls of the treated grapes were thicker and less apt to lose water.

Grape juice quality at harvest: On September 28, 2004, the grapes were harvested, and the juice was evaluated for color and chemical factors. According to the winemaker, grape quality parameters were quite similar for both treatments. The main three — pH, total acidity, and brix — showed little variation between the two. The results of these analyses are displayed in the graphs that follow.



Yield results: Grapes from 116 plants of each treatment were harvested and weighed for a yield comparison on an area on the eastern end of the test area. This area was of uniform soil characteristics compared to other areas of the test area. The plants selected were separated by a few border rows to eliminate the chances of drift from the Vitazyme area to control plants. Vitazyme greatly increased grape yield in this study without reducing the quality of the grapes to a significant degree

Income results: Based on a \$300/ton value of these grapes, the extra 1,445 lb of grapes (0.7225 ton) produced \$216.75 more income per acre.

Wine making: On September 25, 2004, the grapes were picked for the study. One ton of grapes were purchased from each of the treatments, and on September 26 the winemaking process began. See the schedule below for details.

September 26. The grapes were destemmed, and cold soaked for 48 hours. During this time tartaric acid was added to raise the acidity to 0.7.

September 28. Yeast was added to the destemmed grapes, as well as yeast nutrient (diammonium phosphate, yeast cell walls, and other items), and Color Pro (an enzyme material to extract more color from the skins, and stabilize the color).

October 6. After 8 days of fermentation, the juice was pressed from the mash. At this point there was 3% sugar left. Malic acid bacteria were added at this point to convert the malic acid to lactic acid. The fermenting wine was then placed in stainless steel barrels. Each batch yielded 148 gallons of juice per ton of grapes.

Continued on the next page

October 10. After 4 more days, half of the wine from each treatment was put in identical oak barrels; the remaining wine was retained in a stainless steel barrel.

Conclusions for the first year: Vitazyme performed admirably the first year of this Cabernet Sauvignon wine grape trial in California by producing 46% more grapes than the control. The quality of this increased load of grapes did not appear to be compromised, since the quality parameters measured — color, phenolic compounds, sugars, and acids — showed only minor variations between the two treatments. The wine will be aged for at least a year, and then a tasting panel will evaluate the taste qualities of the wine produced from the two treatments. If little difference exists between the two wines at this time — or if Vitazyme improves wine quality — then it is apparent that Vitazyme can be an important factor in increasing the productivity and profitability of wine-grape vineyards.

- **Increase in leaf chlorophyll: 3.0 SPAD units**
- **Grape yield increase: 46%**
- **Increase in grape income: \$216.75/acre**

Hay

Location: Far Hills, New Jersey

Variety: orchard grass, timothy, red clover

Soil type: silty clay

Age: mature

Cutting date: about June 15

Experimental design: A 10-acre hay field was divided into two equal parts. Half of the field was left untreated and the other half was sprayed with Vitazyme to evaluate the product's effects on hay yield. All other practices were the same for both halves.

1. Control

2. Vitazyme

Fertilization: 200 lb/acre 19-19-19% N-P₂O₅K₂O in late April

Vitazyme application: 13 oz/acre sprayed on the treated half on May 1

Yield results: The hay was cut, dried, and baled as standard rectangular bales. Then the bales for the two five-acre parcels were counted. Each bale weighed approximately 50 pounds.

Treatment	Hay yield bales/5acres	Hay yield lb/acre	Increase lb/acre	Value of increase* \$/acre
Control	290	2,900	—	—
Vitazyme	315	3,150	250 (+ 9%)	\$15.00

Conclusions: In this New Jersey on-farm hay trail with Vitazyme, the product increased both the yield (+9%) and income (+ \$15.00/acre) of the crop after only one application applied around spring greenup time.

- **Increase in hay value: \$15.00/acre**
- **Increase in hay yield: 9%**

Lettuce

Location: Santiago de Cuba Experiment Station, Dos Rios, Palma Soriano, Santiago de Cuba

Variety: black-seeded Simpson

Soil type: Leptic haplustert

Transplanting date: February 10, 2004



Experimental design: Two beds were prepared, each 10 m² (1 x 10 m), which were planted to 1,440 lettuce transplants. One bed was treated with Vitazyme to evaluate growth effects of the product compared to the untreated control.

1. Control

2. Vitazyme

Fertilization: unknown

Vitazyme application: soil drenching of the transplant roots (rate unknown), and another soil application

Growth results: At a certain date after significant lettuce growth had occurred, 10 randomly selected plants from each treatment were evaluated for plant height, leaf number, and plant weight.

Parameter	Control	Vitazyme
Plant height (average of 10 plants)	30 cm	38 cm (+27%)
Leaf number (average of 10 plants)	8.1	9.4 (+16%)
Plant weight (total of 10 plants)	0.6 kg	1.1 kg (+83%)

The Vitazyme treated lettuce in these samples, on the right, shows much greater size and leaf development than the control on the left.

	Control	Vitazyme
Estimated yield per plot	86.4 kg	158.4 kg (+83%)

Yield results: Based on the excellent responses of the plant parameters to Vitazyme, and previous studies with lettuce, the estimated probable yield of this lettuce variety was 83%.

Conclusions: Vitazyme produced excellent growth and yield responses in this Santiago de Cuba lettuce trial.

Plant height increased by 27%, leaf number by 16%, and plant weight by 83% in randomly selected plants. Most impressive was the projected lettuce yield, which was 83% greater with Vitazyme than with the untreated control. This product clearly produces an excellent benefit to lettuce production in Cuba.

- **Increase in plant height: 27%**
- **Increase in plant weight: 83%**
- **Increase in leaf number: 16%**
- **Estimated yield increase: 83%**

Lettuce

Location: Granja MININT Jaguey Grande, Cuba

Variety: unknown

Soil type: Leptic haplustert

Experimental design: An experimental area was divided into control and Vitazyme treated areas to determine the product's effects on lettuce yield. All other treatments on the test area were the same.

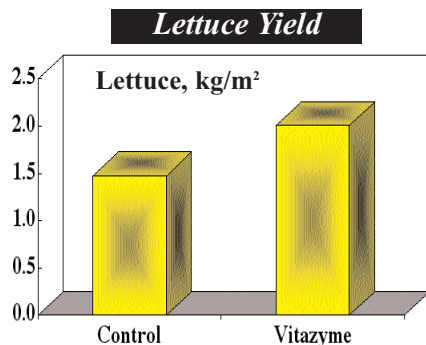
1. Control

2. Vitazyme

Fertilization: 20 tons/acre of organic fertilizer

Vitazyme application: 1 lb/ha on the seeds at planting, and again at 15 and 30 days after planting on the plants and soil

Yield and income results:



Treatment	Lettuce yield kg/m²	Change kg/m²	Value of production pesos	Change pesos
Control	1.475	—	31.86	—
Vitazyme	2.006	0.531 (+ 36%)	43.34	+ 11.48

Conclusions: Vitazyme applied three times to lettuce in this Cuban study increased yield by 36%, and improved income substantially.

• **Increase in lettuce yield: 36%**

Oil Palm (Nursery Plants)

Asociacion Nacional de Cultivadores de Palma Africana (ANCUPA)

Location: ANCUPA Experimental Station, Santo Domingo, Ecuador

Variety: African oil palm, hybrid cv.

Soil type: unknown

Planting time: 2003

Experimental design: A variety of biostimulant materials were evaluated in an oil palm plantation nursery to determine their effects on oil palm seedling rooting, and then their potential to improve early growth and reduce the time to field planting. Only results for Vitazyme will be reported in this summary.

1. Control

2. Vitazyme

Fertilization: unknown

Vitazyme application: 3 cc per plant, diluted in water, sprayed in a 1 meter radius around the plant at trial initiation in May and June

Root and growth results:

During 2003, at initiation of the oil palm seedling study, the oil palm seedlings were analyzed for root number, weight, and percent dry matter. This process was repeated in July and again sometime later.

Root Weight

Treatment	Root wet weight, g			Root dry weight, g		
	Initial	Eval. 1	Eval. 2	Initial	Eval. 1	Eval. 2
Vitazyme	72.70	90.90 (+25%)	178.07 (+145%)	23.07	37.25 (+61%)	60.87 (+164%)
		[Eval. 1 vs. Eval. 2 +96%]			[Eval. 1 vs. Eval. 2 +63%]	
Control	61.40	68.90 (+12%)	50.45 (-18%)	17.62	26.85 (+52%)	15.40 (-13%)
		[Eval. 1 vs. Eval. 2 -27%]			[Eval. 1 vs. Eval. 2 -43%]	

*Methodology for this determination is not known.

Root Number

Treatment	Primary root number			Secondary root number			Total Roots	
	Initial	Eval. 1	Eval. 2	Initial	Eval. 1	Eval. 2	Initial	Eval. 2
Vitazyme	7.75	10.50 (+35%)	10.00 (+29%)	32.50	69.50 (+114%)	64.75 (+99%)	40.25	74.75 (+86%)
		[Eval. 1 vs. Eval. 2 -5%]			[Eval. 1 vs. Eval. 2 -7%]			
Control	7.50	5.75 (-23%)	4.50 (-40%)	39.00	32.50 (-17%)	30.75 (-21%)	46.50	35.25 (-24%)
		[Eval. 1 vs. Eval. 2 -22%]			[Eval. 1 vs. Eval. 2 -5%]			

*Methodology for this determination is not known.

Conclusions: Vitazyme had a profound positive effect on the growth and development of young oil palm plants in this ANCUPA nursery trial in Ecuador. Both wet and dry root weights were increased during both the first and second growth intervals, but especially during the second period. Overall weight increases were 145% (wet) and 164% (dry). The untreated control, on the other hand, actually experienced root weight reductions for the same period, of -18% (wet) and -13% (dry).

Root number responded excellently to Vitazyme as well, especially the smaller, finer, secondary roots. Primary roots increased by

Root Number

Treatment	Dry matter in roots, %		
	Initial	Eval. 1	Eval. 2
Vitazyme	37.73	40.98 (+29%)	57.50 (+81%)
		[Eval. 1 vs. Eval. 2 +40%]	
Control	28.70	38.97 (+36%)	24.50 (-15%)
		[Eval. 1 vs. Eval. 2 -37%]	

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These young oil palm plants were treated with Vitazyme, and produced excellent root and leaf responses.

29% over the test period, while secondary roots increased by 99%, giving a total increase of 86%. At the same time, the untreated control lost root numbers, losing 22% of the primary roots and 5% of the secondary roots.

The percentage of dry matter in the roots increased markedly with Vitazyme, rising from 31.73 to 57.50% over the test period, at the same time that the percentage of dry matter in the roots of the untreated control dropped from 28.70% to 24.50%.

Vitazyme is clearly a very effective root growth enhancer for young oil palm plants. Three other treatments among the sixteen in this study also performed quite well, but **Vitazyme was overall the most consistent performer of all products tested.**

- **Increase in primary root number: 29%**
- **Overall increase in root wet weight: 145%**
- **Increase in secondary root number: 99%**
- **Overall increase in root number: 86%**
- **Overall increase in root dry weight: 164%**
- **Overall increase in root dry matter percentage: 81%**

Onions

Location: Santiago de Cuba Experiment Station, Dos Rios, Palma Soriana, Santiago de Cuba

Variety: red bulb multiplying onion

Soil type: Leptic haplustert

Transplanting Date: January 13, 2004

Experimental design: Two areas of onions were used in two studies, one area in each study treated with Vitazyme and the other area left untreated. All other treatments were identical for both areas.

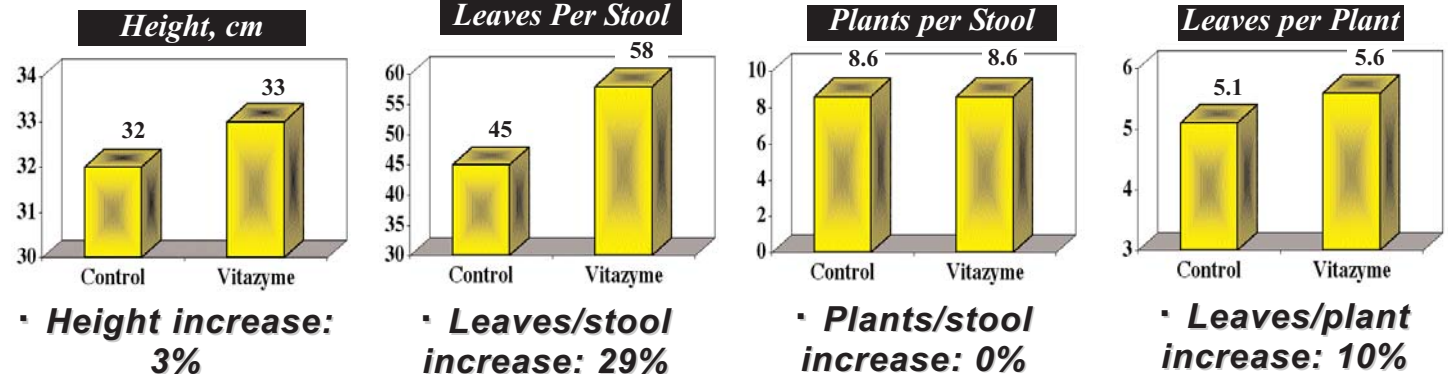
1. Control

2. Vitazyme

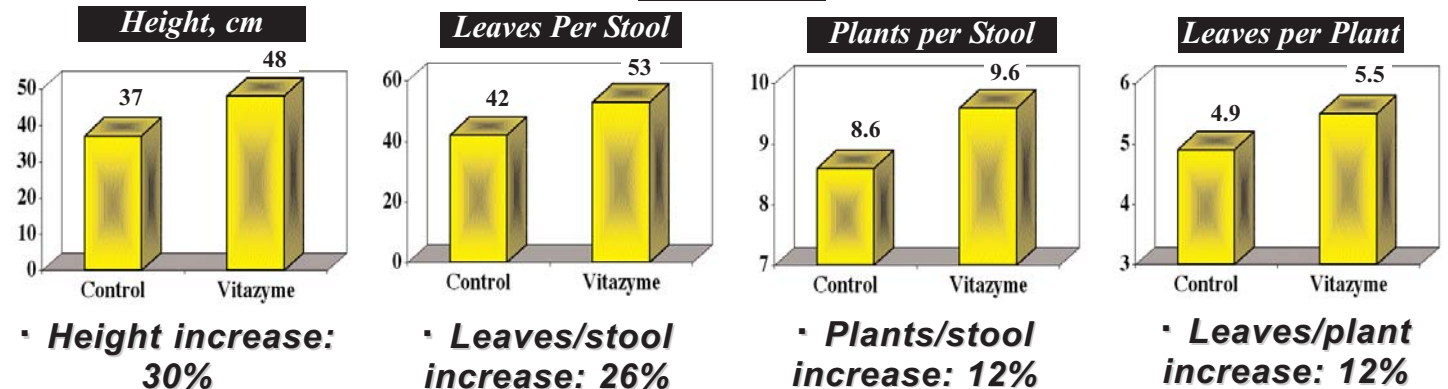
Fertilization: unknown

Vitazyme application: 13 oz/acre on the leaves and soil on January 1, and again on February 17, 2004

Trial 1



Trial 2



Conclusions: In this Cuban onion study, both trials showed a clear advantage for Vitazyme on growth and yield potential in terms of plant height, leaves per stool, and leaves per plant.

Onions



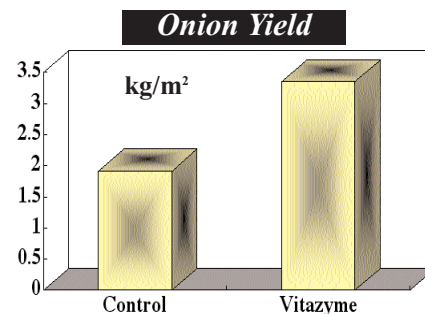
The response of onions to Vitazyme in this trial is typical of what to expect in terms of average tuber size, root growth, and leaf size.

Conclusions: Onions in this Cuban study responded very well to Vitazyme by increasing yield by 74%, and average onion weight by 71%. The increase in value of this production was 135.24 pesos; the field area for this increase was not defined in the report.

Location: Granja MININT Jaguey Grande, Cuba
Soil type: Leptic haplustert
Experimental design: An experimental area was divided into a Vitazyme treated and an untreated area to determine the product's effects on onion yield.

1. Control **2. Vitazyme**
Fertilization: unknown
Vitazyme application: 1 liter/ha on the seedlings at transplanting, and 1 liter/ha on the plants and soil at 35 and at 79 days after transplanting (total application = 2.4 liters/ha, or 0.0068 cc/plant)
Yield results:

Variety: J-5
Planting date: unknown



Treatment	Onion yield	Change	Weight per plant	Change	Value of production	Change
	kg/m²	kg/m²	g/plant	g/plant	pesos	pesos
Control	1.92	—	55.26	—	180.32	—
Vitazyme	3.35	1.43 (+74%)	94.70	39.44 (+71%)	315.56	+135.24

▪ **Increase in onion yield: 74%**

▪ **Increase in weight per onion: 71%**

Pearl Millet

[An article published on August 3, 2004, in the Journal of Crop Management/

Researchers: S.A. Deepak, Department of Studies in Applied Botany and Biotechnology, University of Mysore, Manasagangotri, Mysore 570 006, India; P.W. Syltie, Vital Earth Resources Research Center, 706 East Broadway, Gladewater, Texas 75647; Chandrashekhara Shetty, and H.S. Shetty, Department of Studies in Applied Botany and Biotechnology, University of Mysore, Manasagangotri, Mysore 570 006, India
 Corresponding author: H.S. Shetty. hhs uom@hotmail.com
 Deepak, S.A., Syltie, P.W., Shetty, C., and Shetty, H.S. 2004. Vitazyme promotes growth in pearl millet. Online. *Crop Management* doi:10.1094/CM-2004-0803-01-RS.

Seed Vigor Results

Effects of Vitazyme seed treatments to pearl millet on seed quality parameters

Treatment	Concentration	Seed germination*	Seedling vigor*
	%	± SD	±SD
Vitazyme	0.0001	92 ± 1.4 bc	1189 ± 12.8 c
	0.001	92 ± 1.6 bc	1193 ± 11.0 bc
	0.01	91 ± 1.7 bc	1189 ± 12.3 c
	0.05	93 ± 1.8 abc	1192 ± 12.2 bc
	0.1	95 ± 1.1 a	1189 ± 12.6 bc
	0.5	92 ± 1.4 bc	1196 ± 12.7 bc
	1.0	92 ± 1.4 bc	1195 ± 10.0 bc
	2.0	95 ± 1.5 a	1203 ± 8.3 b
	3.0	90 ± 1.8 c	1196 ± 5.0 bc
	6.0	92 ± 1.0 bc	1201 ± 7.2 bc
	12.0	92 ± 1.6 bc	1198 ± 7.5 bc
Apron	18.0	92 ± 1.3 bc	1200 ± 7.3 bc
	24.0	93 ± 1.4 ab	1199 ± 7.7 bc
	6 g/kg of seeds	91 ± 0.9 bc	1146 ± 10.0 d
	Apron (6 g/kg) + Vitazyme (2%)	92 ± 1.1 bc	1247 ± 8.5 a
Control	Distilled water	92 ± 1.2 bc	982 ± 6.0 e
Degrees of freedom		15	176
Significant at P =		0.001	0.001

* Values are means of three independent trials. Means followed by the same letter(s) within the column are not significantly different according to Tukey's HSD. SD = significant difference.

Abstract: This study investigated the incorporation of the plant growth promoter Vitazyme as an additional seed-dressing component to pearl millet, along with a regularly recommended systemic fungicide. Preliminary in vitro examination indicated a significant enhancement in seedling vigor for all of the concentrations tested. Vitazyme seed treatments, alone or in combination with Apron 35SD, resulted in improved field emergence. Yield analyses indicated Vitazyme seed treatment alone or in combination with foliar spray showed yield measurements comparable to Apron 35SD. Furthermore, the combination of seed treatments/foliar applications with Apron 35SD provided the best yield improvement.

Conclusions: Compared with other methods of applying Vitazyme, seed treatment is a more practical and cost effective treatment, especially for pearl millet. The application of effective growth promoters, such as Vitazyme, as a seed dressing for pearl millet, alone or

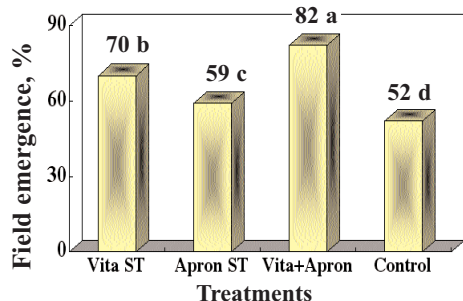
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in combination with systemic fungicides, for qualitative and quantitative trait improvement (germination, seedling vigor, and yield), is an appropriate agronomic practice.

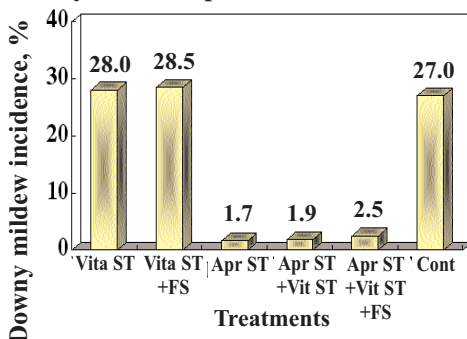
For an on-line copy of the complete article, go to <http://www.plantmanagementnetwork.org/pub/cm/research/2004/millet>.

Field Trial Results

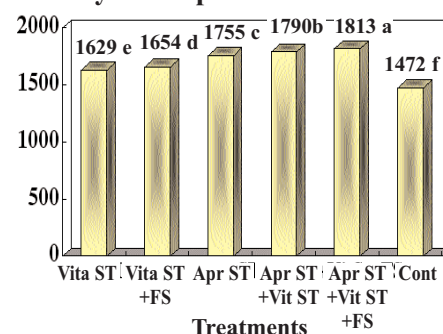
Efficacy of Vitazyme and Apron 35SD seed treatments to pearl millet on seedling emergence under field conditions



Downy mildew incidence (60DAS) under adverse plot conditions in Vitazyme and Apron 35SD treatments



Effect of Vitazyme and Apron 35SD treatments to pearl millet on grain yield of pearl millet



Peppers

Location: Santiago de Cuba Experiment Station, Dos Rios, Palma Soriana, Santiago de Cuba

Variety: Chay

Row spacing: 1 meter

Soil type: Leptic haplustert

Transplanting Date: December 5, 2003

Experimental design: An area of 73m² was used for each of the two treatments to determine the effects of the products on the growth and yield potential of the peppers. Each plot had an equal number of plants.

1. Control

2. Vitazyme

Fertilization: unknown

Vitazyme application: 1 liter/ha on January 20, 2004, and 1 liter/ha on February 11, 2004

Growth results: Plants were evaluated on January 21 and February 2, 2004, for height and leaf number using random sampling of plants and leaves. The experimental design of this study was not conducive to a detailed statistical analysis, so only basic statistics were calculated.

Plant Height

Leaves per Plant (February 6)

Sample	Control	Vitazyme
	---- number of leaves ----	
Mean	91.1	101.8 (+12%)

January 21, 2004

Sample	Control	Vitazyme
	cm	
Mean	23.4	23.5

February 9, 2004

Sample	Control	Vitazyme
	cm	
Mean	25.4	32.0 (+26%)

Yield results (estimated): A formula was used to calculate estimated fruit weight and final yield of the pepper crop (after two pickings), based upon previous field studies.

Conclusions: This study in Santiago de Cuba showed that two applications of Vitazyme substantially increased plant height by 59 days after transplanting (+26%), while leaves per plant increased by 12% with Vitazyme by 63 days after transplanting. Estimated pepper yield with Vitazyme increased by 50% over the control.

Pepper Yield

Parameter	Control	Vitazyme
Fruit weight	16 g	24 g
Fruit yield/plot	4.8 kg	7.2 kg

▪ **Increase in plant height (Jan. 21): none**

▪ **Increase in plant height (Feb 9): 26%**

▪ **Increase in leaves per plant: 12%**

Pine Trees (Seedlings)

Research organization: Temple-Inland, Applied Research and Development

Location: Diboll, Texas

Soil type: deep coarse sand, low organic matter (1%)

Planting date: March, 2003

Experimental design: The purpose of the test was to discover and evaluate effects of Vitazyme on pine seedling growth parameters with one, two, or three applications. Pine seedlings were planted at 20 seeds/square foot in 12 beds that were 4 x 280 feet. Three replicates were utilized for the four treatments in a randomized complete block design.

Tree species: Loblolly pine

Fumigation: methyl bromide in October, 2002

Irrigation: Overhead sprinklers, daily

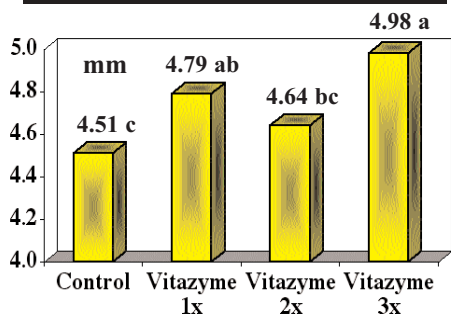
1. Vitazyme applied once
2. Vitazyme applied twice
3. Vitazyme applied three times
4. Control

Fertilization: 150 lb of N/acre, in four to five foliar applications beginning with a low rate and “ramped up” as the trees grew. The beds have also received annual applications of composted pine bark mulch and green manure cover crops in an attempt to increase soil organic matter.

Vitazyme applications: (1) 13 oz/acre solution sprayed over all three Vitazyme treatments in late April, when seedlings were newly emerged; (2) 13 oz/acre solution sprayed over Treatments 2 and 3 in early June; (3) 13 oz/acre solution sprayed over Treatment 3 in early August.

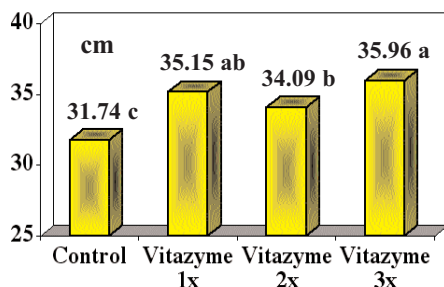
Growth analysis: In December of 2002 the pine seedlings were lifted and bagged for a few weeks before being measured in January of 2003. Fifty trees were measured for each of the 12 plots, the values were averaged, and a statistical analysis was performed using CoHort software.

Root Collar Diameter (RCD)*



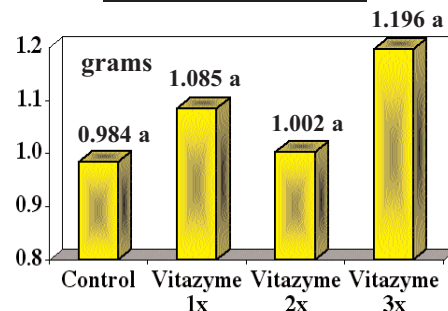
*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls Test. LSD_{0,01}=0.29 mm.

Stem Length*



*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls Test. LSD_{0,1}=1.81 cm.

Root Weight*



*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls Test. LSD_{0,01}=0.250 gram.

Vitazyme applied three times to these pine seedlings increased root collar diameter by 10%, a significant increase over the double Vitazyme application as well as the control. A single Vitazyme application also increased root collar diameter significantly over the control, by 6%.

All three Vitazyme treatments significantly increased pine seedling height above the control, but especially the triple application. This treatment was also significantly greater than the double Vitazyme application.

Three Vitazyme applications increased pine seedling root weight by 22% over the untreated control, while one and two applications increased root weight by 10 and 2%, respectively. However, due to a high degree of variability in the data, no treatment differences were significant.

Vitazyme treatments decreased the ratio of the root to the stem by from -11% with two applications to -6% for three application. None of the changes were significantly different than the control.

Conclusions: In this replicated pine nursery trial, using Vitazyme to affect several growth parameters, several positive effects of this product were noted and are summarized below.

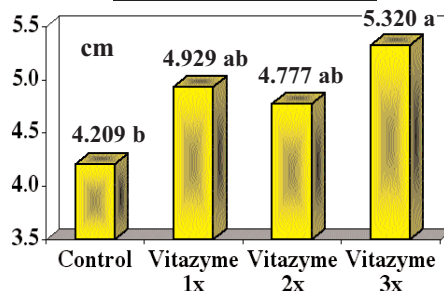
Vitazyme in every application improved pine seedling growth parameters, often-times significantly and especially for the triple applications.

Treatment	Percentage changes with Vitazyme vs. the control				
	Root collar diameter	Stem length	Root weight	Stem weight	Root:Stem
Vitazyme once	+6%	+11%	+10%	+17%	-7%
Vitazyme twice	+3%	+7%	+2%	+13%	-11%
Vitazyme three times	+10%	+13%	+22%	+26%	-6%

While root weight increases were not significant for Vitazyme, nor were the 1x and 2x stem weight increases significant due to high plant variability, nevertheless the trend throughout this study was for strongly positive growth responses from Vitazyme. For the 3x application, root and stem increases above the the control were 22 and 26%, respectively.

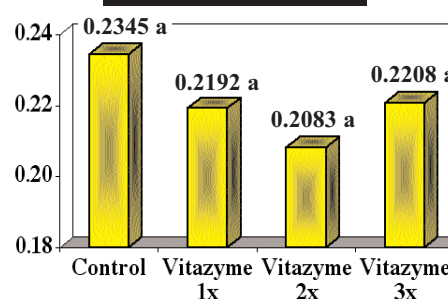
Because the stem weights were increased more than measured root weights in this study, the root:stem ratios were reduced below that of the control... though not significantly. However, since Vitazyme is notorious for increasing root growth for all types of plants, it is likely that this increase of root weight was masked in the study by a significant loss of this increased root mass during digging and storage. Also, the increased mycorrhizal biomass resulting from Vitazyme use, that normally occurs but was not measured in this trial, likely accounted for a goodly portion of the increased root collar, stem length, root weight, and stem weight measurements. It is well documented that ecto-mycorrhizae are critical for the normal growth of pine species, so Vitazyme responses most likely can in part be accounted for by this rhizosphere organism stimulation.

Stem Weight*



*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls Test. LSD_{0,1}=1.033 grams.

Root : Stem*



*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls Test. LSD_{0,01}=0.0463.

Continued on the next page

Due to the good results of Vitazyme in this pine seedling study, it is recommended that Vitazyme be used as a standard treatment for this pine nursery. To further stimulate more aggressive seedling growth and germination, it is further recommended that:

- (1) Vitazyme be used to soak the seeds before planting with a 5% solution to encourage faster, more uniform, and more complete emergence.
- (2) additional fertilizers be applied to the seedbed before planting to this highly unfertile soil, to encourage more vigorous growth and positive interaction with Vitazyme ... which will accelerate their availability and uptake. These additions should be based on a good soil test and would likely include Ca, Mg, K, P, S, Zn, Cu, Fe, and B besides the N already being utilized. Although pine trees can grow reasonably well on infertile soils, they will respond well to additions of fertilizer nutrients to yield even better trees for superior survival in plantations.

- **Increase in root collar diameter (1x and 3x): 6 to 10%**
 - **Increase in stem length (1x and 3x): 11 to 13%**
 - **Increase in root weight (1x and 3x): 10 to 22%**
 - **Increase in stem weight (1x and 3x): 17 to 26%**
 - **Change in root:stem: -6 to -11%**

Potatoes

Researcher: Jon Gilley, Agro-Engineering, Alamosa, Colorado

Variety: Norkotah 278

Planting date: May 7, 2004

Soil: loamy sand

Row spacing: 34 inches

In-row spacing: 10, 11, and 12 inches

Previous crop: sudan grass

Soil test results: pH, 8.5; NO₃-N, 110 lb/acre; P, 49 units; K, 562 mg/l; S, 49 mg/l; Zn, 1.12 mg/l; Fe, 9.1 mg/l; Cu, 0.7 mg/l; Mn, 7.5mg/l; Na, 3% of CEC; salinity hazard, low; lime hazard, low.

Experimental design: A potato field with center pivot irrigation was divided into Vitazyme treated and control areas for three different in-row spacings — 10, 11, and 12 inches — to determine effects on tuber yield and size.

- (1) 10-inch spacing: Control
- (2) 10-inch spacing: Vitazyme
- (3) 11-inch spacing: Control
- (4) 11-inch spacing: Vitazyme
- (5) 12-inch spacing: Control
- (6) 12-inch spacing: Vitazyme

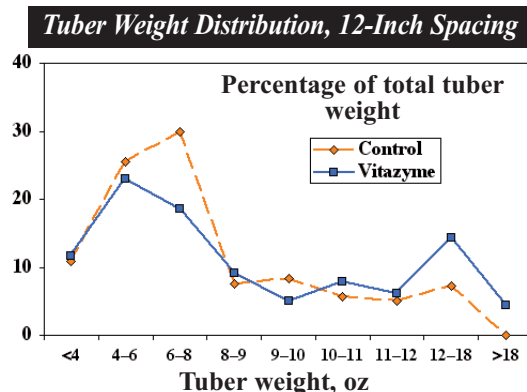
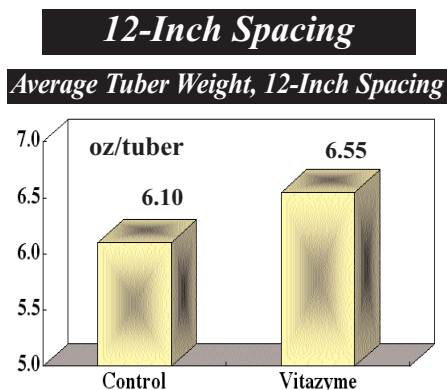
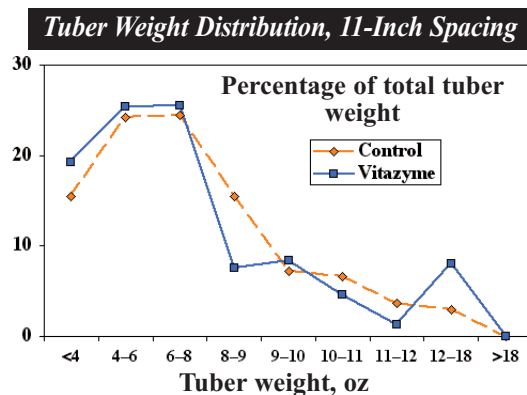
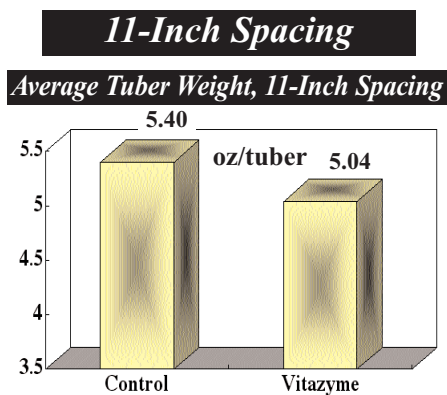
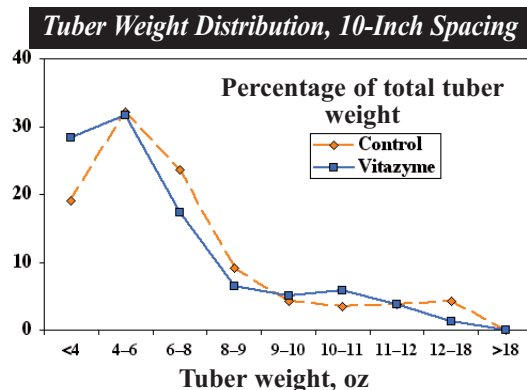
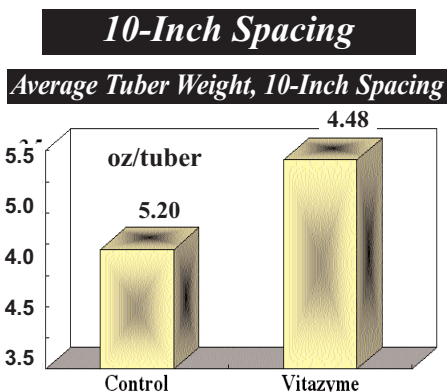
Fertilization: 149-201-30 lb/acre of N-P₂O₅-K₂O, 22 lb/acre of S, 2.5 lb/acre of Zn

Vitazyme application: (1) 13 oz/acre with the first irrigation; (2) 13 oz/acre at tuber initiation (hook stage) through the irrigation system

Harvest date: September 27, 2004

Tuber size results: Samples were dug and weighed for each treatment, and a sack of tubers for each treatment was collected. These tubers were individually weighed and recorded for later analysis, when they were arranged according to size units.

Location: Hooper, Colorado



Vitazyme reduced average tuber size at both the 10 and 11-inch spacings (-14% and -7%, respectively), but at the 12-inch spacing Vitazyme increased tuber size by 5%. At the 12-inch spacing the largest tubers were also produced, 4.4% of them being over 18 oz in weight. As the graph shows, all sizes above 10 oz were increased by Vitazyme, especially the 12 to 18 oz range. On the other hand, the lightest (<4 oz) tubers were increased at both 10 and 11-inches.

Yield results: Samples for the two 12-inch spacing treatments were weighed on a scale and calculated to determine tuber weight on a truckload for the same area of each treatment.

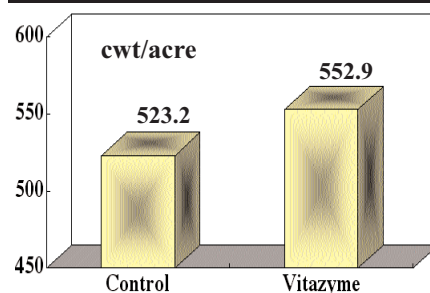
Income results: Tuber weight categories were weighted for value according to the price for each category, and the totals for both of the two 12-inch spacing treatments were determined.

Treatment	Tuber yield	Tuber price*	Total income	Income increase
	cwt/acre	\$/cwt	\$/acre	\$/acre
Control	523.2	4.72	2,469.50	—
Vitazyme	552.9	4.73	2,615.22	145.72

*Potato prices per cwt in the San Luis Valley of Colorado for November, 2004, are \$1.00 (<4oz), \$4.50 (4-8oz), \$5.51 (8-9oz), \$6.15 (9-10oz), \$6.82 (10-11oz), \$7.42 (11-12oz), \$6.00 (12-18oz), \$2.00 (18-20oz), and \$1.00 (>20oz).

- **Decrease in tuber weight (10-inch spacing): -14%**
- **Decrease in tuber weight (11-inch spacing): -7%**
- **Increase in tuber weight (12-inch spacing): + 7%**
- **Increase in tuber yield (12-inch spacing): + 6%**

Tuber yield, 12-inch row spacing



Vitazyme increased the value of these two harvested potato samples by \$145.72/acre.

Conclusions: This Colorado potato study utilizing 10, 11, and 12-inch row spacings revealed that Vitazyme increased the overall tuber yield of the 12-inch spacing by 6%; yields for the other two spacings were not determined. Vitazyme increased the average tuber weight at the 12-inch spacing, but did not for the 10 and 11-inch spacings. Income was increased by Vitazyme by \$145.72/acre at the 12-inch spacing.

Potatoes

Researcher: Jon Gilley, Agro-Engineering, Alamosa, Colorado

Location: Center, Colorado

Planting date: May 1, 2004

In-row spacing: 11 inches

Soil test results: NO₃-N, 48 lb/acre

Harvest date: October 1, 2004

Experimental design: A potato field under center pivot irrigation was split into a control (untreated) area and a Vitazyme treated area to determine the effect of Vitazyme on tuber weight classifications.

1. Control

2. Vitazyme

Fertilization: 168-199.5-30.5 lb/acre of N-P-K, 70 lb/acre S, 2.5 lb/acre Zn

Vitazyme application: (1) 13 oz/acre with the first irrigation; (2) 13 oz/acre at tuber initiation (hook stage) through the irrigation system

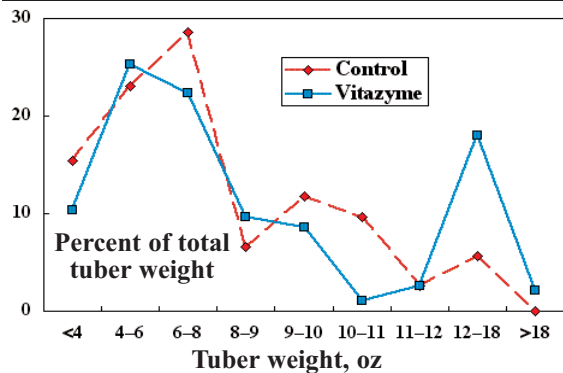
Tuber size results: Samples were dug and weighed for both treatments, and a sack of tubers was collected for each. These tubers were individually weighed and recorded for later analysis, when they were arranged according to size units.

Variety: Norkotah 8
Row spacing: 34 inches
Soil type: loamy sand
Previous crop: potatoes

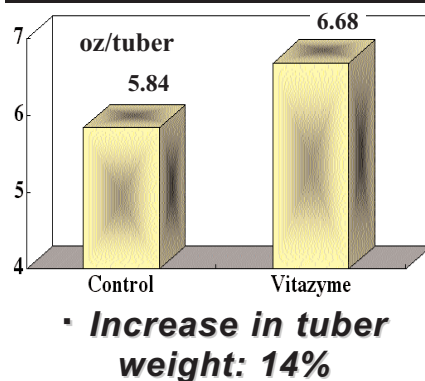


Superb roots in potatoes like these are seldom seen, but with Vitazyme they are a standard response.

Tuber Weight Distribution



Average Tuber Weight



Conclusions: In this San Luis Valley potato trial, Vitazyme produced considerably larger tubers, on average, than the control treatment, by 14%. Especially for the 12 to 18 ounce grouping, the treated plants produced heavier tubers, and a lower percentage of the lighter categories as well.

Potatoes

Researcher: Jon Gilley, Agro-Engineering, Alamosa, Colorado

Variety: Norkotah

Planting date: May 6, 2004

Soil: loamy sand

Row spacing: 34 inches

n-row spacing: 9, 10, and 11 inches

Previous crop: wheat

Soil test results: pH, 8.3; NO₃-N, 12 lb/acre; P, 74 units; K, 376 mg/l; S, 41 mg/l; Zn, 1.05 mg/l; Fe, 4.4 mg/l; Cu, 0.39 mg/l; Mn, 8.4 mg/l; Na, 3% of CEC; salinity hazard, low; lime hazard, high.

Experimental design: A center pivot irrigated field was divided into Vitazyme treated and untreated areas for three different in-row spacings — 9, 10, and 11 inches — to determine effects on tuber yield and tuber size.

(1) 9-inch spacing: Control

(2) 10-inch spacing: Control

(3) 11-inch spacing: Control

(4) 9-inch spacing: Vitazyme

(5) 10-inch spacing: Vitazyme

(6) 11-inch spacing: Vitazyme

Fertilization: 195-209-50 lb/acre of N-P₂O₅-K₂O, 78.5 lb/acre of S, 4 lb/acre of Zn

Vitazyme application: (1) 13 oz/acre with the first irrigation; (2) 13 oz/acre at tuber initiation (hook stage) through the irrigation system

Harvest date: September 25, 2004

Tuber size results: Samples were dug and weighed for each treatment, and a sack of tubers for each treatment was collected. These tubers were all weighed and recorded for later analysis, when they were arranged within different size units.

Vitazyme increased the average tuber weight by 20% at the 9-inch spacing, but by only 9% at the 10-inch spacing, while actually decreasing tuber weight slightly at the 11-inch spacing. The relationship between tuber weight change and in-row spacing is nearly straight-line, as shown in the graph on the right. Vitazyme is shown to be more effectively increase tuber weight at closer spacing intervals than at wider intervals.

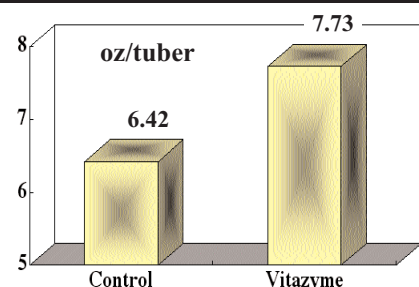
At 9 and 10-inch spacings the tuber size distribution was very similar, with Vitazyme producing more tubers in the 9 to 18 ounce range than the control. At the 11-inch spacing, Vitazyme caused the growth of more 9 to 11 ounce tubers, but reduced the number of tubers on either side of that range, except for the large tubers over 20 ounces.

Yield results: Samples for each treatment were weighed and calculated to determine per acre yields. Yield increases at all three row spacings were consistent, ranging from 6 to 10%.

Income results: Each tuber size category was weighted with the market price for that category on a percentage basis, and the size values were added to give a total value per cwt for each treatment.

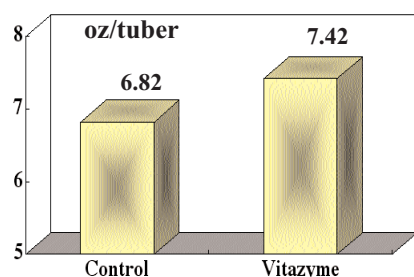
9-Inch Spacing

Average Tuber Weight, 9-Inch Spacing



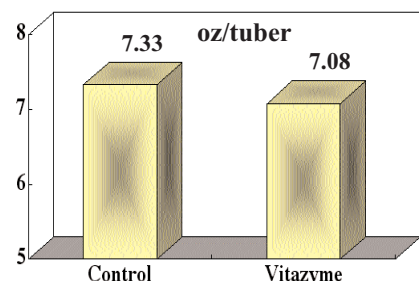
10-Inch Spacing

Average Tuber Weight, 10-Inch Spacing



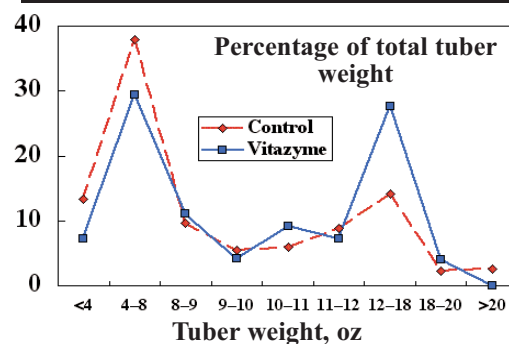
11-Inch Spacing

Average Tuber Weight, 11-Inch Spacing

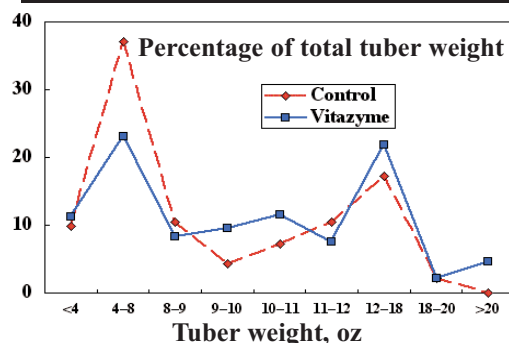


Location: Hooper, Colorado

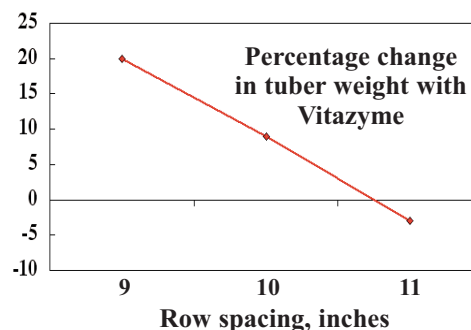
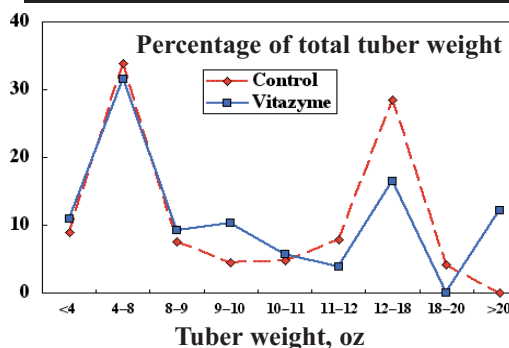
Tuber Weight Distribution, 9-Inch Spacing



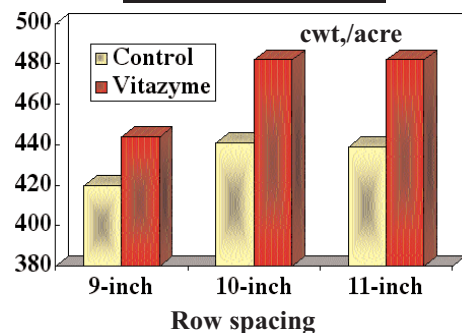
Tuber Weight Distribution, 10-Inch Spacing



Tuber Weight Distribution, 11-Inch Spacing



Tuber yield



especially at the 9 and 10-inch spacings. For the 9 and 10-inch spacings the tuber value was improved due to Vitazyme tuber size improvements, though such an effect was not noted for the 11-inch spacing.

Conclusions: In this Colorado potato trial using 9, 10, and 11-inch row spacings, Vitazyme boosted potato yields 6, 9, and 10%, respectively. These yield increases resulted in a higher value for the tubers, because of size improvements, for the 9 and 10-inch spacings, although this did not hold true for the 11-inch spacing. The increased total yield and better sizes contributed to good income increases for all three row spacings, but especially for the 9-inch spacing where an increase of \$735.72/acre was achieved.

Treatment	Tuber weight cwt/acre	Tuber price* \$/cwt	Total income \$/acre	Income increase \$/acre
9-inch spacing				
Control	420	6.42	2,696.40	—
Vitazyme	444	7.73	3,432.12	735.72
10-inch spacing				
Control	441	6.82	3,007.62	—
Vitazyme	482	7.42	3,576.42	568.80
11-inch spacing				
Control	439	7.33	3,217.87	—
Vitazyme	482	7.08	3,412.56	194.69

* Potato prices per cwt in the San Luis Valley of Colorado for November, 2004, are \$1.00 (<4oz), \$4.50 (4-8oz), \$5.51 (8-9oz), \$6.15 (9-10oz), \$6.82 (10-11oz), \$7.42 (11-12 oz), \$6.00 (12-18oz), \$2.00 (18-20oz), and \$1.00 (>20oz).

- **Increase in tuber yield (9-inch spacing): 6%**
- **Increase in tuber yield (10-inch spacing): 9%**
- **Increase in tuber yield (11-inch spacing): 10%**
- **Income increase (9-inch spacing): \$735.72/acre**
- **Income increase (10-inch spacing): \$568.80/acre**
- **Income increase (11-inch spacing): \$194.69/acre**
- **Increase in tuber weight (9-inch spacing): 20%**
- **Increase in tuber weight (10-inch spacing): 9%**
- **Increase in tuber weight (11-inch spacing): 9%**

Potatoes

Location: Presque Isle, Maine

Market: McCains Foods

Row spacing: 34 inches

Soil type: gravely loam

Experimental design: A farmer's field was divided into Vitazyme treated and control areas, all other treatments of the entire field being the same

1. Control

2. Vitazyme

Fertilization: 1,300 lb/acre of 12-15-15% N-P₂O₅-K₂O on May 13

Vitazyme application: (1) 13 oz/acre on the leaves and soil on June 25; (2) 13 oz/acre on the leaves and soil on July 12, 2004

Yield results: Tuber weights were determined during harvest by measuring load weights.

Tuber Weight

Treatment	Tuber weight cwt/acre	Change cwt/acre
Control	363.6	—
Vitazyme	381.6	18.0 (+ 5%)

Variety: Shepody

Planting date: May 22, 2004

In-row spacing: 16 inches



Note the much better development of roots for the Vitazyme treated potatoes on the right.

Income results: The increased yield of 18.0 cwt/acre, at \$5.30/cwt, produced additional income of \$95.40/acre

Conclusions: Vitazyme in this split field potato study in Maine revealed that the product increased yield by 18 cwt/acre (+5%), that meant \$95.40 more income/acre for the farmer.

- **Increase in tuber weight: 5%**

Potatoes



Tubers from the same plants as the photo on the right show many more tubers at midseason, with larger leaves and more fully developed roots.

Researcher: Jon Gilley, Agro-

Engineering, Alamosa, Colorado

Location: Monte Vista, Colorado

Variety: Norkotah 223

Planting date: May 5, 2004

Row spacing: 34 inches

In-row spacing: unknown

Soil type: cobbly loam

Previous crop: potatoes

Soil test results: pH, 6.8; NO₃-N, 100 lb/acre; P, 81 units; K, 115 mg/l; S, 8 mg/l; Zn, 5.16 mg/l; Fe, 14.5 mg/l; Cu, 0.67 mg/l; Mn, 9.1 mg/l; Na, 2% of CEC; salinity hazard, low; lime hazard, none.



At midseason these San Luis Valley potatoes were noticeably larger when treated with Vitazyme.

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Harvest date: October 1, 2004

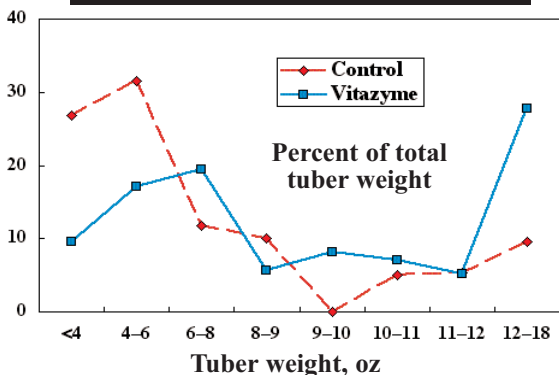
Experimental design: A center pivot irrigated potato field was divided into Vitazyme treated and untreated portions to determine the product's effects on tuber yield and weight classifications.

1. Control 2. Vitazyme

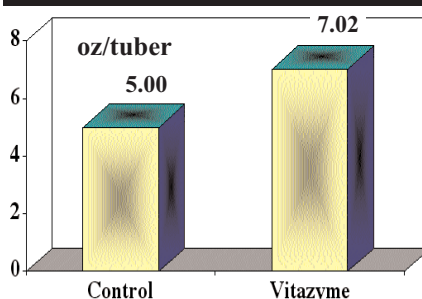
Fertilization: 164.5-180-230 lb/acre of N-P₂O₅-K₂O, 68.5 lb/acre S, 1 lb/acre Zn

Vitazyme application: (1) 13 oz/acre with the first irrigation; (2) 13 oz/acre at tuber initiation (hook stage) through the irrigation system

Tuber Weight Distribution



Average Tuber Weight



Tuber size results: Samples were dug and weighed for both treatments, and a sack of tubers was collected for each. These tubers were individually weighed and recorded for later analysis, when they were arranged according to size units.

In this field, Vitazyme greatly increased average tuber size (+40%), and skewed the weight towards the larger weight categories. There were many more

tubers less than 6 oz with the control than with Vitazyme, and many more large tubers above 12 oz as well.

Treatment	Tuber yield	Change
	cwt/acre	sacks/acre
Control	357	—
Vitazyme	345	(-) 12 (-3%)

Tuber yield results: A four-row section of each treatment (0.33 acre) was harvested and weighed.

Income results: Prices for the various weight ranges were multiplied by those weights, and the totals were added on a percentage basis to give a value for the samples.

Treatment	Tuber yield	Tuber price	Income	Change
	cwt/acre	\$/cwt	\$/acre	\$/acre
Control	357	4.08	1,456.56	—
Vitazyme	345	5.09	1,756.05	299.49

Conclusions: Vitazyme in this sample of potatoes grown in the San Luis Valley of Colorado caused a slight yield reduction, but caused a **dramatic increase in tuber weight (+40%)**. This increased tuber size resulted in a substantial improvement in tuber value (a \$1.01/cwt increase in value), which netted the farmer an extra \$299.49/acre in income.

• **Increase in income: \$299.49/acre**

• **Increase in tuber weight: 40%**

• **Change in tuber yield: -3%**

Potatoes

Location: Presque Isle, Maine

In-row spacing: 7.5 inches

Market: seed

Experimental design: This split-field comparison evaluated ACA and Equity on the east side, and Vitazyme on the west side of the field. Both yield and tuber size were compared at harvest.

Variety: Andover

Soil type: gravelly loam

Row spacing: 34 inches

Planting date: unknown

1. Control (ACA + Equity)

2. Vitazyme

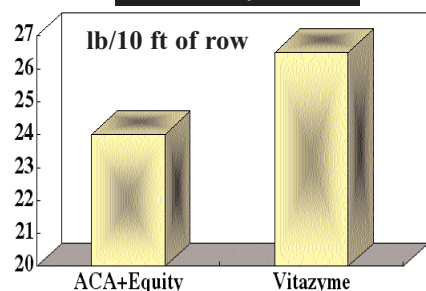
Fertilization: unknown

Vitazyme application: (1) 13 oz/acre on the seed pieces at planting; (2) 13 oz/acre on the leaves and soil at tuber initiation

Yield results: Ten-foot row sections were dug for each treatment on September 6, 2004, and the tubers were counted, weighed, and sized. Each 10-foot section had 11 plants.

Treatment	Tuber weight	Change	Tuber number	Change
	lb/10ft of row	lb/10ft of row	number	number
ACA+Equity	24.0	—	80	—
Vitazyme	26.5	2.5 (+10%)	81	1 (+1%)

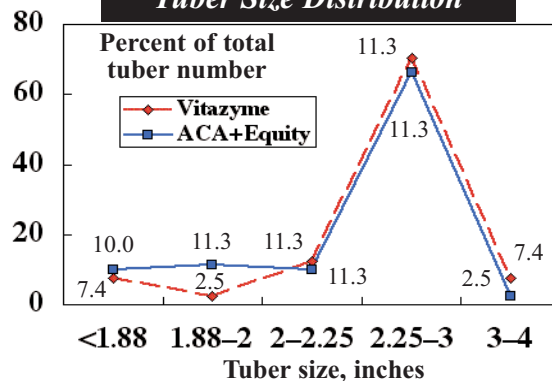
Tuber yield



Vitazyme produced larger tubers, on average, than did the ACA + Equity treatment.

Conclusions: For this on-farm field comparison in northern Maine, Vitazyme produced a 10% greater yield of larger, more acceptable tubers than the other treatment. In addition, the soils treated with Vitazyme were "softer", and the potatoes were deeper, than for the ACA+Equity treatment.

Tuber Size Distribution



• **Increase in tuber yield: 10%**

Potatoes

Researcher: Jon Gilley, Agro-Engineering, Alamosa, Colorado

Variety: Norkotah 296

Row spacing: 34 inches

Soil test results: pH, 8.2; NO₃-N, 80 lb/acre; P, 96units; K, 317 mg/l; S, 34 mg/l; Zn, 1.71 mg/l; Fe, 7.1 mg/l; Cu, 0.63mg/l; Mn, 8.6mg/l; Na, 4% of CEC; salinity hazard, low; lime hazard, low.

Harvest date: September 27, 2004

Experimental design: A center pivot irrigated field of potatoes was divided into two parts, Vitazyme treated and untreated, but all other treatments across the field were identical. The effects of Vitazyme on tuber yield and size were then evaluated.

1. Control 2. Vitazyme

Fertilization: 197.5-199.5-100 lb/acre of N-P-K, 128.5 lb/acre of S, and 3 lb/acre of Zn

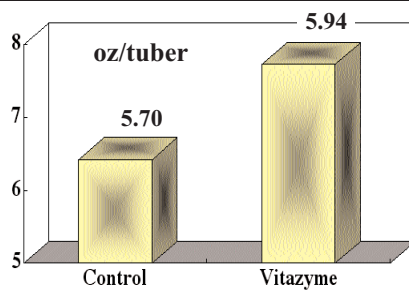
Vitazyme application: (1) 13 oz/acre with the first irrigation; (2) 13 oz/acre at tuber initiation (hook stage) through the irrigation system

Tuber size results: Samples were dug and weighed for both treatments, and a sack of tubers was collected for each. These tubers were individually weighed and recorded for later analysis, when they were arranged according to size units.

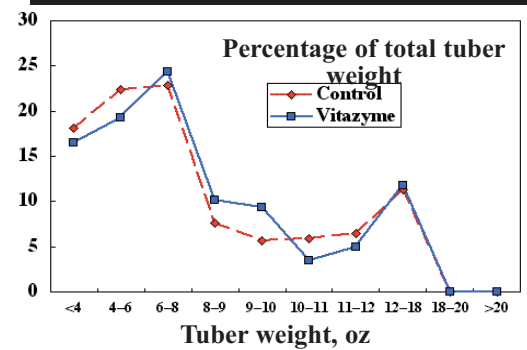
Vitazyme tended to increase average tuber weight, especially for the 9-inch spacing, moving the average weight towards the larger size while, in general, increasing the mid-range sizes of 9 to 18 oz. This effect was especially pronounced with the 11-inch spacing. The net effect was to

9-Inch Spacing

Average Tuber Weight, 9-Inch Spacing

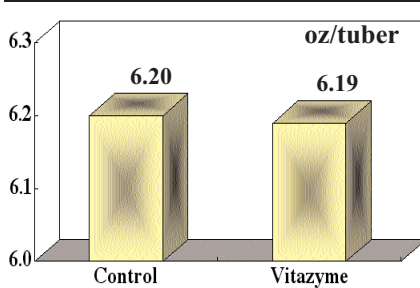


Tuber Weight Distribution, 9-Inch Spacing

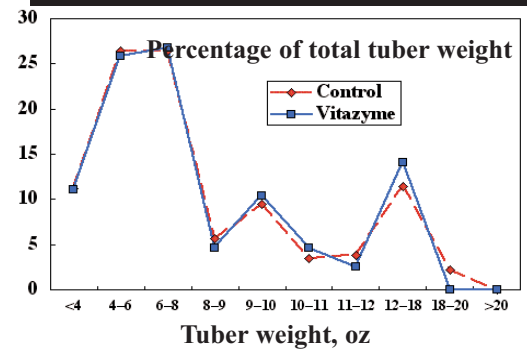


10-Inch Spacing

Average Tuber Weight, 10-Inch Spacing

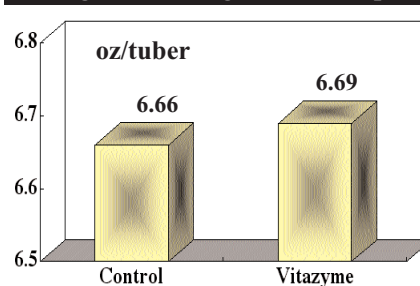


Tuber Weight Distribution, 10-Inch Spacing

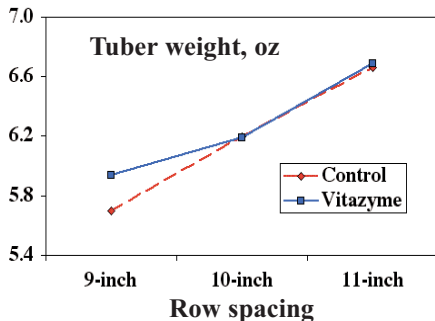
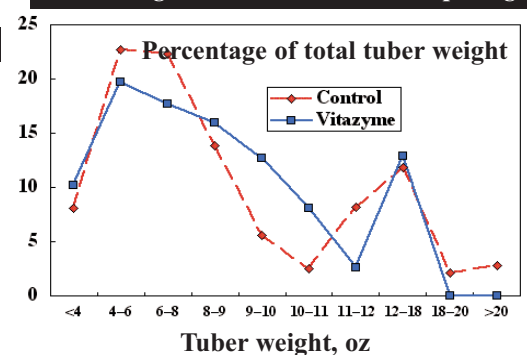


11-Inch Spacing

Average Tuber Weight, 11-Inch Spacing



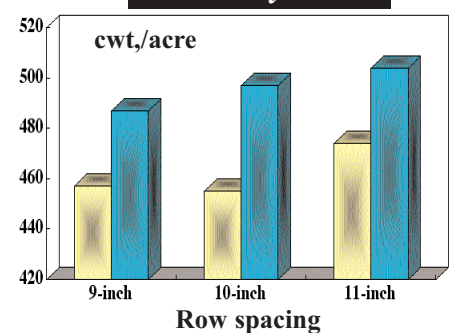
Tuber Weight Distribution, 11-Inch Spacing



Treatment	Tuber weight cwt/acre	Tuber price* cwt/acre	Total income \$/acre	Income increase \$/acre
9-inch spacing				
Control	457	4.53	2,070.21	—
Vitazyme	487	4.58	2,230.46	160.25
10-inch spacing				
Control	455	4.64	2,111.20	—
Vitazyme	497	4.72	2,345.84	234.64
11-inch spacing				
Control	474	4.77	2,260.98	—
Vitazyme	504	0.97	2,504.88	243.90

* Potato prices per cwt in the San Luis Valley of Colorado for November, 2004, are \$1.00 (<4oz), \$4.50 (4-8oz), \$5.51 (8-9oz), \$6.15 (9-10oz), \$6.82 (10-11oz), \$7.42 (11-12oz), \$6.00 (12-18oz), \$2.00 (18-20oz), and \$1.00 (>20oz).

Tuber yield



Continued on the next page

move the size ranges towards those that were more profitable.

As expected, average tuber weight increased with increased in-row plant spacing for both treatments. See the accompanying graph on the previous page.

Yield results: Samples for each treatment were weighed on a scale and calculated to determine per acre yields. See the results on the previous page. Yield increases were consistent for all three row spacings, ranging from 6 to 9%.

Income results: Each tuber size category was weighted to a percentage of the total weight, and that percentage was multiplied by the price for that category. When added, those sums gave a total value for the crop.

For all row spacings Vitazyme increased potato income substantially. This increase was not only due to higher yields, but also due to a higher average price for tubers that were of higher valued weight classes.

Conclusions: In this Colorado potato study, Vitazyme increased yields at 9, 10, and 11-inch row spacings from 6 to 9% over the controls. These increases produced tubers that were of higher value than the control due to better weight distribution, so that yields were increased by \$160.25 to \$243.90/acre. **These income increases revealed an income:cost benefit of about \$16 to \$24 per dollar invested in product.**

- **Increase in tuber weight (9-inch spacing): 4%**
- **Increase in tuber weight (10-inch spacing): 0%**
- **Increase in tuber weight (11-inch spacing): 0.5%**
- **Increase in tuber yield (9-inch spacing): 7%**
- **Increase in tuber yield (10-inch spacing): 9%**
- **Increase in tuber yield (11-inch spacing): 6%**
- **Income increase (9-inch spacing): \$160.25/acre**
- **Income increase (10-inch spacing): \$234.64/acre**
- **Income increase (11-inch spacing): \$243.00/acre**

Potatoes

Location: Foss Farm, Fort Fairfield, Maine

Row spacing: 34 inches

Soil type: gravelly loam

Planting date: May 16, 2004

Variety: Norwis

In-row spacing: 6.6 inches

Market: seed



The advantage of Vitazyme treated potato plants at midseason is obvious in this photo.

Experimental design: A potato field was divided into two parts, one treated with Vitazyme and the other left untreated. All other treatments were the same for both sides.

1. Control
2. Vitazyme

Fertilization: 1,100 lb/acre of 12-15-15% N-P₂O₅-K₂O plus other materials

Vitazyme application: (1) 13 oz/acre on the leaves and soil on June 15, 2004; (2) 13 oz/acre on the leaves and soil on July 1, 2004

Yield results: Ten-foot row sections were dug for each treatment, and the tubers were weighed, counted, and sized. Each 10-foot section had 13 plants.

Treatment	Tuber weight	Change	Tuber number	Change
	lb/10ft of row	lb/10ft of row	number	number
Control	25.0	—	112	—
Vitazyme	29.0	4.0 (+ 16%)	116	4 (+ 4%)

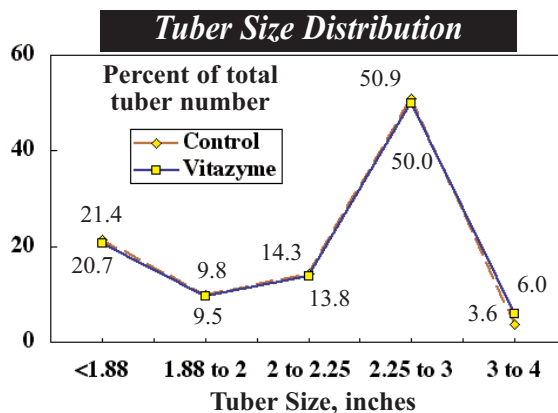
There was little difference in the size distribution of the tubers for the two treatments, except for a small tendency for Vitazyme to produce larger potatoes, especially at the largest size (3 to 4 inches).

Conclusions: This in-field potato study in northern Maine showed that Vitazyme increased tuber yield by 16% while slightly increasing the average tuber size. There were also **significantly more roots noted with Vitazyme treated plants**, noticed particularly at digging.

- **Increase in tuber yield: 16%**



Tubers removed from the plants of the left-hand photo show a decided number and size advantage with Vitazyme.



Potatoes

Location: W.E. Doyen and Sons, Mapleton, Maine

Variety: Katahdin

Row spacing: 34 inches

Planting date: May 22, 2004

Experimental design: A potato field was divided into two parts, one part treated with Vitazyme, to evaluate the effects on yield and tuber size.

1. Control

Market: seed or table

In-row spacing: 7.5 inches

Soil type: gravelly loam

2. Vitazyme

Fertilization: unknown

Vitazyme application: 13 oz/acre on July 2; 13oz/acre on July 29

Chlorophyll effects: On July 30, 30 plants from each treatment were evaluated for chlorophyll content using a Minolta SPAD meter.

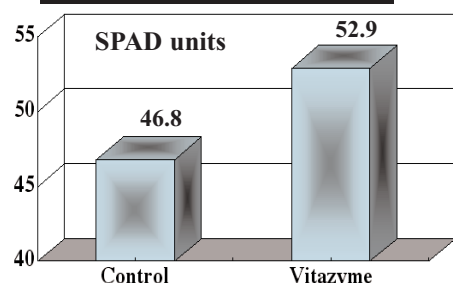
On this date the Vitazyme treated plants were visibly greener than the control treatment. Tubers from sample plants were noticeably larger for the treated plants.

Yield results: Two 10-foot control row sections and three 10-foot Vitazyme treated sections were dug before harvest, and the tubers were weighed and sized. Values were averaged for the two treatments.

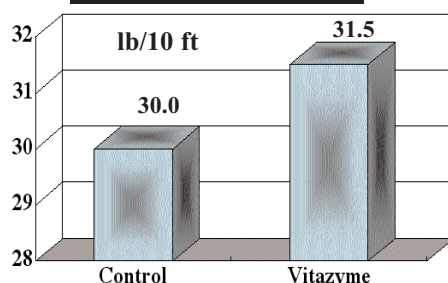


Note the larger plants with more chlorophyll and much larger tubers on the Vitazyme treated side (right).

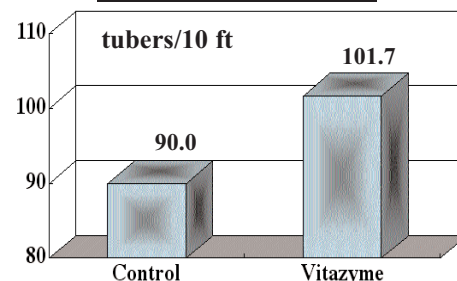
Leaf Chlorophyll



Tuber Yield



Tuber Number



Conclusions: Vitazyme in this on-farm Maine potato study increased the yield by 5% and tuber number by 13%. Tuber distribution with Vitazyme was moved in favor of the 2.25 to 3.5 inch size, where there were 3.6% more tubers than for the control. Other observations during harvest were the following:

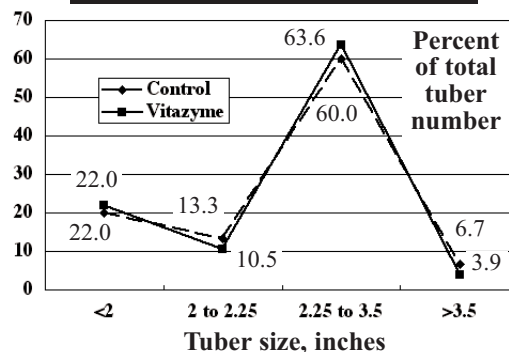
- q The Vitazyme treated tubers had a brighter appearance than the controls.
- q Less soil adhered to the Vitazyme treated tubers than to the controls.
- q Little if any rhizoctonia was evident with the Vitazyme treated potatoes, though some was evident for the control tubers.

▪ **Increase in leaf chlorophyll: 6.1 SPAD units**

▪ **Tuber yield increase: 5%**

▪ **Tuber number increase: 13%**

Tuber Size Distribution



Rice

Rice Trial of the Cuban Ministry of Sugar

Farm: Aracelio Iglesias Diaz Agricultural Enterprise

Variety: unknown

Planting date: unknown

Experimental design: A field of rice was divided into a Vitazyme treated area (25 ha, or 62.5 acres), and a control area (2 ha, or 5 acres), to evaluate effects on crop yield.

1. Control

Location: Majajigua, Sancti Spiritus, Cuba

Soil type: "gleyish" Vertisol

Seeding rate: unknown

2. Vitazyme

Fertilization: unknown

Vitazyme application: 1 liter/ha during active tillering

Yield results: Due to a lack of irrigation water the crop did not attain maturity.

Conclusions: Despite the fact that the crop was not harvested, the Vitazyme treated crop was darker green 10 to 12 days after application, showing the product's effect to stimulate chlorophyll development. It was also noted that Vitazyme reduced plant stress during drought conditions.

Rice – Seedling Growth In Vitro

Institute for Rice Research, Republic of Cuba

Research entity: Institute for Rice Research

Location: Institute for Rice Research, Province of Havana, Cuba

Variety: Reforma

Testing date: 2003

Experimental design: In the laboratory, Petri dishes (9 cm x 1.5 cm) with filter paper were wetted with Vitazyme solutions of 0, 2, 4, 6, 8, and 10%. Each treatment was replicated four times in a completely randomized design, with 100 rice seeds in each Petri dish. The moisture level of the dishes was maintained by adding distilled water to the dishes as required. Coleoptile and root growth were measured at 5 and 10 days after germination. This experiment was repeated three times.

Results: An average of the three Petri dish experiments is given in the following table.

While none of the treatments were significantly greater than the 0% control, Vitazyme consistently increased root growth in Petri dishes at both 5 and 10 days after test initiation. Increases of 5 to 15% were recorded. Coleoptile extension stimulation was less impressive, but still produced increases of from 1 to 10% at 5 to 10 days after test initiation. Two negative results at 5 days were reversed by 10 days after initiation.

Vitazyme	Roots*		Coleoptiles*	
	5 days	10 days	5 days	10 days
%	----- cm -----			
0	4.12 a	5.49 a	1.75 a	4.88 a
2	4.37 a (+6%)	5.46 a (-1%)	1.62 a (-7%)	5.00 a (+2%)
4	4.57 a (+11%)	6.17 a (+12%)	1.81 a (+3%)	5.07 a (+4%)
6	4.71 a (+14%)	5.87 a (+7%)	1.83 a (+5%)	5.19 a (+6%)
8	4.75 a (+15%)	5.74 a (+5%)	1.92 a (+10%)	5.26 a (+8%)
10	4.75 a (+15%)	5.75 a (+5%)	1.73 a (-1%)	4.91 a (+1%)

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

Conclusions: In these Petri dish studies using Vitazyme at different concentrations to stimulate root and coleoptile extension, the product consistently produced increases of up to 15% in root growth and of up to 10% in coleoptile growth above the control. These increases in seedling growth reveal how Vitazyme can produce faster and more aggressive germination of rice seedlings.

- **Increase in rice root extension at 5 days: up to 15%**
- **Increase in rice root extension at 10 days: up to 12%**
- **Increase in rice coleoptile extension at 5 days: up to 10%**
- **Increase in rice coleoptile extension at 10 days: up to 8%**

Rice – Seedling Growth In Vitro

Institute for Rice Research, Republic of Cuba



In this Cuban rice trial, Vitazyme gave taller, higher yielding plants that contained more chlorophyll.

Research entity: Institute for Rice Research

Location: (1) Institute for Rice Research, Province of Havana; (2) Experiment Station, south of Jibaro, Province of Sancti Spiritus

Varieties: Perla de Cuba ["Cuban Pearl"], a short cycle type, at Havana Province, and 4499, a medium cycle type, at Sancti Spiritus

Soil types: unknown

Planting date: unknown, in 2003

Planting rate: unknown



Notice how much better developed the rice plants are, in terms of root and leaf growth and grain maturity, with Vitazyme than with the control.

Treatment	Vitazyme application			
	NPK fertilizer	Active tillering	Flowering initiation	Primordial change
1	0	0	0	0
2	100%	0	0	0
3	75%	0	0	0
4	100%	x	x	0
5	75%	x	x	0
6	75%	x	0	0
7	75%	0	0	x
8	75%	0	x	0

Experimental design: A randomized complete block design with four reps was set up at Sancti Spiritus, the plots 3x4 meters with four reps. At Havana Province, there were two reps with plots that were 2x10 meters. Eight treatments were utilized at both sites.

Fertilization: At Sancti Spiritus, all treatments received 68 kg/ha of triple superphosphate (0-46-0% N-P₂O₅-K₂O), 90 kg/ha of KCl (0-0-60% N-P₂O₅-K₂O), and 170 kg/ha urea (46-0-0% N-P₂O₅-K₂O). At

Havana Province, the rate of application was 34 kg/ha 0-46-0, 48 kg/ha 0-60-0, and 127 kg/ha of urea.

Vitazyme application: All treatments receiving Vitazyme were sprayed using a manual sprayer at 1.4 atmospheres of pressure, with a delivery rate of 100 ml/m². One liter/ha was applied at the growth stages indicated above.

Results: Besides rice yield and economic analyses, the plant height, number of stems per m², leaf area per m², and thickness and length of the first basal internode were evaluated for each trial.

Havana Province, cv. Perla de Cuba

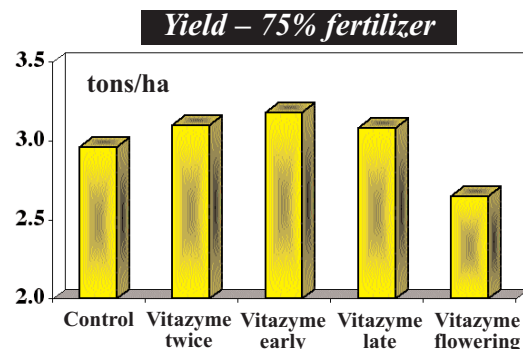
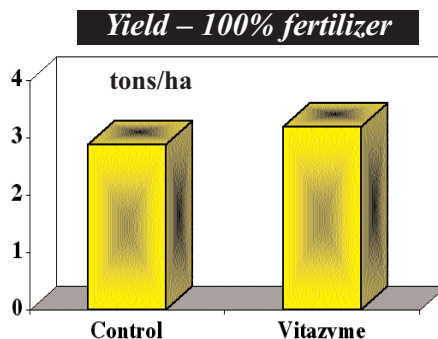
Treatment	Height*	Leaves*	Stems*	Internode thickness*	Internode length*	Leaf area*
	cm	number/m ²	stems/m ²	mm	cm	cm ²
1 (no fert.)	92	1,888	688	0.53	3.8	22.2
2 (100% fert.)	96	3,024	864	0.43	4.9	23.3
3 (75% fert)	102	3,024	864	0.49	3.9	28.5
4 (100% + 2x Vit.)	100 (+4%)	3,440 (+14%)	560 (-35%)	0.50 (+16%)	5.9 (+20%)	26.7 (+15%)
5 (75% + 2x Vit.)	100 (-2%)	3,152 (+4%)	832 (-4%)	0.44 (-10%)	3.7 (-5%)	33.3 (+17%)
6 (75% + Vit. early)	104 (+2%)	2,480 (-18%)	672 (-22%)	0.49 (0)	3.8 (-3%)	30.3 (+6%)
7 (75% + Vit. late)	92 (-10%)	2,784 (-8%)	704 (-19%)	0.37 (-24%)	7.2 (+85%)	24.0 (-16%)
8 (75% + Vit. flow.)	74 (-27%)	3,648 (+21%)	992 (+15%)	0.36 (-27%)	5.0 (+28%)	16.0 (-44%)

*All comparisons for percentage changes are made using the same fertilization levels. Thus, Treatment 4 is compared with Treatment 2, and Treatments 5,6,7, and 8 are compared with Treatment 3.

Treatment	Grain yield*	Panicles*	Kernels*	Kernel wt.*	Panicle length*
	tons/ha	per m ²	per panicle	g/1000	cm
1 (no fert.)	2.41 b	230 b	64 a	24.86 c	22 b
2 (100% fert.)	2.88 ab	344 a	72 a	26.58 ab	22 b
3 (75% fert)	2.96 ab	343 a	61 a	26.00 bc	23 ab
4 (100% + 2x Vit.)	3.19 a (+11%)	301 a (-13%)	75 a (+4%)	26.14 abc (-2%)	23 ab (+5%)
5 (75% + 2x Vit.)	3.10 a (+5%)	330 a (-4%)	81 a (+33%)	26.64 ab (+2%)	23 ab (0)
6 (75% + Vit. early)	3.18 a (+7%)	332 a (-3%)	67 a (+10%)	27.50 a (+6%)	23 ab (0)
7 (75% + Vit. late)	3.08 a (+4%)	315 a (-8%)	61 a (0)	27.25 a (+5%)	22 b (-4%)
8 (75% + Vit. flow.)	2.65 bc (-10%)	347 a (+1%)	72 a (+18%)	26.67 ab (+3%)	24 a (+4%)

*All comparisons for percentage changes are made using the same fertilization levels. Thus, Treatment 4 is compared with Treatment 2, and Treatments 5,6,7, and 8 are compared with Treatment 3. Means followed by the same letter are not significantly different at P=0.05.

Vitazyme application to rice in this trial at 100% fertilizer increased leaf number (+14%), leaf area (+15%), and height (+4%), though stem number was reduced; internode length and thickness were reduced. With 75% fertilizer, Vitazyme applications caused considerable variation in growth parameters depending upon application times. Early applications increased leaf area, up to 17%, but had variable effects on height and leaf number. Stem density per unit



area was decreased, and internode thickness was decreased while, for a late application, internode length was greatly increased (+85%). Vitazyme applied at flowering increased stems per unit area (+15%) while increasing internode length and reducing leaf area and height; leaf and stem number were concurrently increased.

Vitazyme increased the yield of rice at 100% fertilizer by up to 11% (two applications early), although a single application at the beginning of flowering actually reduced yield from the control. These yield increases were due primarily to increases in the number and weight of kernels per panicle, since the panicle number per unit area actually decreased — though not significantly — for all but the single early flowering application. Of interest is the fact that 75% fertilizer (Treatment 3) out-yielded — though not significantly — the 100% fertilizer treatment (Treatment 2). Also, all of the Vitazyme applications but Treatment 8 (Vitazyme applied at flower initiation) increased rice yield above the 100% fertilizer treatment.

One weakness of this experiment was a failure to isolate the treatments from one another in the paddy. Thus, treatment effects migrated to some extent from one plot to another, obscuring some of the effects by tending to equalize fertility and Vitazyme responses.

• **Yield increase, 100% fertilizer + Vitazyme (2x): 11%**

• **Yield increase, 75% fertilizer + Vitazyme (2x): 7%**

Sancti Spiritus, cv. 4499

By 76 days after planting Vitazyme had enhanced the height of all of the rice treatments in this study, the increase being from 7 to 14% above the appropriate controls. No individual plot data is available to com- Continued on the next page

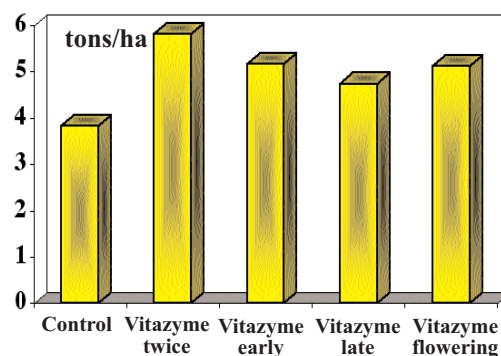
Treatment	Plant height at days after planting*			
	26	37	53	76
	----- cm -----			
1 (no fert.)	19	32	38	39
2 (100% fert.)	30	51	44	78
3 (75% fert)	28	43	47	71
4 (100% + 2x Vit.)	30 (0)	48 (-6%)	61 (+39%)	88 (+13%)
5 (75% + 2x Vit.)	28 (0)	47 (+9%)	52 (+11%)	76 (+7%)
6 (75% + Vit. early)	29 (+4%)	40 (-7%)	51 (+9%)	81 (+14%)
7 (75% + Vit. late)	27 (-4%)	44 (+2%)	53 (+13%)	80 (+13%)
8 (75% + Vit. flow.)	28 (0)	45 (+5%)	37 (-21%)	81 (+14%)

*All comparisons for percentage changes are made using the same fertilization levels. Thus, Treatment 4 is compared with Treatment 2, and Treatments 5,6,7, and 8 are compared with Treatment 3.

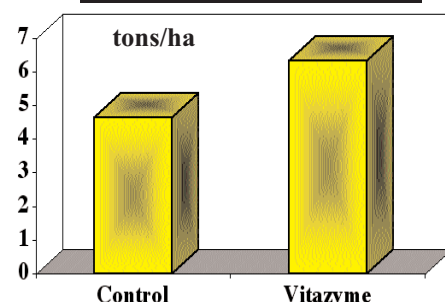
pare the treatments on a statistical basis.

All Vitazyme treatments in this rice trial exceeded the respective controls highly significantly, at the 100% fertilizer level by 36% and at the 75% fertilizer level by 24 to 52%. Moreover, all of the 75% fertilizer + Vitazyme treatment yields exceeded the 100% fertilizer treatment (Treatment 2) yield; while the single application (Treatments 6, 7, and 8) increases were not significantly greater, the double application (Treatment 5) was, by a full 1.16 tons/acre, or 25%. These results dramatically show the effect of Vitazyme's active agents to stimulate improved nitrogen and mineral utilization and natural soil nitrogen fixation, thus reducing the farmer's reliance on expensive fertilizer inputs. These yield improvements were influenced primarily by a great increase (34 to 56%) in panicle density per unit area, a reflection of the number of tillers (stems) produced per plant. Kernels per panicle were also increased, from 1 to 16%, whereas effects on unproductive tillers and panicle length were somewhat variable.

Yield – 75% fertilizer



Yield – 100% fertilizer



Treatment	Grain yield*	Panicles*	Kernels*	Unproductive kernels*	Panicle length*
	tons/ha	per m ²	per panicle	grains/panicle	cm
1 (no fert.)	3.17 e	182 f	62 c	25 a	18.4 c
2 (100% fert.)	4.65 c	267 d	79 b	17 ab	21.3 b
3 (75% fert)	3.83 d	215 e	77 b	16 ab	20.7 b
4 (100% + 2x Vit.)	6.34 a (+36%)	365 a (+37%)	92 a (+16%)	18 ab (+6%)	23.3 a (+9%)
5 (75% + 2x Vit.)	5.81 b (+52%)	336 ab (+56%)	81 b (+5%)	13 b (-19%)	21.3 b (+3%)
6 (75% + Vit. early)	5.17 c (+35%)	327 b (+52%)	82 b (+6%)	18 ab (+13%)	21.3 b (+3%)
7 (75% + Vit. late)	4.74 c (+24%)	310 bc (+44%)	78 b (+1%)	17 ab (+6%)	20.7 b (0)
8 (75% + Vit. flow.)	5.12 c (34%)	288 cd (+34%)	83 b (+8%)	20 ab (+25%)	18.4 c (-11%)

*All comparisons for percentage changes are made using the same fertilization levels. Thus, Treatment 4 is compared with Treatment 2, and Treatments 5,6,7, and 8 are compared with Treatment 3. Means followed by the same letter are not significantly different at P=0.05.

▪ **Yield increase, 100% fertilizer + Vitazyme (2x): 36%**

▪ **Yield increase, 75% fertilizer + Vitazyme (2x): 52%**

Income results: The economic effects from this study are shown using the calculations of the Cuban researchers. Calculations were made only on the Sancti Spiritus site, so only those figures are shown below.

Treatment	Grain yield (with hull)	Yield (white)	Price	Market value	Cost of increased yield	Cost of fert. + other	Total cost	Profit	Economic effect
	tons/ha	tons/ha	US\$	US\$/ha	US\$/ha	US\$/ha	US\$/ha	US\$/ha	US\$/ha
Control (100% fert.)	4.65	3.02	170	513.40	—	101.70	101.70	411.70	—
100% fert. + 2x Vit.	6.34	4.12	170	700.40	27.50	132.58	160.08	540.32	128.62
75% fert. + 2x Vit.	5.81	3.78	170	642.60	19.00	117.57	136.50	506.10	94.38
75% fert. + Vita. early	5.17	3.36	170	571.20	8.50	110.73	110.73	460.47	48.77

▪ **Income increase with Vitazyme vs. fertilizer: \$48.77 to \$128.62/ha**

Conclusions: Vitazyme in these Cuban rice studies proved to be an excellent booster of rice growth and yield at two locations: Havana Province and Sancti Spiritus. Economic profits were also markedly improved. Conclusions of the Cuban research team are as follows:

1. The biostimulant Vitazyme increased the agricultural yield of rice cultivation.
2. The 100% and 75% nitrogen variants, plus the application of Vitazyme during active tillering or the beginning of the panicle stages, were the most effective to increase the agricultural yield, with economic effects of \$128.62 and \$94.38 per hectare respectively.

Rice

Institute for Rice Research, Republic of Cuba

Research entity: Institute for Rice Research

Location: Institute for Rice Research, Estacion de Jucarito, Granma, Cuba

Variety: unknown

Planting date: unknown, in 2003

Soil type: unknown

Harvest date: unknown

Experimental design: A randomized complete block design was set up to determine the effects of Vitazyme on rice yield and profitability. Only three of the several treatments established were reported, and are as follows:

1. **Control:** 75% normal N (58.5 Kg/ha N, or 127 kg/ha urea)
2. **Treatment 2:** 75% normal N + Vitazyme twice
3. **Treatment 3:** 75% normal N + Vitazyme once

Fertilization: 58.5 kg/ha N (127 kg/ha urea) for all three treatments

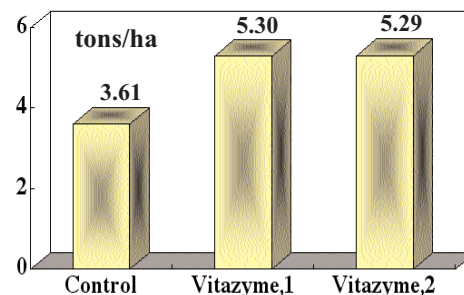
Vitazyme application: 1 liter/ha at tillering for Treatment 3, and 1 liter/ha at both tillering and flower initiation for Treatment 2

Conclusions: Vitazyme greatly increased rice yield in this Cuban study, by 47% over the control for both the single and double 1 liter/ha treatments. Crop returns were also substantially increased, by \$125.03 to \$149.01 per hectare for the two treatments

▪ **Grain yield increase: 47%**

▪ **Income increase: \$125.03/ha – \$149.01/ha**

Grain Yield



Grain Income

Treatment	Cost of production	Net income	Income increase
	\$/ha	\$/ha	\$/ha
1. Control	70.79	327.01	—
2. Vitazyme twice	132.76	452.04	125.03
3. Vitazyme once	109.78	76.02	149.01

Soybeans

A Testimonial on Emergence and Yield

Location: near Cecilia, Kentucky

Variety: NK 39Q4

Soil type: Crider silty clay loam

Row spacing: drilled in 7.5-inch rows with a no-till planter

Planting date: May 5, 2003

Experimental design: A soybean field was planted with seed treated with dry inoculant plus straight, undiluted Vitazyme put into a planter box. After the planter ran out of treated seed, the last part of the field was planted with untreated seed.

Fertilization: unknown

Vitazyme application: 6 oz/acre of straight undiluted Vitazyme on the seeds in the planter box together with dry rhizobium inoculant; this gave very good seed contact for both the Vitazyme and the inoculant.

Germination time: The treated seeds had emerged by May 9, four days after planting, despite cold soil temperatures, which was several days before the untreated beans.

Yield results: 56.8 bu/acre in a dry year. Surrounding fields yielded less, though exact yields are not known.

Conclusions: Vitazyme applied straight to seeds at planting stimulated soybean germination by a great degree over the untreated soybeans, despite cold soil temperatures, and resulted in higher bean yields despite a very dry growing season.

▪ **Days to emergence: 4 days after planting**

Soybeans

Agricultural Custom Research and Education Services

Location: Cedar Falls, Iowa

Soil type: Floyd loam (pH 6.8, organic matter 4.2%, CEC 15.7, good fertility)

Previous crop: corn

Planting rate: 157,000 seeds/acre

Planting date: May 4, 2004

Variety: Pioneer 92M72 non-GMO

Planting depth: 1.5 inches

Row spacing: 30 inches

Tillage: conventional

Experimental design: A Latin-square design with six replicates was established with plots 15 (6 rows) x 40 feet (0.0138 acre), to discover the effects of Vitazyme,

Treatment	Product	Vitazyme rate
1	Control	0
2	Vitazyme	13 oz/acre x 2
3	Product X	13 oz/acre x 2
4	Product Y	13 oz/acre x 2
5	Vitazyme + Product Y	13 oz/acre x 2 each
6	Product X + Product Y	13 oz/acre x 2 each

a new variant of Vitazyme (Product X), and a possible synergistic product with Vitazyme (Product Y). Six treatments were used, as outlined



The Vitazyme treated row displays greater growth and more chlorophyll development on June 6 in an Iowa trial.

Continued on the next page



The Vitazyme treated soybean on the right displays greater root and rhizobium nodule development than does the untreated control.

Income results: A \$6.00/bu price for soybeans is used for these calculations.

Conclusions: In this replicated Iowa soybean study, **Vitazyme and all other products and combinations produced statistically greater soybean yields than the control.** This increase amounted to very profitable gross income increases of \$25.80 to \$43.80. The greatest yield increase was for the combined Product X + Product Y treatment. The grain moisture at harvest was not significantly affected by the treatments, although all of them were dry at harvest so the drydown rate could not be evaluated.

This soybean study shows that regular Vitazyme will improve soybean yield as well as any other treatment or combination except the new variant of Vitazyme (Product X) combined with Product Y. This combined product increased yield by 2.0 bu/acre above the regular Vitazyme alone.

below, and an analysis of variance utilized the Student-Newman-Keuls method to separate treatment means.

Fertilization: none

Vitazyme application: 13 oz/acre applied at planting on the seeds, and again on June 15 when the plants were 7 to 9 inches tall (3.5 trifoliates)

Harvest date: October 6

Yield results: The center two rows of each plot were harvested with a plot combine, and the grain was weighed with an electronic scale.

All products and combinations significantly increased soybean yield, from 9 to 15%. Especially effective was Treatment 6 (Product X + Product Y), which gave a 15% yield increase, of 7.3 bu/acre. Grain moisture was not affected significantly for any of the treatments.

Treatment	Grain yield**	Change	Moisture**	Change
	bu/acre	bu/acre	%	%
1. Control*	48.2 b	—	11.70 a	—
2. Vitazyme	53.5 a	5.3 (+11%)	11.65 a	- 0.05
3. Product X	53.3 a	5.1 (+11%)	11.60 a	- 0.10
4. Product Y	52.5 a	4.3 (+9%)	11.70 a	0
5. Vita + Prod Y`	53.5 a	5.3 (+11%)	11.73 a	+ 0.03
6. Prod X + Prod Y	55.5 a	7.3 (+15%)	11.62 a	- 0.08

* Average of three control treatments.

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

Treatment	Grain increase	Extra income
	bu/acre	\$/acre
2. Vitazyme	5.3	31.80
3. Product X	5.1	30.60
4. Product Y	4.3	25.80
5. Vita + Prod Y`	5.3	31.80
6. Prod X + Prod Y	7.3	43.80

Yield Changes

Vitazyme.....+11%
 Product X.....+11%
 Product Y.....+9%
 Vita + Prod Y....+11%
 Prod X + Prod Y..+15%

Sugar Cane

Location: Santiago de Cuba, Cuba

Variety: C89-147

Type: ratoon

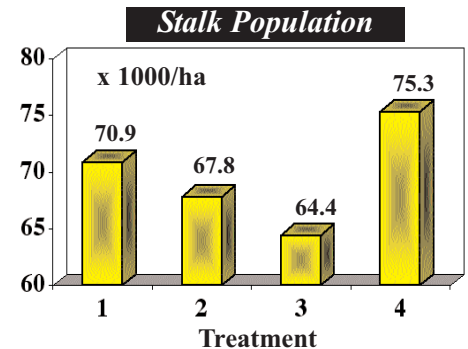
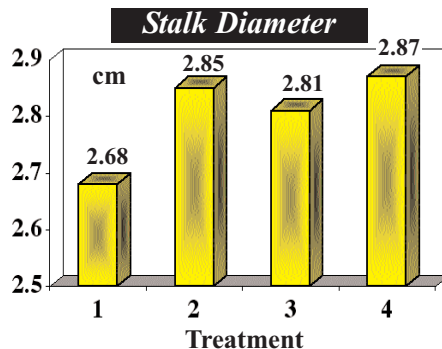
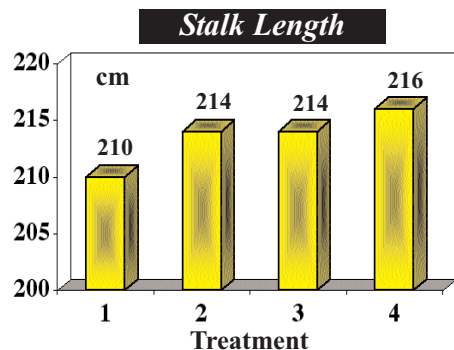
Soil type: Leptic haplustert

Experimental design: Four treatments were applied to a Latin square design, having four replicates of 64 m², to evaluate the effect of Vitazyme on sugar cane yield at normal and 50% recommended N applications.

Fertilization: Nitrogen was applied at 75 kg/ha for Treatments 2 and 4, and at 37.5 kg/ha for Treatment 3. The control (Treatment 1) received no fertilizer, as recommended for the crop cycle and soil of this study.

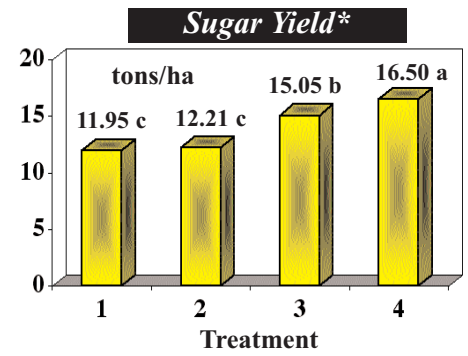
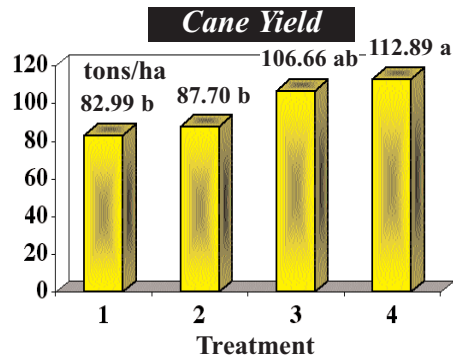
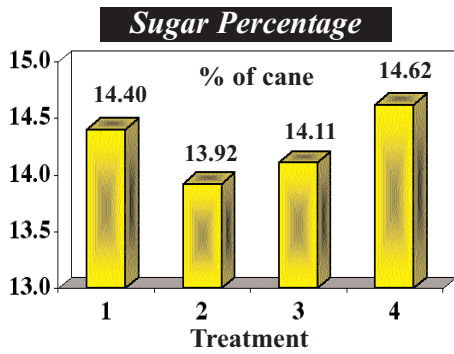
Vitazyme application: 1 liter/ha three times, monthly from the last harvest, for Treatments 3 and 4

Growth results:



Vitazyme increased stalk length and diameter in most cases compared to the no nitrogen control, though stalk population was increased only by the 100% N + Vitazyme treatment (Treatment 4). Compared to the 100% N control, Vitazyme + 100% N increased stalk length (+1%), stalk diameter (+1%), and stalk population (+11%), while the 50% N + Vitazyme treatment (Treatment 3) improved none of these sugar cane growth parameters vs. Treatment 2, even though yield was significantly increased above it, as will be noted in the following analyses.

Yield and quality results:



*Means followed by the same letter are not significantly different. Standard error = 4.59 tons/ha

*Means followed by the same letter are not significantly different. Standard error (sugar yield) = 0.53 t/ha; standard error (cane yield) = 4.59 t/ha.

Sugar cane yield was significantly increased above both the no N control and the 100% N control by Vitazyme, by from 29 to 36%. Compared to the 100% N control, Vitazyme significantly boosted total yield at the 100% N level (29%), and almost at the 50% N level as well (22%). Sugar percentage of the cane was not significantly affected.

The all-important sugar yield was boosted by a highly significant 38% (4.55 tons/ha) by Vitazyme + 100% N above the no N control, and by 35% (4.29 tons/ha) above the 100% N control. **The 50% N + Vitazyme treatment (Treatment 3) increased the sugar yield a substantial 23% above the 100% N control, representing a savings in nitrogen fertilizer while at the same time increasing sugar yield.**

Economic calculations by the Cuban researchers: The three Vitazyme treatments, plus the control treatment, were evaluated for income using two sugar prices. The results are shown below.

Treatment	Cumulative Vitazyme rate	Cane yield	Increased cane yield	Sugar yield	Sugar increase ¹	Extra cost of production	Added value of sugar at ² ...		Added income of sugar at ...	
							\$0.06/lb	\$0.07/lb	\$0.06/lb	\$0.07/lb
1 (no N)	0	82.99	—	9.13	—	—	—	—	—	—
2 (100% N)	0	87.70	4.71	9.65	0.52	63.61	68.74	80.24	5.13	16.63
3 (50% N)	3	106.66	23.67	11.73	2.60	146.41	343.72	401.18	197.31	254.77
4 (100% N)	3	112.89	29.90	12.42	3.29	187.77	434.94	507.65	247.17	319.88

¹ At 11% recoverable sugar of the cane yield.

² Sugar values are \$132.20/ton (for \$0.06/lb) and \$154.30/ton (for \$0.07/lb).

Treatments 3 and 4 both gave excellent returns on investment, with only \$0.43/lb extra cost per dollar of added sugar (at \$0.06/lb), and \$0.37 extra cost per dollar of added sugar (at \$0.07/lb). Treatment 3 was especially of interest because it received only 50% of the recommended nitrogen along with Vitazyme, but still produced added returns as high as did the 100% nitrogen plus Vitazyme treatment.

Conclusions: In this Cuban sugar cane trial, Vitazyme applied three times during the growing season substantially and significantly improved the growth, cane yield, and sugar yield versus both the no N control and the 100% N control. The sugar yield was improved by a highly significant 35% above the 100% N level with Vitazyme applied at the same N level. **Only 50% N + Vitazyme also increased yield above the 100% N, by 23%, showing how effective both Vitazyme + standard fertilization, and Vitazyme along with reduced fertilizer, are in promoting more profitable sugar production in Cuba on haplustert or calcareo-eutric vertisol soils, for a ratoon sugar cane crop.**

Treatment	Extra cost per dollar of added sugar ...	
	at \$0.06/lb	at \$0.07/lb
1 (no N)	—	—
2 (100% N)	0.92	0.79
3 (50% N)	0.43	0.37
4 (100% N)	0.43	0.37

- Increase in stalk length: 1 to 3%
- Increase in cane yield: 22 to 36%
- Increase in sugar yield: 23 to 38%

- Increase in stalk diameter: 1 to 7%
- Change in stalk population: -9 to +11%
- Change in sugar percentage: -2 to +5%

Sugar Cane

Location: Espana Rep. Estate, Mantanzas Province, Cuba

Variety: Matanzas C323-68

Type: ratoon

Soil type: Eustrtox (Ferralsol)

Experimental design: A 0.3 ha plot containing three replicates was established to evaluate the effects of Vitazyme and reduced fertilizer on sugar cane yield and sugar content. Three treatments were used.

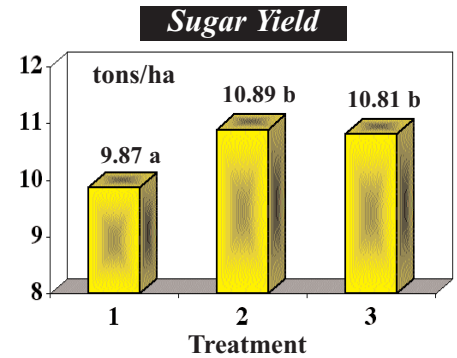
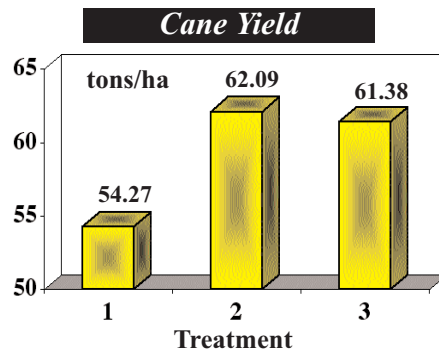
Treatment	Vitazyme	Fertilizer
1	0	100%
2	1 liter/ha x 3	100%
3	1 liter/ha x 5	75%

Fertilization: Fertilizer was applied at 100 or 75% of recommended rates to all treatments (100%: 130 kg/ha N, 100 kg/ha K₂O; 75%: 97.5 kg/ha N, 75 kg/ha K₂O).

Vitazyme application: 1 liter/ha three times broadcast monthly from the last harvest for Treatment 2, and five times for Treatment 3

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Conclusions: The total cane yield was increased about the same (13 to 14%) by Vitazyme at either 100% or 75% fertilizer. This fact demonstrates that Vitazyme will enhance yields as well under reduced fertilizer regimes as under full fertilizer regimes: the 75% fertilizer treatment + Vitazyme applied five times gave about the same increase as did the 100% fertilizer treatment + Vitazyme applied three times. The sugar yield increase was about 10% for both of the Vitazyme treatments. **These increases show that Vitazyme is an excellent supplement for sugar cane production in Cuba in red Eustrustox or Ferralsol soils, especially since it reveals the potential to achieve high yields while reducing fertilizer use.**



*Means followed by the same letter are not significantly different. Standard error = 1.25 tons/ha

• **Increase in cane yield: 13 to 14%**

• **Increase in sugar yield: 10%**

Sugar Cane



Note how much more prolifically the Vitazyme treated sugar cane is growing versus the control in this Cuban study.



The Vitazyme treated sugar cane seed pieces show much better early rooting, and consequently more vigorous shoot growth; Cuba.

Location: Holguin, Cuba

Type: ratoon

Experimental design: A Latin rectangle design with four replicates, on 64 m², was prepared to evaluate the effect of Vitazyme, in various application rates and times, with full and reduced fertility levels, on the growth and yield of sugar cane. The twelve treatments are listed below.

Variety: C323-68

Soil type: Calciustert

1. Control

2. Vitazyme

Treatment	Vitazyme				
	Rate	Applications	Cumulative dosage	Placement	Fertilizer
	l/ha	number	l/ha		% of recommended
1	0	0	0	—	0
2	0	0	0	—	100
3	1	3	3	broadcast	100
4	1	3	3	band	100
5	0.5	3	1.5	band	100
6	1	3	3	broadcast	75
7	0.5	5	2.5	band	100
8	0.5	5	2.5	band	75
9	0.5	5	2.5	band	50
10	1	5	5	broadcast	100
11	1	5	5	broadcast	75
12	1	5	5	broadcast	50

Fertilization: 100% recommendation: 130 kg/ha N and 176 kg/ha P₂O₅/acre

Vitazyme applications: See the table above. Timing of the applications was monthly after the last harvest.

Individual treatment growth and yield results: Growth and yield results were inconsistent. Nevertheless, the highest yielding individual treatments were as follows:

Growth and yield trends:

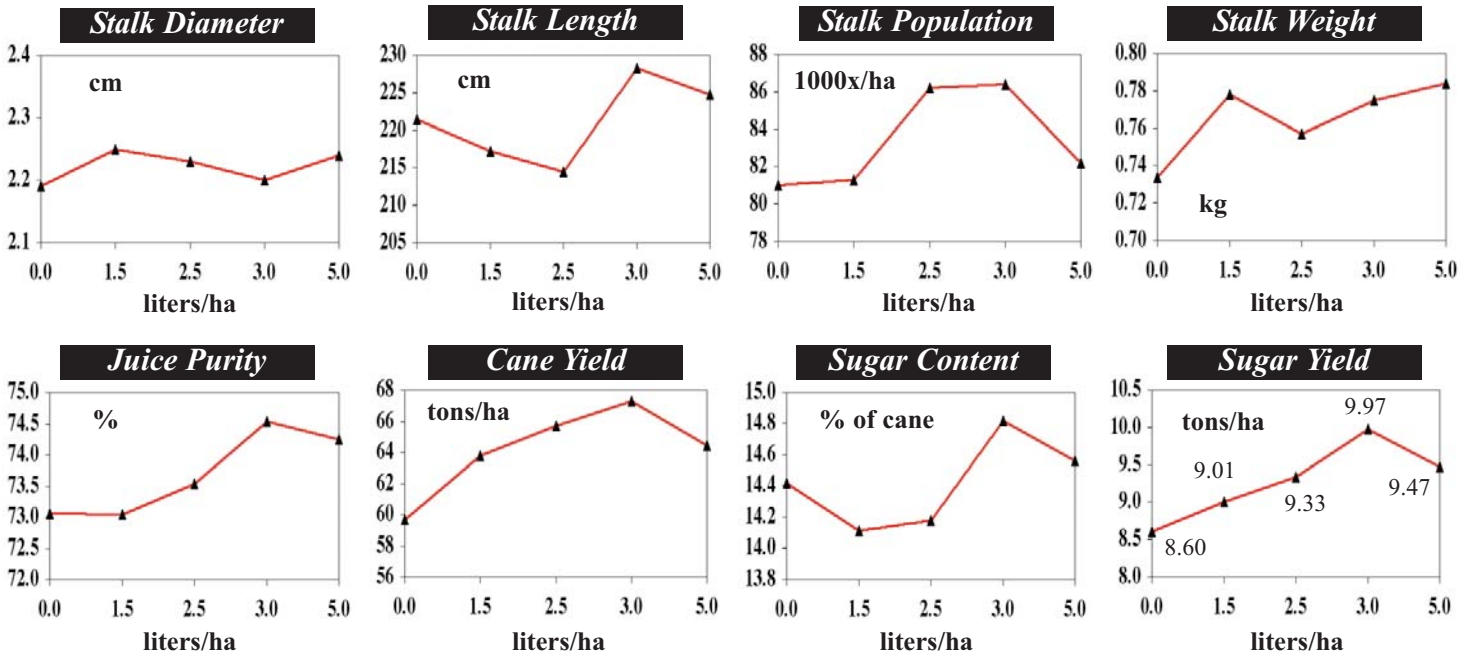
An analysis was made of the various growth and yield parameters to show the trends of these parameters under the conditions of this study. Both Vitazyme and the fertilizer were evaluated.

Treatment	Cane yield	Cane yield increase vs. ...		Sugar yield	Cane yield increase vs. ...	
		No fertilizer	100% fertilizer		No fertilizer	100% fertilizer
	tons/ha	tons/ha	tons/ha	tons/ha	tons/ha	tons/ha
10	78.43	25.0 (+47%)	12.5 (+19%)	12.06	4.60 (+62%)	2.33 (+24%)
4	75.16	21.7 (+41%)	9.2 (+14%)	11.30	3.84 (+52%)	1.57 (+16%)
7	76.47	23.0 (+43%)	10.5 (+16%)	10.95	3.49 (+47%)	1.22 (+13%)
3	65.67	12.2 (+23%)	—	9.67	2.21 (+30%)	—

There is a trend for increasing rates of Vitazyme to improve all parameters, especially the all-important sugar yield component.

- 1 Sugar yield increase at 0.5 liter/ha — 0.65 ton/ha (+8%)
- 1 Sugar yield increase at 1.0 liter/ha — 1.12 ton/ha (+13%)

Cumulative Vitazyme Application



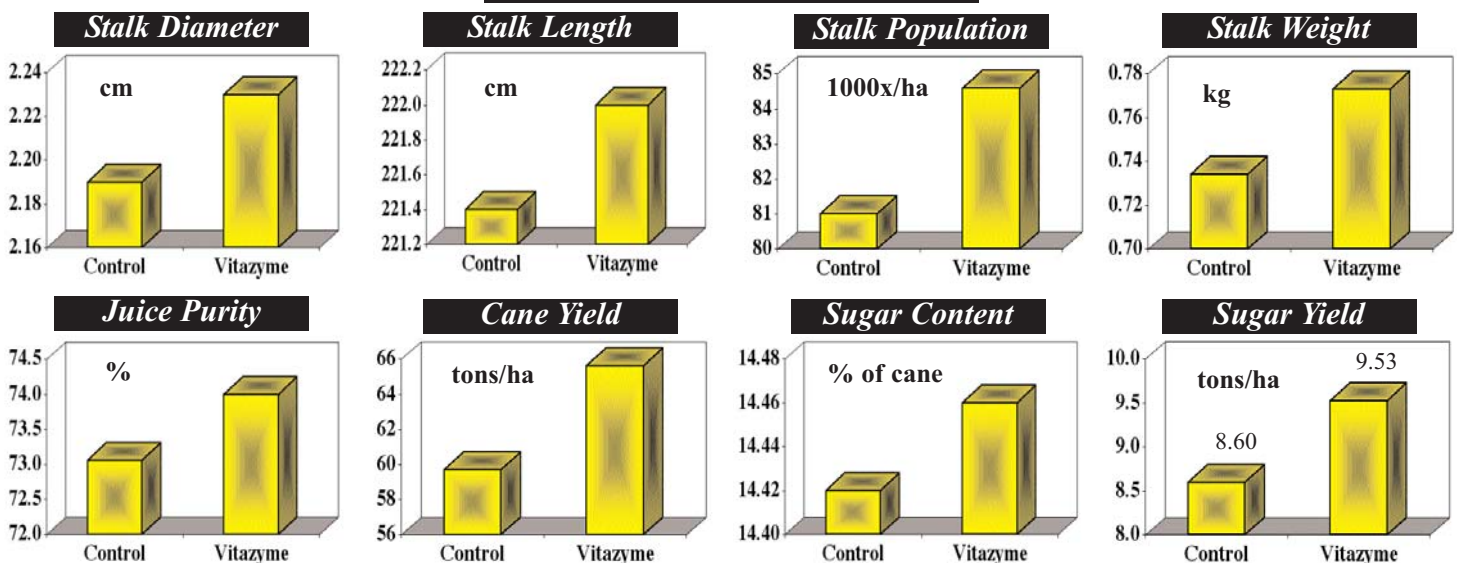
The trend of the total Vitazyme applications is for, in most cases, the growth parameter to increase with the rate but then drop off at the highest rate of Vitazyme (5 liters/ha). The exceptions are stalk diameter and stalk weight. Yields of cane and sugar yield, as well as percent sugar in the cane, are all highest for the 3 liters/ha total application, but drop off for the 5 liters/ha application. These data confirm that at the 5 liter total application some of the active agents in Vitazyme are over-saturating enzyme systems in the plant, and the 3 liter total amount is sufficient for optimum plant activity.

- 1 Sugar yield increase at 1.5 liters/ha — 0.41 tons/ha (+5%)
- 1 Sugar yield increase at 2.5 liters/ha — 0.71 ton/ha (+8%)
- 1 Sugar yield increase at 3 liters/ha — 1.37 tons/ha (+16%)
- 1 Sugar yield increase at 5 liters/ha — 0.87 ton/ha (+10%)

A similar trend appears with the number of applications of Vitazyme as with the cumulative level of product application ... since more applications usually mean more total product applied. Three applications for all but one parameter produced the greatest growth and yield response, indicating that enzyme systems were being saturated after that optimum level.

- 1 Sugar yield increase with three applications — 1.13 tons/ha (+13%)
- 1 Sugar yield increase with five applications — 0.80 ton/ha (+9%)

Overall Vitazyme Effects



For every parameter Vitazyme increased plant performance, sometimes quite a lot. **The overall effect to increase sugar yield was 0.93 ton/ha, an increase of 11%.** Note that the "control" is the mean of the non-fertilized and 100% fertilized controls; a breakdown of overall sugar yield increases are 2.07 tons/ha (+28%) and -0.20 ton/ha (-0.2%), respectively, the latter almost equal to the 100% fertilized control.

As fertilizer rates increased in this sugar cane study, the growth and yield parameters in *Continued on the next page*

most cases increased. This was especially true for the final sugar yield, which rose in a relatively straight-line fashion as the fertilizer rate increased.

Economic calculations by the Cuban researchers: Three Vitazyme treatments, plus two control treatments, were evaluated for income using two sugar prices. The five treatments are 1, 2, 4, 7, and 10.

Treatment	Cumulative Vitazyme rate	Cane yield ¹	Increased cane yield	Sugar yield ²	Sugar increase	Extra cost of production	Added value of sugar at ³ ...		Added income of sugar at ...	
							\$0.06/lb	\$0.07/lb	\$0.06/lb	\$0.07/lb
	l/ha	t/ha	t/ha	t/ha	t/ha	\$/ha	\$/ha	\$/ha	\$/ha	\$/ha
1 (no N)	0	53.43b	—	5.97	—	—	—	—	—	—
2 (100% N)	0	65.94ab	12.51	7.78	1.81	203.75	239.28	279.28	35.53	75.53
10 (100% N)	5	78.43a	25.00	9.61	3.63	307.50	481.21	561.65	173.71	254.15
4 (100% N)	3	75.16ab	21.73	9.04	3.07	271.95	405.85	473.70	133.90	201.75
7 (100%N)	2.5	76.47ab	23.04	8.76	2.79	280.50	368.84	430.50	88.34	150.00

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

² Sugar yield=Cane yield x % Sugar x 0.80.

³ Sugar values are \$132.20/ton (for \$0.06/lb) and \$154.30/ton (for \$0.07/lb).

Treatments 10 and 4 gave the best overall return on investment, with only \$0.64 to \$0.67 extra cost per dollar of added sugar (at \$0.06), and \$0.55 to \$0.57 extra cost per per dollar of added sugar (at \$0.07),

Conclusions: In this 12-treatment sugar cane study in Cuba, **Vitazyme provided excellent growth and yield responses** despite the fact that there was considerable variation in the data. Growth parameters such as stalk diameter and length, stalk population, and stalk weight, as well as juice purity, sugar content, and cane and sugar yields increased with Vitazyme until 3 liters/ha cumulative rate for three total applications. Higher applications apparently oversaturated enzyme systems and began creating inhibitions. Fertilizer rates increased yields and growth parameters linearly as rates increased. Vitazyme treatments increased sugar yields by 2.07 tons/ha (28%) over the unfertilized control, and was practically equal to the 100% fertilizer recommendation control. The best individual Vitazyme treatments were five broadcast applications, three band applications, or three broadcast applications at 1 liter/ha each application, or five band applications at 0.5 liter/ha each time, along with 100% fertilization.

Treatment	Extra cost per dollar of added sugar ...	
	at \$0.06/lb	at \$0.07/lb
	\$/lb	\$/lb
1 (no N)	—	—
2 (100% N)	0.85	0.73
10 (100% N)	0.64	0.55
4 (100% N)	0.67	0.57
7 (100% N)	0.76	0.65

This study reveals **the considerable ability that Vitazyme has to improve Cuban sugar production on black plastic**

Sugar Cane



Untreated sugar cane gave a normal expected growth response for Cuban soils and growing conditions.

Location: Santiago de Cuba, Cuba

Type: new planting

Row spacing: 1.6 meters

Variety: C86-12

Soil type: Hapluster

Treatment	Vitazyme			Placement
	Rate	Applications	Cumulative dosage	
	l/ha		l/ha	
1	0	0	0	—
2	0.5	3	1.5	broadcast
3	0.5	3	1.5	band
4	0.5	5	2.5	broadcast
5	0.5	5	2.5	band
6	1	3	3	broadcast
7	1	3	3	band
8	1	5	5	broadcast
9	1	5	5	band
10	1% + 1*	2	soak + 2	broadcast
11	2.5% + 1*	2	soak + 2	broadcast
12	5% + 1*	2	soak + 2	broadcast

*Cane sets were soaked in indicated solutions (v/v) for 5 minutes before planting.



With added Vitazyme the sugar cane has shown a remarkable response in height and leaf density, that translated into higher sugar yields.

Experimental design: A sugar cane trial having four replicates in a Latin rectangle of 64 m² was established to evaluate the growth and yield of this crop in response to various Vitazyme applications. Fertility was used as recommended for newly planted cane. Twelve treatments were used.

Fertilization: None was needed in the plant cane cycle investigated, and in the soil type utilized, as recommended in Cuba for newly planted cane.

Vitazyme application: 1 liter/ha (13 oz/acre) monthly from planting

Individual treatment growth and yield results: The results for individual treatments for both growth and yield parameters showed

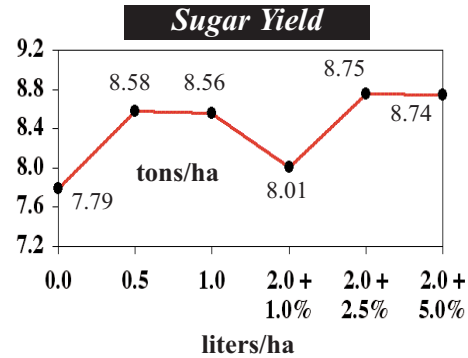
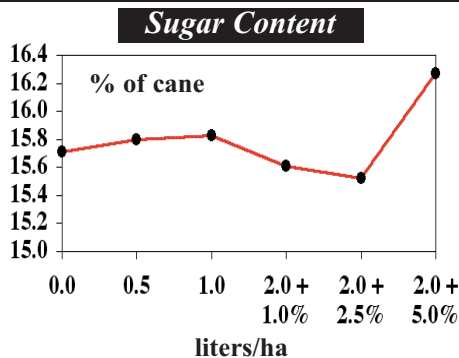
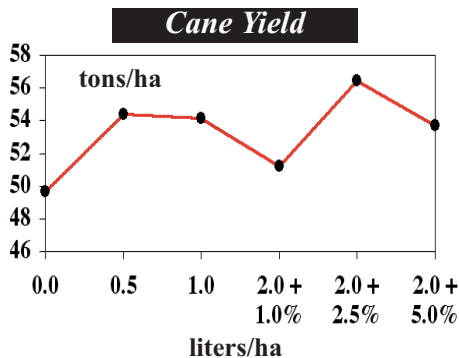
that Vitazyme treatments, in all but one case, exceeded the control. Highest treatment values for sugar yield were as follows:

Growth and yield trends: An analysis was made of growth and yield parameters to display the trends of these parameters in this study.

Vitazyme in all cases raised cane and sugar yields, Both the 2.5 and 5.0% soaks plus two applications gave the best sugar increases.

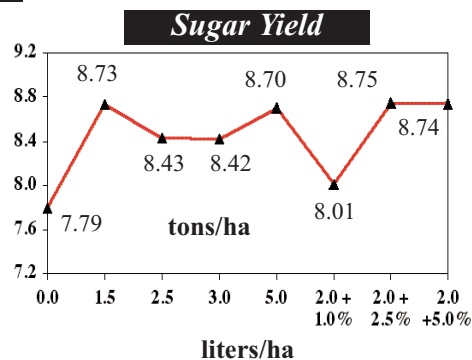
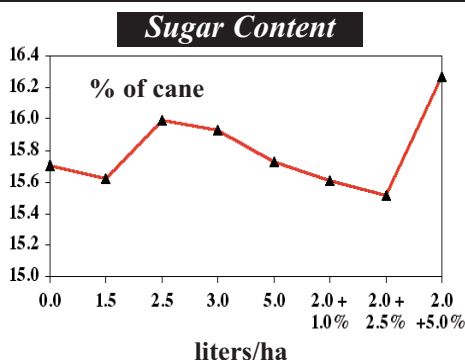
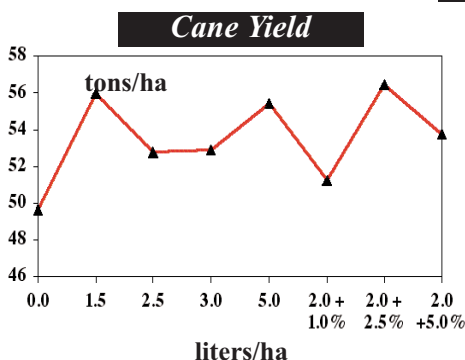
Treatment	Cane yield tons/ha	Sugar yield tons/ha	Sugar increase vs. control tons/ha
6	58.31 (+18%)	9.25	1.46 (+19%)
8	57.81 (+17%)	9.13	1.34 (+17%)
5	55.79 (+12%)	9.00	1.21 (+16%)
3	57.22 (+15%)	8.79	1.00 (+13%)
11	56.44 (+14%)	8.75	0.96 (+12%)

Rate of Vitazyme



- 1 Sugar yield increase at 0.5 liter/ha — 0.79 ton/ha (+10%)
- 1 Sugar yield increase at 1.0 liter/ha — 0.77 ton/ha (+10%)
- 1 Sugar yield increase at 2 liters/ha + a 1.0% soak — 0.22 ton/ha (+3%)
- 1 Sugar yield increase at 2 liters/ha + a 2.5% soak — 0.96 ton/ha (+12%)
- 1 Sugar yield increase at 2 liters/ha + a 5.0% soak — 0.95 ton/ha (+12%)

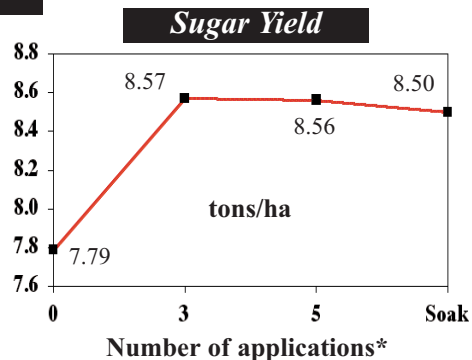
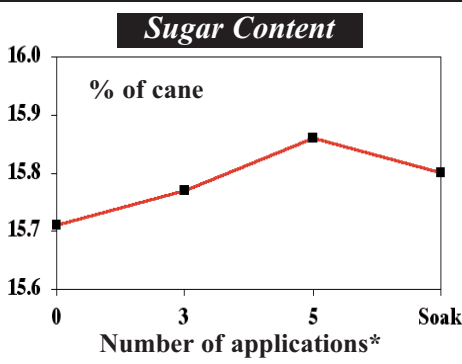
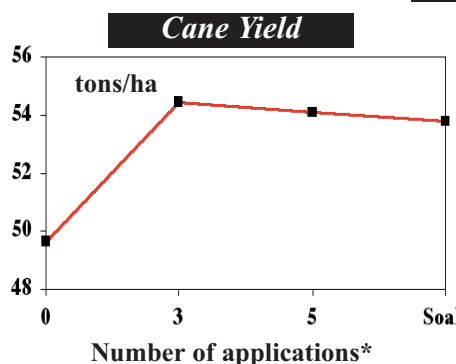
Cumulative Vitazyme Application



All Vitazyme cumulative applications increased sugar and cane yields, the highest increases being for 1.5, 5, and 2 liters/ha (with 2.5 and 5.0% soaks). Sugar content of the cane was affected little except for the 2 liters/ha + 5.0% soak, which boosted sugar to 16.27% of the cane.

- 1 Sugar yield increase at 1.5 liters/ha — 0.94 ton/ha (+12%)
- 1 Sugar yield increase at 2.5 liters/ha — 0.64 ton/ha (+8%)
- 1 Sugar yield increase at 3 liters/ha — 0.63 ton/ha (+8%)
- 1 Sugar yield increase at 5 liters/ha — 0.91 ton/ha (+12%)
- 1 Sugar yield increase at 2 liters/ha + a 1.0% soak — 0.22 ton/ha (+3%)
- 1 Sugar yield increase at 2 liters/ha + a 2.5% soak — 0.96 ton/ha (+12%)
- 1 Sugar yield increase at 2 liters/ha + a 5.0% soak — 0.95 ton/ha (+12%)

Number of Vitazyme Applications



* The soak had two applications as well.

Continued on the next page

Vitazyme in every case increased cane yield and sugar yield. The sugar increase was uniform for all three applications, as was the sugar content of the cane.

- 1 **Sugar yield increase with three applications — 0.78 ton/ha (+10%)**
- 1 **Sugar yield increase with five applications — 0.77 ton/ha (+10%)**
- 1 **Sugar yield increase with a seed piece soak plus two applications — 0.71 ton/ha (+9%)**

Treatment	Cumulative Vitazyme rate	Cane yield ¹	Increased cane yield	Sugar yield ²	Sugar increase	Extra cost of production	Added value of sugar at ³ ...		Added income of sugar at ...	
							\$0.06/lb	\$0.07/lb	\$0.06/lb	\$0.07/lb
	l/ha	t/ha	t/ha	t/ha	t/ha	\$/ha	\$/ha	\$/ha	\$/ha	\$/ha
1	0	49.64b	—	6.23	—	—	—	—	—	—
6	3	58.31a	8.67	7.40	1.17	66.35	154.67	180.53	88.32	114.18
8	5	57.81a	8.17	7.30	1.07	88.60	141.45	165.10	52.85	76.50
5	2.5	55.79ab	6.15	7.20	0.97	61.53	128.23	149.67	66.70	88.14
3	1.5	57.22a	7.58	7.03	0.80	50.53	105.76	123.44	55.23	72.91
11	4.5	56.44ab	6.80	7.00	0.77	75.80	101.79	118.81	25.99	43.01

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

² Sugar yield = Cane yield x % Sugar x 0.80.

³ Sugar values are \$132.20/ton (for \$0.06/lb) and \$154.30/ton (for \$0.07/lb).

Economic calculations by the Cuban researchers: Six treatments, including the control, were evaluated for income using two sugar prices. The five Vitazyme treatments used in these calculations are those listed previously. Results are shown on the previous page.

Conclusions: In this Cuban sugar cane study in a new planting, Vitazyme increased the total sugar yield by about 10% for all treatments versus the untreated control. The best overall treatments appeared to be three broadcast applications (1 liter/ha), five broadcast applications (1 liter/ha), and five banded foliar applications (0.5 liter/ha). These were followed closely by the 2.5 or 5.0% five-minute seed piece soaks plus two Vitazyme applications. The most cost-effective treatment is the three broadcast 1 liter/ha foliar applications. Vitazyme is seen to be a very good supplement for improving the growth and yield of newly planted sugar cane in Cuba.

Treatment	Extra cost per dollar of added sugar ...	
	at \$0.06/lb	at \$0.07/lb
1	—	—
6	0.43	0.37
8	0.63	0.54
5	0.48	0.41
3	0.48	0.41
11	0.74	0.64

Sugar Cane

Location: Manuel Fajardo Estate, Havana Province, Cuba

Variety: Co 997

Type: ratoon

Soil type: Eutruxox

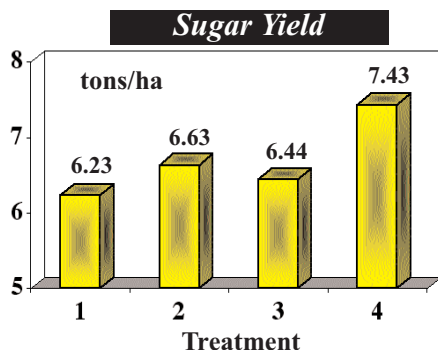
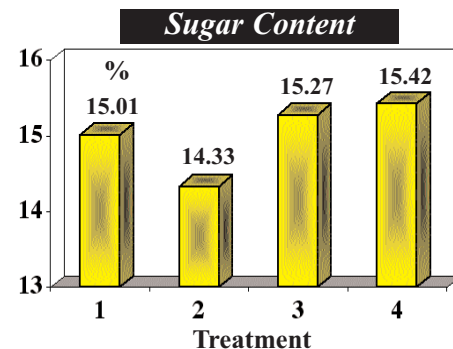
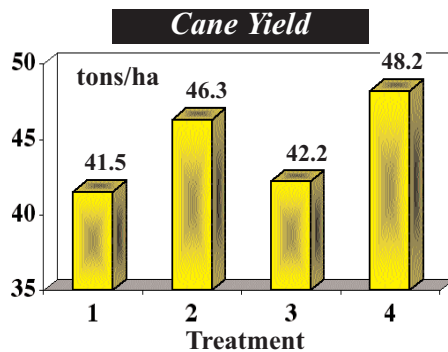
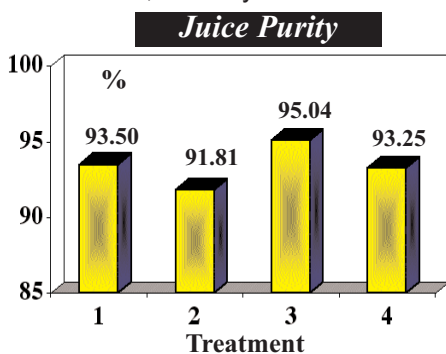
Experimental design: A trial of 64 m², having four replicates in a Latin square, was set up to evaluate the effect of Vitazyme on ratoon sugar cane at normal and reduced fertilizer levels. Four treatments were used.

Fertilization: Fertilizer rates: 130 kg/ha N and 100 kg/ha K₂O for the 100% rate, and half for the 50% rate

Vitazyme application: one liter/ha three times for Treatments 3 and five times for Treatment 4, monthly after the last harvest

Treatment	Vitazyme*	Fertilizer
1	0	0%
2	0	100%
3	1 liter/ha x 3	50%
4	1 liter/ha x 5	100%

*Rates and times of applications are presumed, based on other tests performed in Cuba.



Conclusions: In this Cuban sugar cane

study, Vitazyme had little effect on juice purity, but total cane yield was increased above the control (Treatment 1) by 2% (at 50% fertilizer) to 16% (at 100% fertilizer); the 100% fertilizer treatment without Vitazyme increased yield by 12%. Compared to the 100% fertilizer control, Vitazyme + 100% fertilizer increased cane yield by 4%, while the 50% fertilizer + Vitazyme treatment was 9% less than the 100% fertilizer treatment.

Sugar content of the cane was boosted by Vitazyme above the 0% fertilizer control by 2 to 3%, but sugar was especially increased above the 100% fertilizer control, by 7 to 8%. **These increases led to favorable sugar yield levels for both Vitazyme treatments compared to the controls.** The 100% fertilizer + Vitazyme

treatment increased sugar yield by 19% above the no fertilizer control, and by 12% above the 100% fertilizer control. The 50% fertilizer + Vitazyme treatment modestly increased sugar yield, by 3% above the no fertilizer control; this yield was only 3% less than the 100% fertilizer control.

Vitazyme in this Cuban (Havana Province) demonstration trial has proven to be an effective agent for increasing the yield and sugar content of sugar cane on red Eustrtox or Ferralsol soils, in a ratoon crop.

- **Change in juice purity: -2 to + 4%**
- **Change in cane yield: -9 to +16%**
- **Increase in sugar content: 2 to 8%**
- **Change in sugar yield: -3 to + 19%**

Tomatoes

Research organization: INIFAT

Soil type: Leptic haplustert

Experimental design: A one hectare tomato field was divided into two parts, one treated with Vitazyme and the other left untreated, to determine yield and growth differences. All other treatments over the field were the same.

1. Control

2. Vitazyme

Fertilization: unknown

Vitazyme application: unknown

Conclusions: Tomato numbers and yield were greatly increased by Vitazyme in this Cuban study. Relatively few details of this study are available.

Location: Cuba

Planting date: unknown

Variety: INIFAT 28

Transplanting date: unknown

Tomato Yield

Treatment	Fruit yield tons/ha	Change tons/ha	Fruit number number	Change number
Control	11.0	—	89,600	—
Vitazyme	13.0	2.0 (+18%)	115,200	25,600 (+29%)

▪ **Increase in tomato yield: 18%**

▪ **Increase in fruit yield: 29%**

Tomatoes

Location: Santiago de Cuba Experiment Station, Dos Rios, Palma Soriano, Santiago de Cuba

Variety: unknown

Soil type: Leptic haplustert

Transplanting date: January 1, 2004

Experimental design: Two areas of equal size (180 m²) were planted to tomatoes. One of the plots was treated with Vitazyme while the other was left untreated, and comparisons were made to evaluate treatment differences. There were 302 plants in the Vitazyme plot and 320 plants in the control plot.

1. Control

2. Vitazyme

Fertilization: unknown

Vitazyme application: 1 liter/ha twice, once at transplanting on January 20, 2004, and again on February 11, 2004

Fruit per Plant (Feb. 23, 2004)

Sample	Control	Vitazyme
	----fruit per plant ----	
Mean	21.4	32.4 (+ 42%)

Growth results: Measurements of plant height and leaves/plant were made from randomly selected plants on January 21 and February 6, while fruit counts were made on February 23. Because of the experimental design of this study no detailed analyses of variance were made, although simple statistics were calculated.



These Vitazyme treated tomatoes show excellent development, and are several days ahead of untreated fruit in the area.

Plant Height

January 21, 2004

February 6, 2004

Sample	Control	Vitazyme
	cm	
Mean	18.0	23.7 (+ 32%)

Sample	Control	Vitazyme
	cm	
Mean	38.9	53.4 (+ 15%)

Fruit Weight

Picking	Control			Vitazyme		
	Weight	Fruits	Mean weight	Weight	Fruits	Mean weight
	g		g		g	
	number		number		number	
1 (March 5)	1,000	30	33.3	1,200	30	40
2 (March 12)	600	40	15.0	1,400	40	35
3 (March 18)	800	40	20.0	1,400	40	35
Mean			22.8			36.8 (+61%)

Estimated Yield

Yield/plant	Control		Vitazyme		
	Plant number	Yield/plot	Yield/plant	Plant number	Yield/plot
0.5 kg	320	160 kg	1.2 kg	302	362.4 kg

Yield results: Three pickings were evaluated in this study, and an estimated yield was also made for all projected pickings based on past plot studies.

Conclusions: This tomato trial at Santiago de Cuba revealed some profound responses of tomatoes to two Vitazyme applications. Plant height at 21 days after transplanting was 32% greater with Vitazyme, while at 37 days after planting the height difference was 15%. The number of fruit/plant with Vitazyme was 42% greater than for the control plants at 54 days after planting. Moreover, the average tomato weight averaged from three pickings was 61% greater with Vitazyme treatment, and the projected yield estimate was 125%

Continued on the next page

greater than the control, despite the plot having 18 fewer plants. Clearly, Vitazyme represents a tremendous benefit for tomato production in Cuba.

• **Estimated yield increase: 125%**

• **Increase in plant height (Jan. 21): 32%** • **Increase in plant height (Feb. 6): 15%**

• **Increase in fruit/plant: 42%**

• **Increase in fruit weight: 61%**

Tomatoes

Vegetable Trial of the Cuban Ministry of Sugar

Farm: Aracelio Iglesias Diaz Agricultural Enterprise

Varieties: Rome and Lignom

Planting date: unknown

Location: Mayajigua, Sancti Spiritus, Cuba

Soil type: "gleyish" Vertisol

Plant spacing: unknown

Experimental design: Two fields of tomatoes of the above varieties were divided so that one hectare of each received Vitazyme one time. Yield, fruit size, and other parameters were used to evaluate Vitazyme effects. Only one replicate was used.

1. Control

2. Vitazyme

Fertilization: compost only

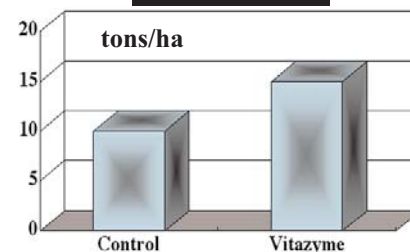
Vitazyme application: 1 liter/ha to the plants after the first picking

Harvest date: unknown

Rome Tomatoes

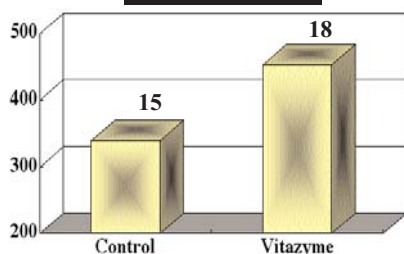
Treatment	Fruit yield	Change	Fruit weight	Change	Fruit color	Foliage color
	tons/ha	tons/ha	g/fruit	g/fruit		
Control	10	—	340	—	Light red	Light green
Vitazyme	15	5 (+ 50%)	453	113 (+ 33%)	Dark red	Dark green

Fruit Yield



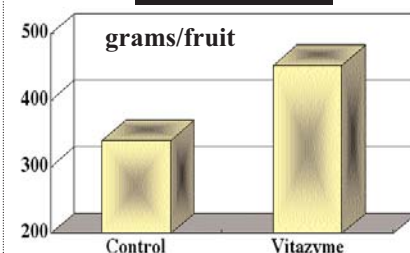
Lignom Tomatoes

Leaf Number



Conclusions: Vitazyme, applied only once after the first picking, caused a remarkable improvement in tomato yield: 50% for the Rome variety, and 20% for the Lignom variety. In addition, the treated Rome tomatoes were 33% heavier than the control fruit, and were darker red in color. Also, the foliage of the treated tomatoes was darker green, containing more carbon fixing chlorophyll than the foliage of the control tomatoes. After the last picking the Vitazyme treated plants continued with greater vigor and yield compared to the control.

Fruit weight



• **Increase in fruit yield (Rome): 50%**

• **Increase in leaf number (Lignom): 20%**

• **Increase in fruit weight (Rome): 33%**

Watermelons

Vegetable Trial of the Cuban Ministry of Sugar

Farm: Aracelio Iglesias Diaz Agricultural Enterprise

Variety: unknown

Location: Majajigua, Sancti Spiritus, Cuba

Soil type: "gleyish" Vertisol

Plant spacing: unknown

Planting date: unknown

Experimental design: A 1 hectare (2.5 acre) field of watermelons was equally divided into two parts, one treated with Vitazyme and the other left untreated, with the objective to quantify effects on yield and fruit size. All other cultural operations were the same for both treatments.

1. Control

2. Vitazyme

Fertilization: compost only

Vitazyme application: (1) 1 liter/ha on the seeds and soil at planting; (2) 1 liter/ha on the plants and soil after plant emergence; (3) 1 liter/ha on the plants at flowering

Harvest date: unknown

Yield results: Both yield and melon weights were determined.

Conclusions: Vitazyme, applied three times during the crop cycle, increased crop yield by 42% and average melon weight by 39%. In addition...

1 The treated crop showed greater foliage.

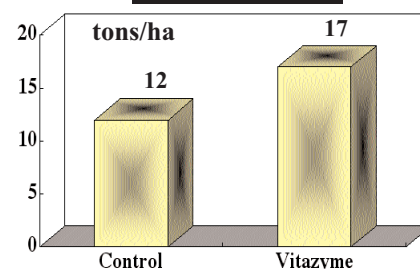
1 Fruit and plant color were darker green.

1 Plants from treated seeds were more vigorous.

• **Increase in melon yield: 42%**

• **Increase in melon weight: 39%**

Melon Yield



Melon Weight

