Vital Earth Resources
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2004 Crop Results

Vitazyme on Pine Trees (Seedlings)

Researcher: Matthew Lowe *Research organization*: Temple-Inland, Applied Research and Development
Location: Diboll, Texas *Tree species*: Loblolly pine
Soil type: deep coarse sand, low organic matter (1%)
Fumigation: methyl bromide in October, 2002
Planting date: March, 2003 *Irrigation*: Overhead sprinklers, daily
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.

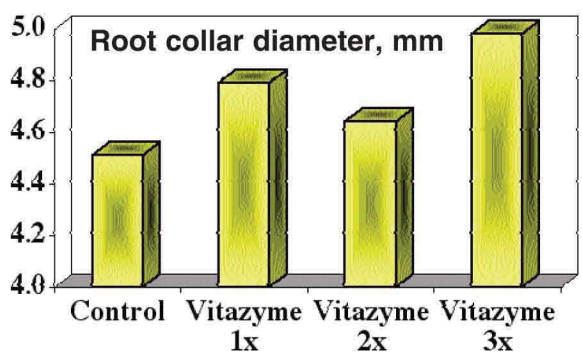
1. **Vitazyme applied once**
2. **Vitazyme applied twice**
3. **Vitazyme applied three times**
4. **Control**

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)

Treatment	RCD*	Change
	mm	mm
3. Vitazyme (3x)	4.98 a	0.47 (+10%)
1. Vitazyme (1x)	4.79 ab	0.28 (+6%)
2. Vitazyme (2x)	4.64 bc	0.13 (+3%)
4. Control	4.51 c	—

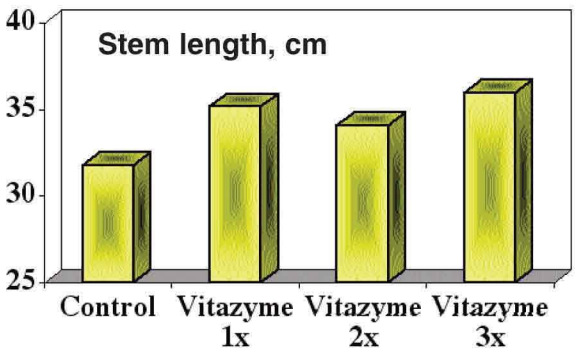
*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls Test. $LSD_{0.01}$=0.29 mm.



Increase in root collar diameter (1x and 3x): 6 to 10%

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%.

Stem Length



Treatment	Stem Diameter*	Change
	cm	cm
3. Vitazyme (3x)	35.96 a	4.22 (+13%)
1. Vitazyme (1x)	35.15 ab	3.41 (+11%)
2. Vitazyme (2x)	34.09 b	2.35 (+7%)
4. Control	31.74 c	—

*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.

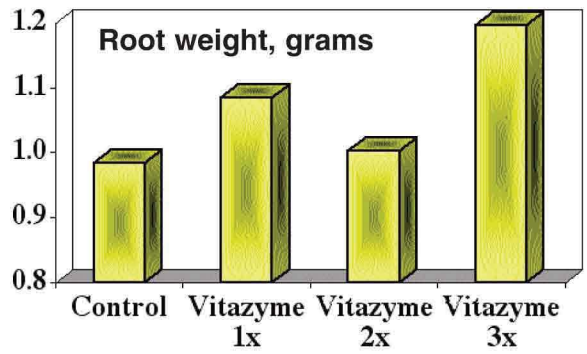
Increase in stem length (1x and 3x): 11 to 13%

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.

Root Weight

Treatment	Root weight*	Change
	grams	grams
3. Vitazyme (3x)	1.196 a	0.212 (+22%)
1. Vitazyme (1x)	1.085 a	0.101 (+10%)
2. Vitazyme (2x)	1.002 a	0.018 (+2%)
4. Control	0.984 a	—

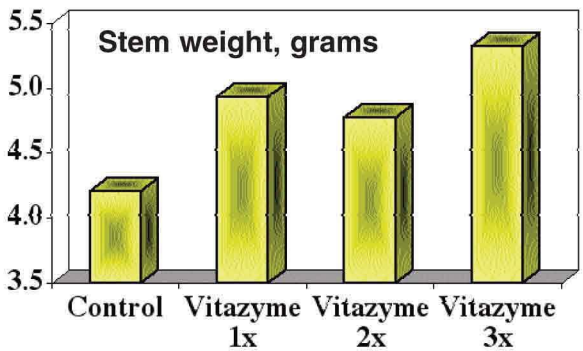
*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls Test. $LSD_{0.01}$=0.250 gram.



Increase in root weight (1x and 3x): 10 to 22%

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.

Stem Weight



Treatment	Stem weight*	Change
	grams	grams
3. Vitazyme (3x)	5.320 a	1.111 (+26%)
1. Vitazyme (1x)	4.929 ab	0.720 (+17%)
2. Vitazyme (2x)	4.777 ab	0.568 (+13%)
4. Control	4.209 b	—

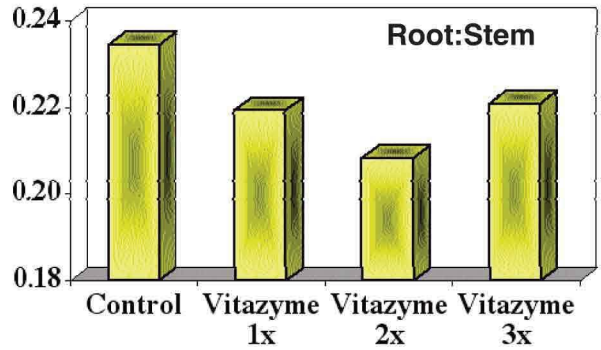
*Means followed by the same letter are not significantly different at P=0.10 according to the Student-Newman-Keuls Test. $LSD_{0.1}$=1.033 grams.

Increase in stem weight (1x and 3x): 17 to 26%

Root:Stem

Treatment	Root:Stem*	Change
4. Control	0.2345 a	——
3. Vitazyme (3x)	0.2208 a	(-)0.0137 (-6%)
1. Vitazyme (1x)	0.2192 a	(-)0.0153 (-7%)
2. Vitazyme (2x)	0.2083 a	(-)0.0262 (-11%)

*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.



Change in root:stem: –6 to –11%

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.

	Percentage changes with Vitazyme vs. the control				
Treatment	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%

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

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 avail-

ability 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.

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2003 Crop Results

Vitazyme on Ornamentals

Researchers: Rene Cecil and Eddie Pearson *Location*: Cactus Ranch, Canton, Texas
Varieties: Candle tree *(Cassia alata)*, banana "basjoo", "banana double" *(Musa nana)*, and Madagascar (Sago) palm *(Cycas thouarsii)* *Potting soil*: pine bark + Carl Pool growers mix + other components
Planting date: about June 15, 2003 for all plants
Experimental design: For the candle tree, banana basjoo, and banana double a number of plants were treated with Vitazyme, while only one average plant served as an untreated control. For the Sago palm, no untreated controls were included in the study, but knowledge of their germination characteristics revealed that germination requires one year.

1. Control **2. Vitazyme**

Fertility treatments: All potting soils received a 20-6-11% N-P_2O_5-K_2O (5 to 6-month release) fertilizer mixed in before planting. In addition, a 19-13-6% N-P_2O5-K_2O topdress fertilizer was in some cases applied, but various fertilizers, amounts, and timing depended on the specific plant and growth conditions.
Vitazyme applications: A soil drench of a 1 tsp/gallon (0.2%) solution at planting on June 15, and again 30 days later on July 15, for the candle tree, banana "basjoo", and banana "double". The Sago palms were soaked in a 0.5 tsp/gal (0.1%) solution for a few days before planting.
Watering schedule: on-demand, adjusted to the individual plant species
Fungicide applications: to all plants every few weeks
Growth results: All data were collected on September 26, 2003, 3.5 months after the first application.

Candle Tree *(Cassia alata)*

Treatment[a]	Height	Leaf size[b]	Stem caliper	Leaf number
	inches	inches	inches	number
1. Control	15	1.5 x 2.0	0.25	9
2. Vitazyme	20	2.5 x 4.0	0.50	12

[a]One plant for the control, and the average of 15 plants for the Vitazyme treatment
[b]Dimensions of the largest fully developed crown leaf.

Vitazyme produced substantial improvements in growth for these candle tree plants. The largest treated plant was 23 inches tall and had a crown leaf of 4 x 6 inches.

Banana "Basjoo" *(Musa nana)*

Treatment[a]	Height	Leaf size[b]	Stem Caliper
	inches	inches	inches
1. Control	21	4.5 x 11.0	0.5
2. Vitazyme	32	5 x 15.5	1.5

[a]One plant for the control, and the average of 15 plants for the Vitazyme treatment
[b]Dimensions of the largest fully developed crown leaf.

Vitazyme greatly improved the growth of all aspects of this banana variety: height, leaf size, and stem caliper.

Banana "Double" *(Musa nana)*

Treatment[a]	Height	Leaf Size[b]	Stem caliper	Leaf number
	inches	inches	inches	number
1. Control	18.5	5 x 9	0.5	7
2. Vitazyme	25.0	6 x 11	0.9	9

[a]One plant for the control, and the average of 15 plants for the Vitazyme treatment
[b]Dimensions of the largest fully developed crown leaf.

The growth of these banana plants was greatly improved by Vitazyme applications as evidenced by height, leaf size, stem caliper, and leaf number.

Madagascar (Sago) Palm *(Cycas thouarsii)*

Number of seeds treated: 38
Number of seeds germinated by September 26 (3.5 months after a Vitazyme soak): 7
Normal time of germination: 12 months
Size of largest germinated palm: 9 inches tall, upper leaf with 16 leaflets and 10 spikes, lower leaf with 13 leaflets and 8 spikes
Time to germination of the first palm: 2 months

Vitazyme as a seed soak greatly reduced the time to germination of these Sago palms, with 7 of the 38 already germinated by 3.5 months, though usually a full year is required. A seed soak with a higher concentration of Vitazyme may have improved early germination even more.

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2002 Crop Results

Vitazyme on Trees and Shrubs

Researcher: Paul W. Syltie *Tree farm:* AM&D Tree Farm *Location:* Canton, Texas
Tree and shrub varieties: live oak, Spanish oak, magnolia, Savannah holly, Nellie R. Stevens holly, Foster holly
Potting soil: custom mix using Vital Earth Resources raw materials
Experimental design: Several locations on the tree farm were selected amongst many tree and shrub varieties, to compare Vitazyme treatment with untreated controls in terms of branch and trunk growth. Entire series of rows were treated with Vitazyme alongside untreated series of rows.

1. Control with full fertilization **2. Vitazyme with full fertilization**

Fertilization: Different amount of pelleted, coated fertilizer were applied in mid-March to each pot, the amount depending on the pot size, using a mixture of "Multicoat" and "Nutricoat". This slow-release fertilizer mix lasts about one year for total release. Amounts applied were as follows: 3 gallons, 40 grams; 30 gallons, 200 grams; 45 gallons, 300 grams; 65 gallons, 360 grams; 95 gallons, 430 grams.
Vitazyme application: Vitazyme was sprayed to the soil surface of each pot using a backpack sprayer, at 13 oz/acre directed only on the pot soil surfaces. Thus, the product was concentrated only in the pots. Applications were made April 5 and June 21, 2002.
Growth Results:

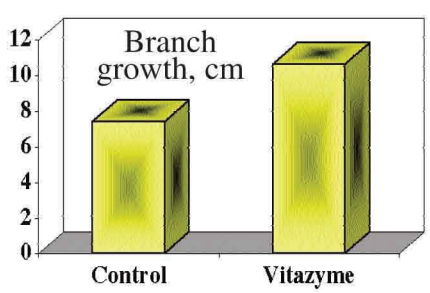
Evaluations on May 21, 2002, 46 days after application one

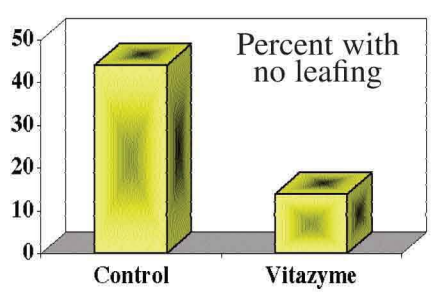
All measurements of new growth were made on unpruned branches, the branch measured from the start of new growth to the tip. A single average twig was selected for measurement from each tree or shrub. Some treated areas were not measured — such as cedar elms — due to difficulty in determining where new growth for the year began. Anomalous trees, such as those which were unusually small or unthrifty, were excluded from the measurements. Rows were selected for measurement that occupied the same relative position in the rows, such as trees that were on the west side of driving lanes to insure equal access to light.

Live Oak — golf course area (45 gal. pots)

Treatment	Number of trees	Branch growth	Change	Trees with no leafing	Percent with no leafing
		cm	cm		
Control	30	7.4	—	24	44%
Vitazyme	38	10.6	3.2 (+ 43%)	6	14%

Increased growth: 43%



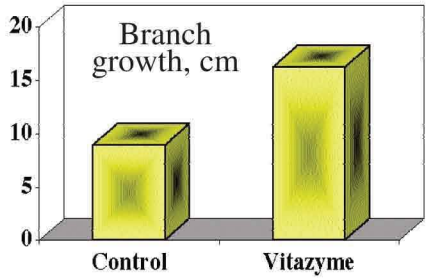


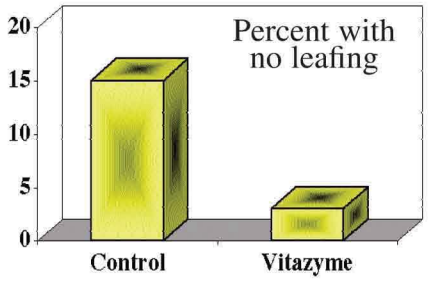
Increased early leafing: 30% more

Live Oak — north area (45 gal. pots)

Treatment	Number of trees	Branch growth	Change	Trees with no leafing	Percent with no leafing
		cm	cm		
Control	34	8.9	—	6	15%
Vitazyme	30	16.2	7.3 (+ 82%)	1	3%

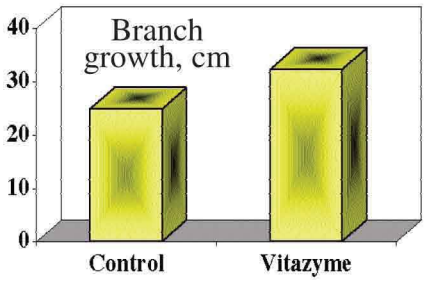
Increased growth: 82%





Increased early leafing: 12% more

Red Oak — golf course area (65 gal. pots)



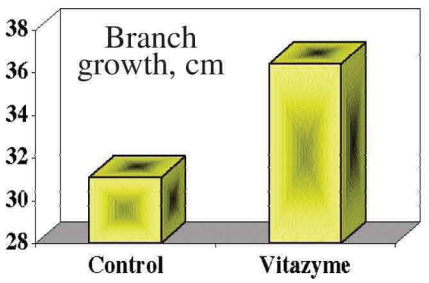
Treatment	Number of trees	Branch growth	Change
		cm	cm
Control	30	24.9	—
Vitazyme	30	32.2	7.3 (+ 29%)

Increased growth: 29%

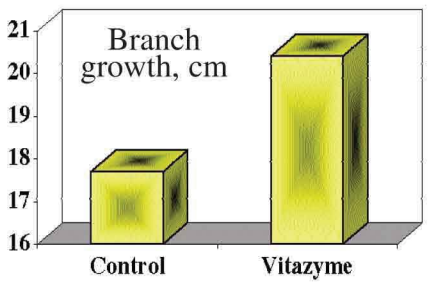
Magnolia (95 gal. pots)

Treatment	Number of trees	Branch growth	Change
		cm	cm
Control	32	31.1	—
Vitazyme	32	36.4	5.3 (+ 17%)

Increased growth: 17%



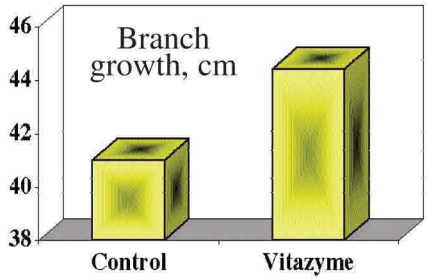
Savannah Holly, large (65 gal. pots)



Treatment	Number of plants	Branch growth	Change
		cm	cm
Control	28	17.7	—
Vitazyme	32	20.4	2.7 (+ 15%)

Increased growth: 15%

Nellie R. Stevens Holly, large (65 gal. pots)



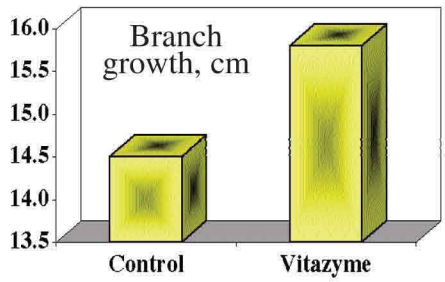
Treatment	Number of plants	Branch growth	Change
		cm	cm
Control	30	41.0	—
Vitazyme	30	44.4	3.4 (+ 8%)

Increased growth: 8%

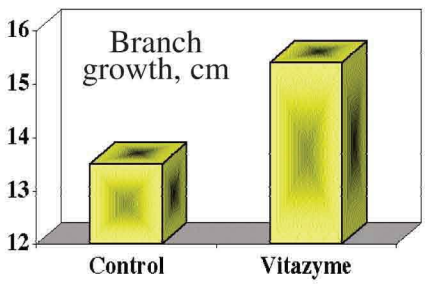
Nellie R. Stevens Holly, small (3 gal. pots)

Treatment	Number of plants	Branch growth	Change
		cm	cm
Control	30	14.5	—
Vitazyme	30	15.8	1.3 (+ 9%)

Increased growth: 9%



Foster Holly, small (3 gal. pots)



Treatment	Number of plants	Branch growth	Change
		cm	cm
Control	30	13.5	—
Vitazyme	30	15.4	1.9 (+14%)

Increased growth: 14%

Conclusions from the early growth data: In all cases Vitazyme increased the new branch growth of these trees and shrubs, from 8 to 82% for the trees, and from 9 to 14% for the small shrubs. Also, Vitazyme triggered substantially more early growth of liveoak trees, meaning that the trees are able to utilize the season longer for greater annual growth. Thus, Vitazyme's active agents, by six weeks after application, significantly triggered additional growth of new branches, and speeded the time to bud break for many of the trees.

Evaluations on September 10, 2002, 81 days after application two

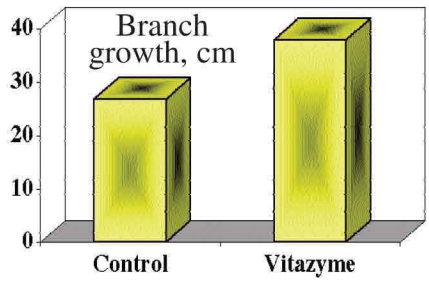
New branch growth measurements were made on new growth since the last pruning, measuring from the last cut to the tip of the new growth. One average twig was selected for each tree measured. In some cases a tree was not measured due to some anomaly, such as small size or lack of thriftiness. The caliper of the trees was determined using a tree caliper tool at six inches above the soil level of the pot. All trees were measured for caliper in a stretch of row regardless of the condition of the tree. For both new branch growth and caliper, rows of tree were selected that were growing in equivalent light conditions (such as on the exposed row along a driving lane) to reduce extraneous variability. Some areas had recently been pruned and could not be measured, and in some cases (as with the cedar elms) it was very difficult to determine where new growth had begun on a twig. Treatments in these situations were not measured.

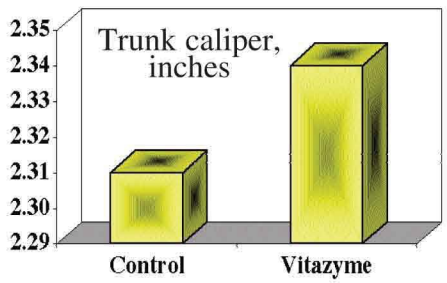
Live Oak — golf course area (45 gal. pots)

Treatment	Number of trees	Branch growth	Change	Number of trees	Trunk caliper	Change
		cm	cm		in	in
Control	20	26.8	—	30	2.31	—
Vitazyme	20	37.8	11.0 (+ 41%)	30	2.34	0.03 (+1.3%)

Increased growth: 41%

Increased caliper: 1.3%



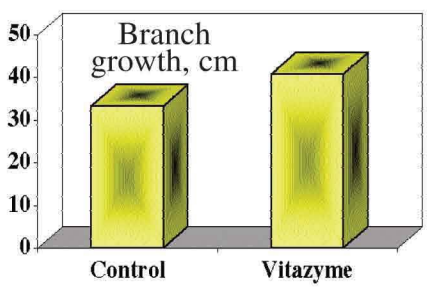


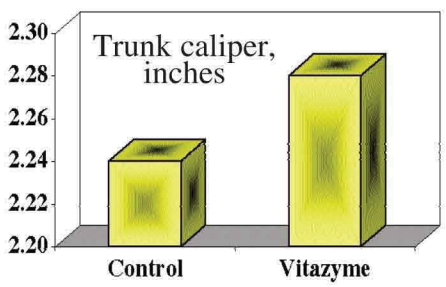
Live Oak — north area (45 gal. pots)

Treatment	Number of trees	Branch growth	Change	Number of trees	Trunk caliper	Change
		cm	cm		in	in
Control	30	33.2	—	30	2.24	—
Vitazyme	25	40.6	7.4 (+ 22%)	30	2.28	0.04 (+1.8%)

Increased growth: 22%

Increased caliper: 1.8%





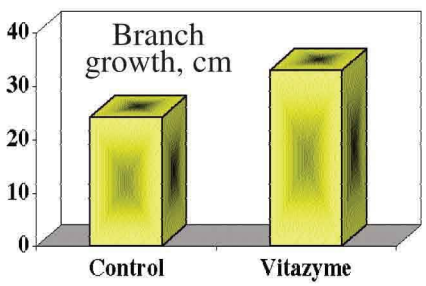
Red Oak — golf course area (65 gal. pots)

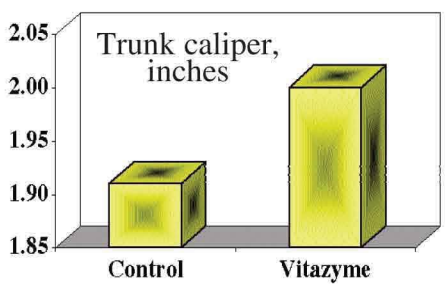
Treatment*	Number of trees	Branch growth	Change	Number of trees	Trunk caliper	Change
		cm	cm		in	in
Control	20	24.2	—	30	1.91	—
Vitazyme	25	32.9	8.7 (+ 36%)	30	2.00	0.09 (+5%)

*The Vitazyme treated trees were much darker green and had a fuller canopy.

Increased growth: 36%

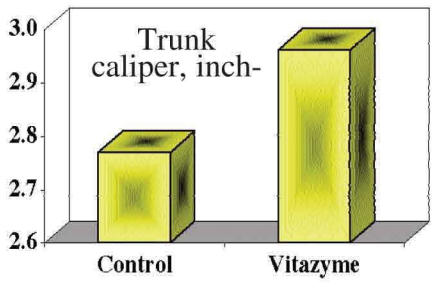
Increased caliper: 5%





Magnolia (95 gal. pots)

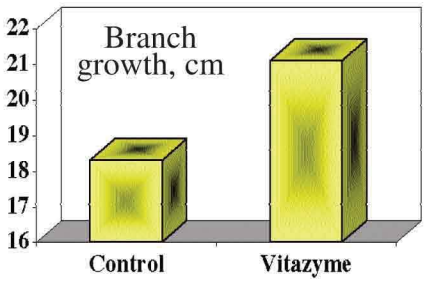
Treatment*	Number of trees	Trunk caliper	Change
		in	in
Control	15	2.77	—
Vitazyme	15	2.96	0.19 (+ 7%)



*The trees had recently been pruned,, so no new growth data could be collected. Many trees had multiple lower trunks so could not be included in the measurements.

Increased caliper: 7%

Savannah Holly, large (65 gal. pots)



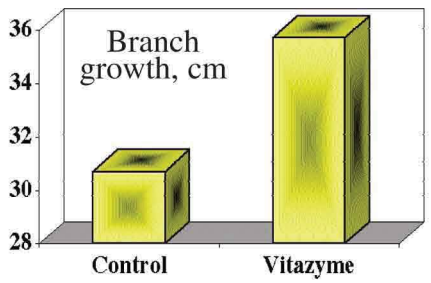
Treatment	Number of plants	Branch growth	Change
		cm	cm
Control	28	18.3	—
Vitazyme	39	21.1	2.8 (+ 15%)

Increased growth: 15%

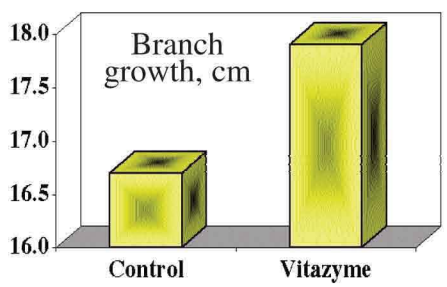
Nellie R. Stevens Holly, large (65 gal. pots)

Treatment	Number of plants	Branch growth	Change
		cm	cm
Control	33	30.7	—
Vitazyme	32	35.7	5.0 (+ 16%)

Increased growth: 16%



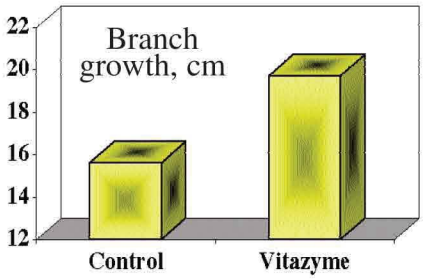
Nellie R. Stevens Holly, small (3 gal. pots)



Treatment	Number of plants	Branch growth	Change
		cm	cm
Control	28	16.7	—
Vitazyme	28	17.9	1.2 (+ 7%)

Increased growth: 7%

Foster Holly, small (3 gal. pots)



Treatment	Number of plants	Branch growth	Change
		cm	cm
Control	28	15.6	—
Vitazyme	28	19.7	4.1 (+26%)

Increased growth: 26%

Conclusions from the late growth data: New branch growth responses for the mid and late summer period were similar to those from the earlier measured period. Trunk diameters measured at this time showed excellent responses to Vitazyme, especially for the faster growing trees: red oak and magnolia. Liveoak trunk calipers increased a small amount versus the control, though in both cases the differences were measurable for this slow growing tree species.

Tree test	May 21		September 10	
	New growth	Bud break	New growth	Caliper
	% above the control			
Liveoak, golf course	43	30	41	1.3
Liveoak, north	82	12	22	1.8
Red oak, golf course	29		36	5
Magnolia	17			7
Savannah holly, large	15		15	
Nellie R. Stevens holly, large	8		16	
Nellie R. Stevens holly, small	9		7	
Foster holly, small	14		26	

Conclusions: A summary of all data collected is as follows:
In all cases Vitazyme caused greater growth of new branches for all tree species measured, for both trees and holly. Percent increases in growth 46 days after the first application were similar to the increases 81 days after the second application. In all but one case the holly gave smaller growth increases than did the oak and magnolia trees, but those increases were still nearly 10% or greater.

These branch and leaf growth increases translated into increases in trunk diameter later in the season. Slow growing liveoaks increased only 1.3 to 1.8% more in trunk caliper than did the controls, but faster growing red oaks increased by 5% and magnolias by 7%. A visible improvement in appearance of the tree canopy — leaf density and color, and branch length — was noted with Vitazyme treatment to red oaks.

Vitazyme also initiated more rapid emergence of buds for the liveoak trees near the golf course. This stimulation of new growth was also apparent later in the growing season where, on September 10, it was noted that the treated trees on average had more actively extending branches than the control trees.

Vitazyme appears to be a highly effective biostimulant of new growth for trees and shrubs as shown in this tree nursery study. This rhizosphere biostimulant has been shown to advance the maturity of containerized, well-managed trees to a significant degree, and most assuredly the profitability of its use has been demonstrated as well due to its effectiveness and low cost.

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2002 Crop Results

Vitazyme on Japanese Maple (*Acer palmatum* L.)

– A Seedling Study –

Researcher: Troy Martin *Location*: Plano, Texas *Growth media*: aged, fine pine bark
Transplanting date: late April, 2002 *Pot size*: 4 inches (standard design)

Experimental design: Japanese maple seeds were germinated and grown until the first true leaves had emerged, when the seedlings were 1.5 inches in height. Then each of 36 tree seedlings was transplanted into 4-inch pots, with 18 placed in one flat and 18 in another.

1. Control **2. Vitazyme**

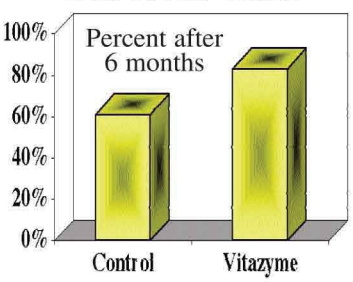
Vitazyme treatments : Every week the treated flat was drenched with a 0.5% Vitazyme solution (0.5 oz/gallon of water), while the control flat was left untreated.

Fertilization: All pots of both treatments received one tablespoon per gallon of Miracle-Gro Water Soluble Azalea, Camellia, and Rhododendron Plant Food every two months.

Growth results: Growth parameters were measured in late October, 2002, and average values for the two treatments are given in the table below.

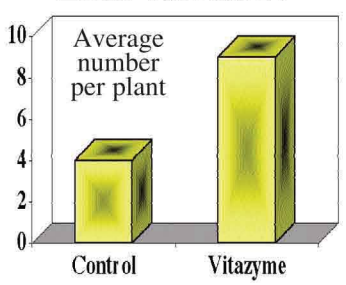
Treatment	Survival rate	Leaf number	Seedling height	Trunk diameter
Control	61%	3 to 5	3.5 in	0.0625 in
Vitazyme	83%	8 to 10	6.5 in	0.125 in

Survival Rate



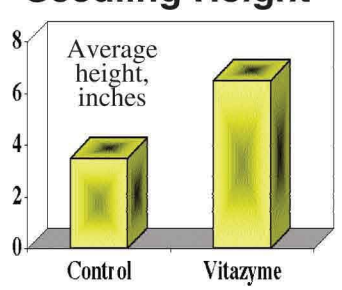
Increase: 22 percentage points

Leaf Number



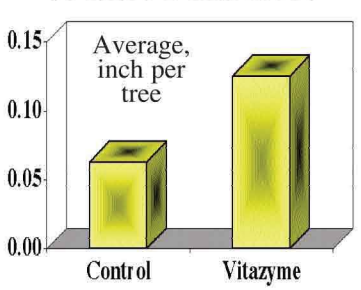
Increase: 125%

Seedling Height



Increase: 86%

Trunk Diameter



Increase: 100%

Conclusions: It is clear from this study that Vitazyme, when applied regularly to Japanese maple seedlings, greatly stimulates new growth of the plants, improving the survival rate and increasing the leaf number, seedling height, and trunk diameter. This product helps stimulate the early development of tree seedlings to encourage earlier transplanting of more vigorous stock into outdoor settings.

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2000 Crop Results

Vitazyme on Nursery Crops

Fruit and Ornamental Trees and Shrubs

Farmers: Bernhardt Lang, Lang Nurseries *Location*: Dansville, New York

Mr. Lang grows a number of different species and varieties of fruit and ornamental tree crops. He sells about 300, 000 trees per year. He has used Vitazyme for foliar and dipping applications for some time, and has noted excellent results as revealed below.

Sugar Maples

Mr. Lang purchased 300 three to five-year-old branched, bare-root sugar maple trees the spring of 2000. These 1.5-inch caliper trees are notoriously hard to transplant, and **expected losses are 15 to 20%.** These trees were dipped in a 1% Vitazyme solution and dried, and stored for several days before planting. **At the end of the 2000 growing season there were no tree losses after Vitazyme treatment.**

Normal tree loss: 15 to 20%
Tree loss with Vitazyme: 0%

Budded Crops: Apples, Plums, Ornamentals

Responses of budded crops were exceptional. These trees are planted and budded in April, and foliar sprayed with Rapid Gro and Vitazyme (0.5 oz/acre) beginning in mid-June. Ten applications were made during the summer and early fall.

Future intentions: Next year Mr. Lang will dip the budded stock as well as the ornamentals in Vitazyme, and will continue to foliar feed as in 2000. **He will give a gallon of Vitazyme in 2001 to each of his customers in order that the vigor and survival of the trees will be insured.**