Avocados *with Vitazyme application*

Researcher: Personnel at Gama Company and Syngenta

Research organization: Gama Company and Syngenta, Santiago, Chile

Location: Panquehue, Valparaiso Region, Santa Blanca, Chile

Variety: Hass/Mexicola

Establishment date of the plantation: 2009

Experimental design: An avocado plant plantation was selected to evaluate the effect of Vitazyme on the yield and quality of avocado fruit. The trees were spaced 3 x 3 meters in the grove. Avocado trees were selected in a completely random distribution in the plantation, and were similar in size, health, vigor, and nutritional status.

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

Fertilization: unknown.

Vitazyme applications: A 1 liter/ha application was made each week throughout the flowering period, beginning when 10% of the flowers were open, on these dates: October 8, 15, and 25, and November 2, 9, and 16 of 2021. The application was made through the irrigation system during the last third of the irrigation time.

Leaf temperature results: Leaf surface temperatures were measured on November 25, 2021.

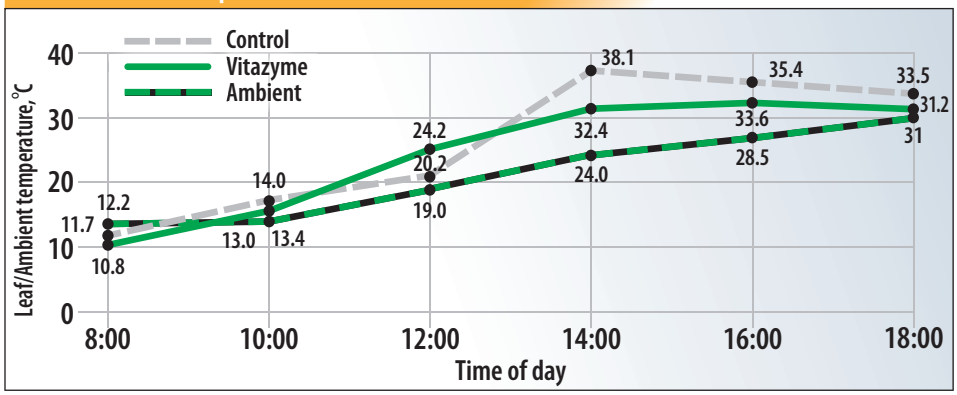
The avocado plantation at Panquehue at Santa Blanca, Chile, was the site of this avocado trial in 2021-22.

Vitazyme was applied to the avocado trees multiple times during the flowering stage, which is represented here at from 0 to 100% flowering.

	Time of day					
Treatment	**8:00**	**10:00**	**12:00**	**14:00**	**16:00**	**18:00**
	----------degrees Centigrade----------					
Control	11.73 ± 1.55	14.03 ± 1.62	20.23 ± 2.04	38.13 ± 3.27	35.40 ± 2.87	33.50 ± 3.47
Vitazyme	10.77 ± 0.93	13.37 ± 0.15	24.22 ± 5.93	32.43 ± 0.25	33.57 ± 4.45	31.17 ± 1.48
P-Value	0.423	0.551	0.386	0.095*	0.591	0.396

*Significantly different mean temperatures at P=0.10 by the Student T-test.

Leaf Ambient Temperature



Leaf temperature reduction with Vitazyme

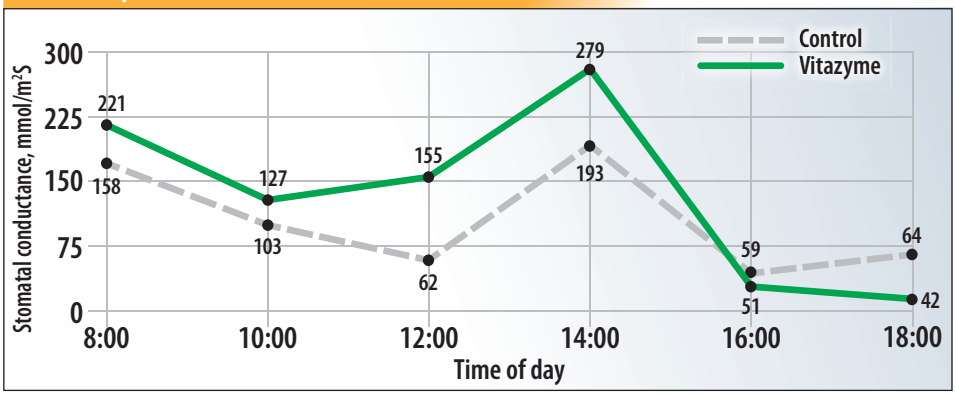
10:00 ..... 0.6 °C
14:00 ..... 5.7 °C
16:00 ..... 1.8 °C
18:00 ..... 2.3 °C

Stomatal conduction results: On November 25, 2021, an evaluation of the conductance of the leaf stomata was performed. This is a measure of the leaf stomatal opening.

	Time of day					
Treatment	**8:00**	**10:00**	**12:00**	**14:00**	**16:00**	**18:00**
	----------mmol/m²s----------					
Control	158.1 ± 53.7	103.1 ± 26.2	62.4 ± 48.4	193.1 ± 16.5	59.07 ± 4.37	64.4 ± 36.2
Vitazyme	221.0 ± 145.0	127.3 ± 87.8	154.6 ± 41.3	279.0 ± 145.0	51.47 ± 8.04	42.2 ± 13.2
P-Value	0.554	0.693	0.087*	0.416	0.246	0.422

*Significantly different mean stomatal conductance at P=0.10 by the Student T-test.

Leaf Temperature



Stomatal conductance increase with Vitazyme

8:00..... 63 mmol/m²S
10:00..... 24 mmol/m²S
12:00..... 93 mmol/m²S
14:00..... 86 mmol/m²S

Leaf analysis results: There were no significant difference between the two treatments for several nutrients measured. Leaves were collected on March 24, 2022

Leaf analysis results												
Treatment	**N**	**P**	**K**	**Ca**	**Mg**	**Na**	**Cl**	**Cu**	**Zn**	**Mn**	**Fe**	**B**
	%	%	%	%	%	%	%	ppm	ppm	ppm	ppm	ppm
Control	2.39	0.10	0.78	2.83	0.60	0.010	0.65	9.62	33.4	111.1	180.3	45.7
Vitazyme	2.11	0.13	0.69	2.83	0.65	0.012	0.84	9.38	26.2	121.0	241.3	50.4
Change	-0.28	+0.03	-0.10	0	+0.05	+0.002	+0.19	-0.24	-7.2	+9.9	+61.0	+4.7

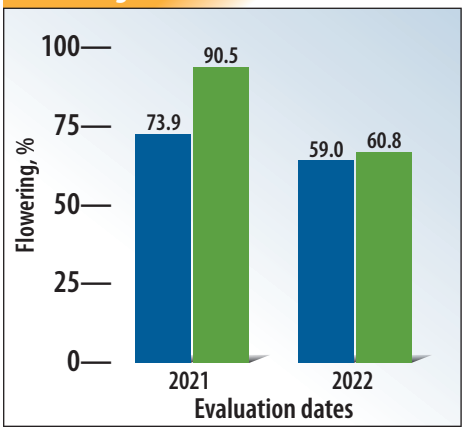
Tree vigor results: Evaluations for vigor were made on May 2, 2022. No significant difference between the treatments was found.

Flowering results: Measurements in flowering on a certain date in October were made both years: October 21, 2021, and October 24, 2022.

Treatment	**2021**	**2022**
	%	%
Control	73.9 ± 17.5	59.0 ± 16.5
Vitazyme	90.5 ± 7.9	60.8 ± 18.2
p-value	0.001*	0.752

*Significantly different means at P=0.05 by the Student T-test.

Flowering

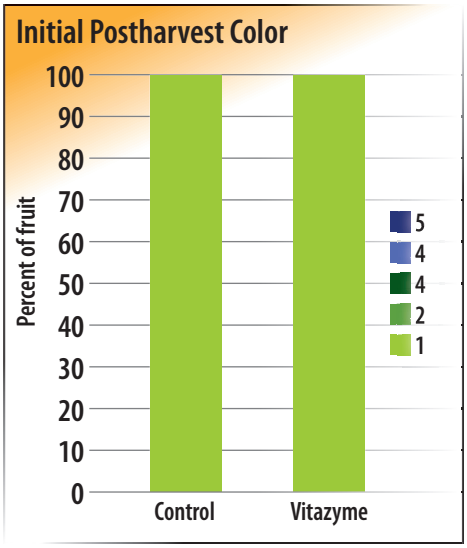


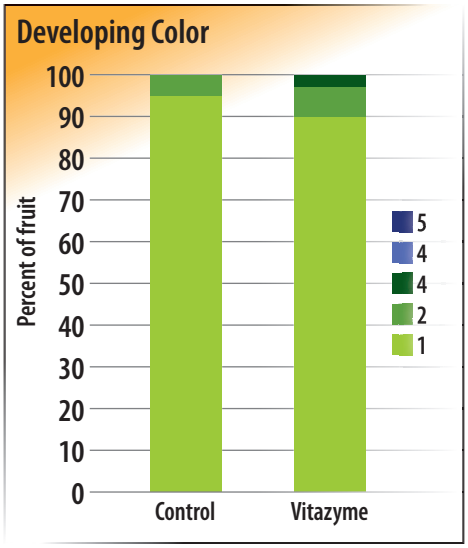
Increase in flowering with Vitazyme

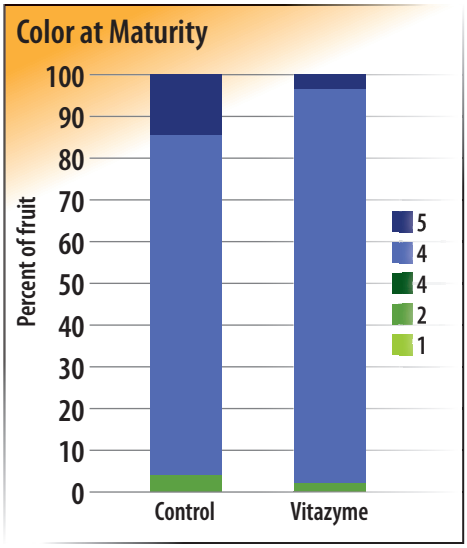
2021....16.6 percentage-points
2022.....1.8 percentage-points

Vitazyme caused a great increase in flowering above the control in 2021, but in 2022 there was only a slight increase.

Fruit yield results: There was no significant effect on yield with Vitazyme
Fruit size results: There was no significant effect on fruit size with Vitazyme.
Fruit color results:



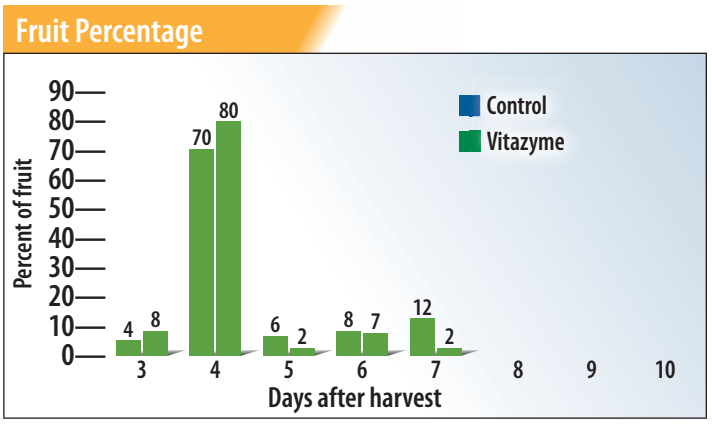




Fruit color is shown here as used to categorize fruit color development of the treated and untreated avocado fruit. Note the more uniformly dark mature color of the Vitazyme treated fruit when ready for consumption.

There were four stages of external browning of the avodado fruit that were measured for both treatments, as shown here. The Vitazyme treatment showed reduced external browning.

Fruit quality results: Vitazyme displayed some improvements in fruit quality.
Vascular browning. Vitazyme produced 5 percentage points more of the highest fruit grade without vascular browning.
Pulp browning. Vitazyme revealed no pulp browning, while the control had 3 percentage points.
Stem end rot. Neither treatment had any stem end rot.
Blackspot. Neither treatment revealed any blackspot on the fruit.
Days to maturity: Both treatments were evaluated for the number of days it took for the fruit to ripen for consumer use.



Increase in ripened fruit after harvest

Three days ..... 4 percentage-points
Four days..... 10 percentage-points

Conclusions: A replicated avocado trial in Chile, using six 1 liter/ha applications spaced a week apart during blossoming, produced some good quality improvements in the fruit, though the yield was not significantly influenced. Leaf temperature and stomatal conductance were also improved, by up to 5.7°C lower at mid-afternoon, and up to 9.3 mmol/m^{2}s. Flowering was advanced significantly by 16.6 percentage points in 2021, and fruit parameters were improved. Color at maturity was advanced with Vitazyme, and vascular and pulp browning were reduced. Days to marketable maturity were also reduced from the control. These results show the excellent quality improvements with Vitzyme for avocados in Chile.

Avocados *with Vitazyme application*

Researcher: Dr. Alberto M. Garcia Munguia ***Research Organization:*** University of Aguascalientes, Agricultural Science Center, Phytotechniques Department, Jesus Maria, Aquascalientes, 20131, Mexico
Location: Municipality of Periban, Michoacan State, Mexico ***Variety:*** Hass ***Age of planting:*** over five years
Initiation date of the trial (first application): December 4, 2020
Experimental design: An avocado grove was partitioned to include a series of randomized block, using four replications, with experimental units containing two trees each. Trees were spaced 4 meters apart in the rows and rows were space 7 meters apart. Each plot was 56m^2, and each treatment of eight total trees was 224m^2.

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

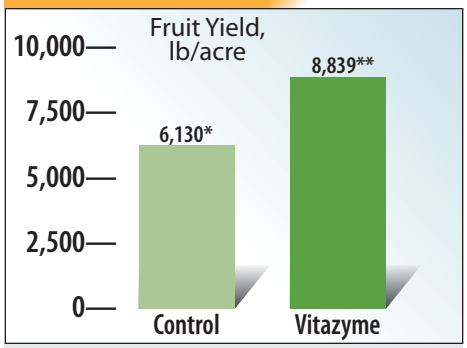
Vitazyme applications: Four foliar sprays, each at 1 liter/ha (13 oz/acre), at 30-day intervals beginning at the vegetable growth stage. Applications were made December 4, 2020, and January 3, February 2, and March 4 of 2021. A motorized sprayer was used, with 1 liter of Vitazyme in 1,000 liters of water sprayed per hectare (about 100 gallons/acre), using adjustable cone nozzles.

Fertilization: unknown, but uniform over all areas

Results: The data were completed on March 18, 2021, 104 days after the first application of Vitazyme on December 4, 2020.

Conclusions: An avocado replicated experiment in Michoacan State, Mexico, revealed that Vitazyme, as four 1 liter/ha (13 oz/acre) applications every 30 days beginning with the vegetative stage, produced excellent yield and fruit size improvements above the untreated control trees. The yield increase of 2,709 lb/acre (3.05 MT/ha), a 44%. Fruit dimensions were improved by 12% (length) and 13% (diameter). These results show the great value of Vitazyme as a simple, efficient way of improving avocado yield and fruit size in Michoacan State, Mexico.

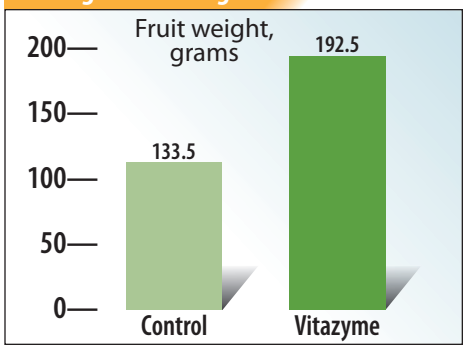
Fruit Yield



*6.88 MT; **9.93 MT.

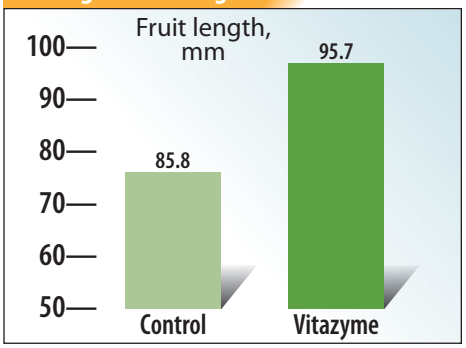
Fruit yield increase with Vitazyme: 44%

Average Fruit Weight



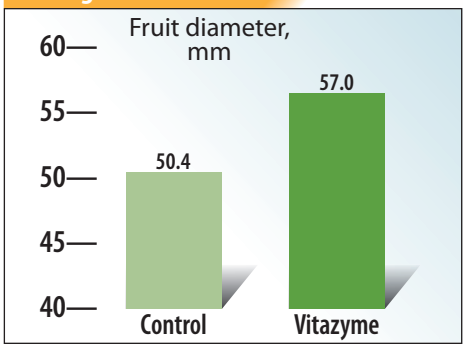
Average fruit weight increase with Vitazyme: 44%

Average Fruit Length



Average fruit length increase with Vitazyme: 12%

Average Fruit Diameter



Average fruit diameter increase with Vitazyme: 13%

Avocados *with Vitazyme application*

Researcher: Steven David
Research organization: Sustainable Farming Solutions, Perth, Western Australia
Location: Western Australia
Variety: Unknown
Experimental design: Nursery avocado plants were treated with Vitazyme and compared with untreated controls to determine the effect of this product on root and top growth.

❶ ***Control*** ❷ ***Vitazyme***

Vitazyme application: (1) Some plants were drenched at two times with a 1% Vitazyme solution; (2) other plants were drenched at two times with a 2% Vitazyme solution. Application timing is not known.

Growth results: Although no measurements were made, it was obvious by observation that both the 1% and 2% pot drenches improved root growth. This was especially true for the 2% drench, which displayed much greater root growth than the untreated control, and was substantially greater than the 1% drench. Note the accompanying photograph.

The circled root ball has been treated twice with a 2% Vitazyme drench, and reveals an amzing improvement in rooting; the 1% drench in the center also shows excellent rooting, far better than the control on the left.

Conclusions: This Western Australia Vitazyme trial revealed that either a 1% or 2% pot root drench, applied two times, greatly increased root growth and associated top growth and development. This product is thus shown to be an excellent adjunct to nursery applications of avocados to stimulate more rapid growth, and reduced time to reach transplanting size.

Avocados *with Vitazyme application*

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

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

Variety: a Phytophthora-sensitive rootstock
Soil type: clayey
Planting date: 2013
Experimental design: Root-rot sensitive avocado trees were treated with three Vitazyme regimes to determine the products effectiveness to control the problem. Each plot had 10 trees, with 16 plots (four reps), or 160 total trees.
Observations: At six months after these applications, there was a noticable increase in leaf area for the Vitazmye treatments, but final results were not yet available.

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

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

Increase in leaf area with drip irrigation: 48%

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

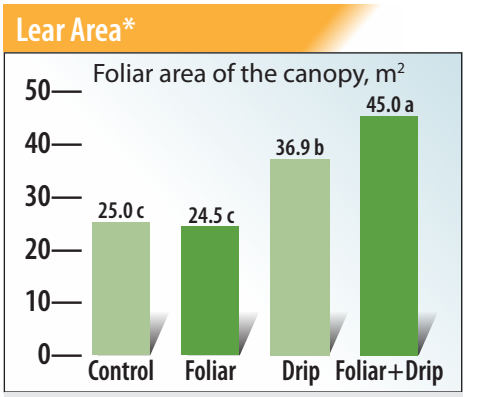
Experiment 2. *Vitazyme for avocado tree vigor (2013)*

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

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

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

Leaf area results:



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

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

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2014 Crop Results

Vitazyme on Avocados

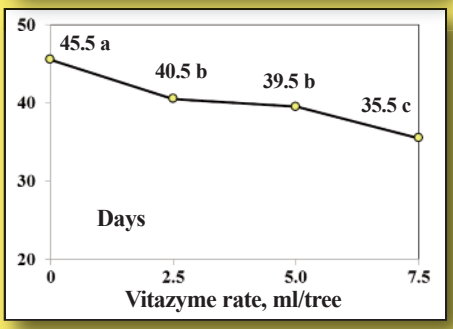
Researcher: Hermilo Sanchez Sanchez, Ph.D. *University location*: Academic Unit of Agro-Hydraulic Engineering, Autonomous University of Puebla, San Juan Acateno, Teziutlan, Puebla, Mexico
Location of study: commercial orchard at Tlalnepantla, Morelos, Mexico *Variety*: Hass
Trial initiation: August 13, 2013 *Soil type*: clayey *Tree age*: 8+ years
Tree spacing: 6m x 6m
Experimental design: An avocado orchard was selected to evaluate the effect of Vitazyme on the yield and quality of the fruit. The experiment was laid out in a Latin Square design with one tree per plot (36 m^2), replicated four times.

Treatment	Days after harvest[1]				Total dosage
	60	120	180	240	
	ml/liter of spray				liters/ha
Control	0	0	0	0	0
Vitazyme 1	2.5	2.5	2.5	2.5	0.7
Vitazyme 2	5.0	5.0	5.0	5.0	1.4
Vitazyme 3	7.5	7.5	7.5	7.5	2.1

[1]All applications received the indicated dosage of Vitazyme in 5 liters per tree of water, applied to the leaves.

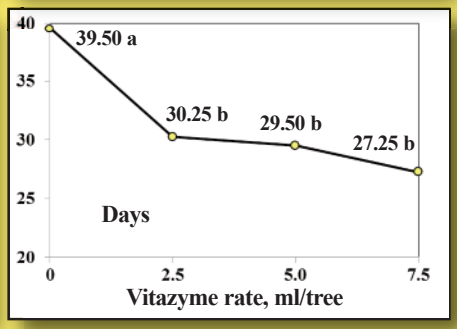
Fertilization: none
Vitazyme application: 2.5, 5.0, and 7.5 ml/tree applied by sprayer to the leaves of appropriate trees every 60 days, for four times, following harvest (see the table)
Statistical evaluation: The Statistical Analysis System (SAS) was used, employing Tukey's Test to evaluate differences among treatment means, at P = 0.05.
Growth and yield results: For all means, values followed by the same letter are not significantly different at P = 0.05 according to Tukey's Test.

Days to Bud Break[1]



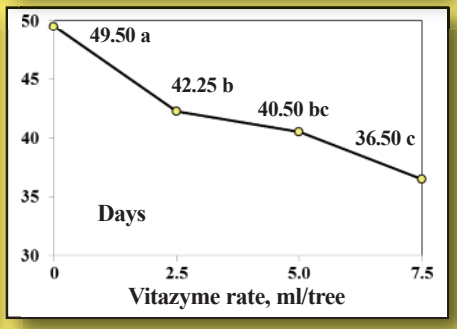
[1]Number of days to bud break after pruning.

Days to Flowering[1]



[1]Number of days to 50% bud break.

Days to Fruit Set[1]



[1]Number of days to 20% of the small fruit formed, starting from 50% bud break.

Reduction in Days to Bud Break
Vitazyme 1 ..... 5 days
Vitazyme 2 ..... 6 days
Vitazyme 3 ..... 10 days

As the Vitazyme rate increased, the time to bud break was reduced linearly by 5 to 10 days.

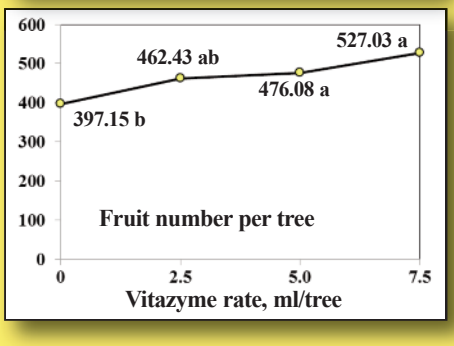
Reduction in Days to Flowering
Vitazyme 1 ... 9.25 days
Vitazyme 2 ... 10.00 days
Vitazyme 3 ... 12.25 days

Days to flowering were reduced by a remarkable 9.25 to 12.25 days, consistent with brassinosteroid effects on fruit trees.

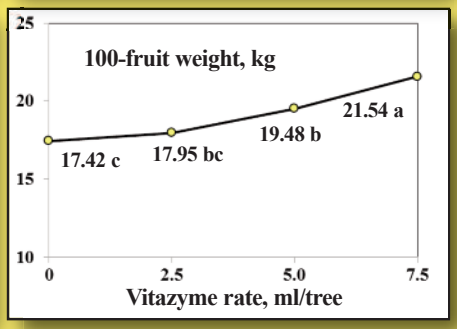
Reduction in Days to Fruit Set
Vitazyme 1 ... 7.25 days
Vitazyme 2 ... 9.00 days
Vitazyme 3 ... 13.00 days

Days to fruit set were greatly reduced, by up to 13 days at the highest Vitazyme application.

Fruits Per Tree

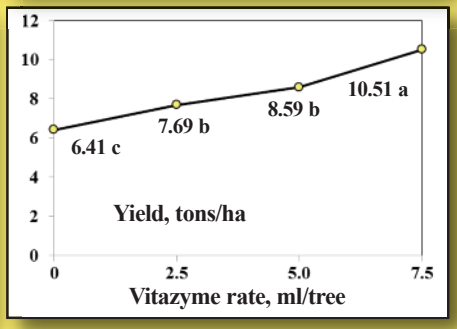


Fruit Weight[1]



[1]100 fruit were weighed.

Fruit Yield[1]



[1]Estimate based on fruit weight.

Increase in Fruits Per Tree
Vitazyme 1 ..... 16%
Vitazyme 2 ..... 20%
Vitazyme 3 ..... 33%

A linear increase in fruit number resulted with higher rates of application, up to a 33% increase.

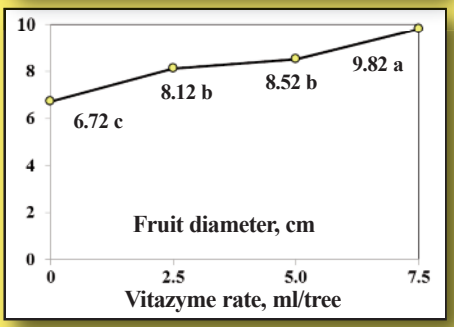
Increase in Fruit Weight
Vitazyme 1 ..... 3%
Vitazyme 2 ..... 12%
Vitazyme 3 ..... 24%

Significant fruit weight increases occurred at the 5.0 and 7.5 ml/tree rates, with up to 24% greater weight.

Increase in Fruit Yield
Vitazyme 1 ..... 20%
Vitazyme 2 ..... 34%
Vitazyme 3 ..... 64%

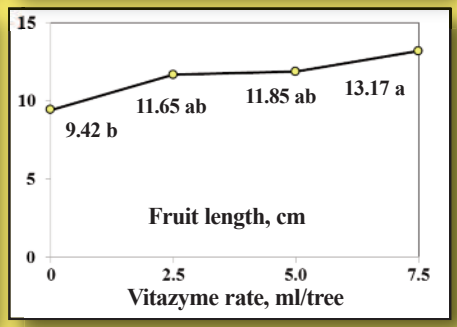
A nearly straight-line increase in yield resulted from added increments of Vitazyme.

Fruit Diameter[1]



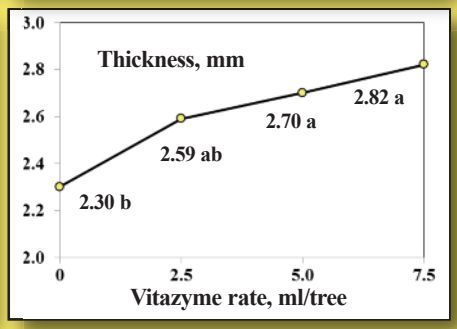
[1]10 fruits were measured with a vernier caliper, and averaged.

Fruit Length[1]



[1]10 fruits were measured with a vernier caliper, and averaged.

Skin Thickness[1]



[1]A cross section of skin from five fruit was measured by microscope, and averaged.

Increase in Fruit Diameter	
Vitazyme 1	21%
Vitazyme 2	27%
Vitazyme 3	46%

All rates of Vitazyme increased fruit diameter significantly, up to 46% at the highest rate.

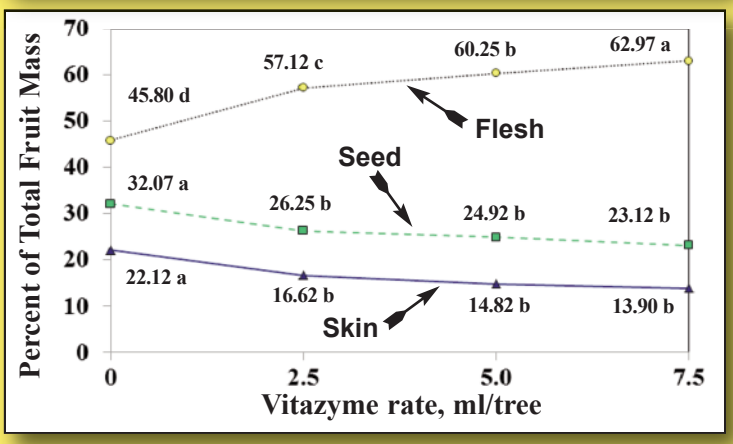
Increase in Fruit Length	
Vitazyme 1	24%
Vitazyme 2	26%
Vitazyme 3	40%

All three Vitazyme treatments were statistically the same, and the 7.5 ml/tree rate produced a 40% increase in fruit length.

Increase in Skin Thickness	
Vitazyme 1	13%
Vitazyme 2	17%
Vitazyme 3	23%

In all cases Vitazyme increased skin thickness, significantly at the 7.5 ml/tree level (23%).

Percentage of Flesh, Skin, and Seed[1]



[1]Ten fruits for each plot were selected, and the flesh, skin, and seeds were separated, weighed, and averaged.

Change with Vitazyme, percentage points	Flesh	Skin	Seed
Vitazyme 1	+11.32	-5.50	-5.82
Vitazyme 2	+14.45	-7.30	-7.15
Vitazyme 3	+17.17	-8.22	-8.95

The percentage of flesh of the avocado fruit increased linearly and significantly with the rate of Vitazyme application, while the percentages of skin and seed conversely dropped with those same rates.

Conclusions: The conclusions of the Mexican authors are as follows.

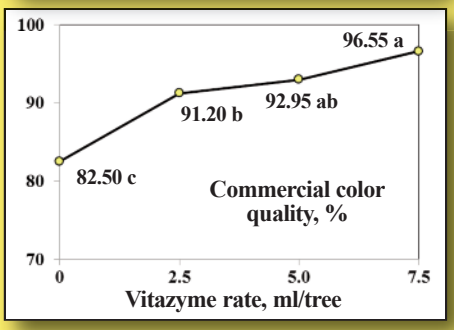
1. Vitazyme, at dosages of 0.7, 1.4 and 2.1 liters per hectare of Vitazyme, equivalent to 100, 200 and 200 mL/200 L water in 1390 liters per hectare of solution, each in 4 foliar sprays at intervals of two months after the last harvest, in 8 years old avocado trees, recorded good effects on the evaluated parameters in the avocado crop, achieving significant improvements in days to bud break, to flowering and to fruit set, as well as in yield and quality of fruits, showing statistical differences with the untreated control throughout the development of the trial.

2. With four foliar applications of Vitazyme at dosages of 0.7, 1.4 and 2.1 liters per hectare of Vitazyme, equivalent to 100, 200, and 300 mL/200 L water in 1390 liters per hectare of solution, each in 4 foliar sprays at intervals of two months after the last harvest, in 8 years old avocado trees, significant yield increases compared with an untreated control of 1.18, 2.18, and 4.11 tons/hectare, or 20, 34, and 64%, respectively, are achieved. Likewise, marked improvements in the quality of the Vitazyme treated fruits are noticed.

3. The use of Vitazyme at dosages of 0.7, 1.4, and 2.1 liters per hectare of Vitazyme, each in 4 foliar sprays at intervals of the two months after the last harvest, is recommended in avocado trees, since it is demonstrated to be an alternative that favorably increased yields per hectare, as well as the quality of avocado fruits.

4. There were no toxic effects to the avocado crop, after applying dosages of 0.7, 1.4, and 2.1 liters per hectare of Vitazyme, equivalent to 100, 200, and 300 mL/200 L water in 1390 liters per hectare of solution.

Uniformity of Color[1]



[1]100 fruit were evaluated for color qualifying for commercial for commercial sales.

Increase in Uniformity (percentage points)	
Vitazyme 1	8.70
Vitazyme 2	10.45
Vitazyme 3	14.05

Significantly more fruit was of commercial color quality with all three Vitazyme treatments, especially the 7.5 ml/tree rate.

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2013 Crop Results

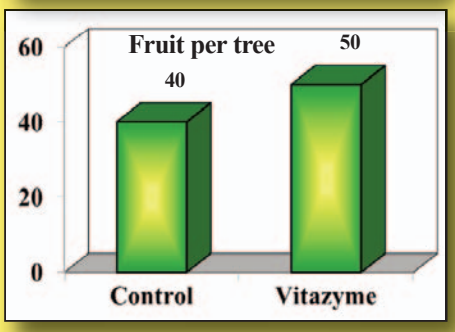
Vitazyme on Avocados

Researcher: unknown *Farmer*: Tran Minh Nhuong *Location*: Ea Po, Dak Nong Province, Viet Nam
Variety: unknown *Years in production*: 5 *Planting density*: 550 plants/ha
Experimental design: Six avocado trees for each treatment — one with Vitazyme and the other an untreated control — were selected near each other to evaluate the effects of Vitazyme on the yield of fruit.

1. Control **2. Vitazyme**

Fertilization: unknown
Vitazyme application: 0.5 liter applied per tree to all six trees, five times during the year
Yield results:

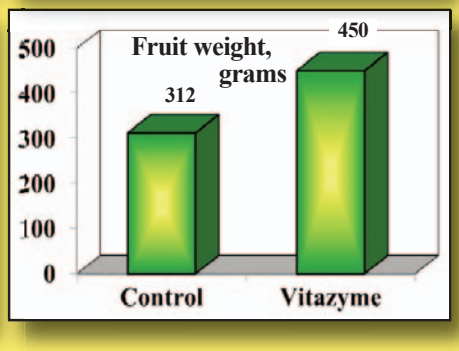
Fruit Number[1]



[1]Per avocado tree.

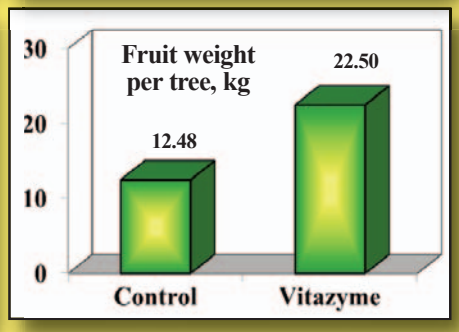
Increase in fruit number: 25%

Fruit Weight



Increase in fruit weight: 44%

Fruit Yield[1]



[1]Per avocado tree per year.

Increase in fruit yield: 80%

Fruit number, weight, and yield all increased dramatically with Vitazyme application.
Income results: Costs of Vitazyme: 24,000 VND/tree
Increase in income with Vitazyme: 162,500 VND/tree
Conclusions: An avocado study in Viet Nam, using six trees for each treatment, revealed that Vitazyme greatly improved the yield (+80%), number (+25%), and size (+44%) of fruit. Moreover, the income per tree was raised by 162,500 VND. It was observed during the trial that **many avocado fruit fell prematurely in the control treatment, but not in the Vitazyme treatment**. This program is shown to be a most excellent adjunct to avocado production in Viet Nam.