Bush Beans *with Vitazyme application*

Researcher: Rajnish Khanna, Ph.D.
Research organization: i-Cultiver, Manteca, California
Location: USDA Plant Gene Expression Center, Albany, California
Variety: *Phaseolus vulgaris*
Growth media: Sunshine Mix #1 (Sungro Horticulture)
Experimental design: A greenhouse trial was established using 5-gallon pots, to compare the effects of Vitazyme on plant growth versus untreated controls. Three pots were used for each treatment.

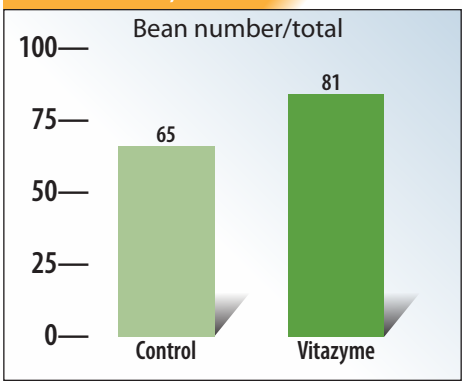
1 *Control* **2 *Vitazyme***

Fertilization: Peters Professional 20-20-20 water soluble fertilizer applied at 1:64 dilution each week
Vitazyme application: a 1% Vitazyme solution sprayed on the leaves and soil, to the dripping point, every 14 days beginning at the four-leaf stage until flowering or harvest
Disease control: Floramite and Decathlon at 0.25 tsp/gal, sprayed at 1-2 gal/100 plants

Yield results: The number of bean pods for each plant was counted, totaled, and statistically analyzed.

Increase in total bean number with Vitazyme: 16 (+25%)

Bean Number, Total



Conclusions: This greenhouse pot trial with beans, using Vitazyme every 14 days, showed that the total bean number increased by 25%, or 5.3 beans per plant. These results show the excellent effect of Vitazyme to increase the productivity of bush beans.

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2013 Crop Results

Vitazyme on Bush Beans

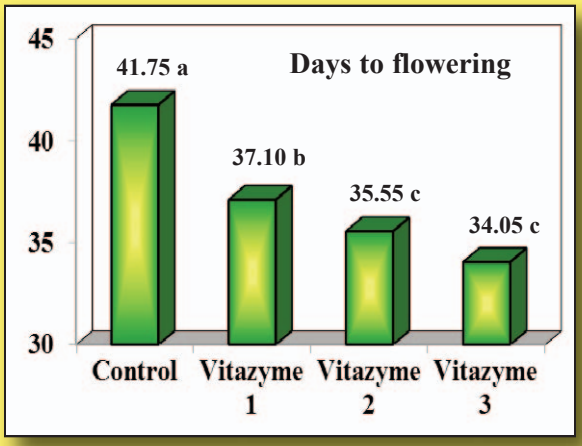
Researcher: Hermilo Sanchez Sanchez, Ph.D. of Puebla, San Juan Acateno, Teziutlan, Puebla, Mexico
University location: Autonomous University
Variety: Strike
Soil type: Pellic vertisol (clayey, dark, high fertility)
Planting date: August 13, 2013
Tral location: field at Tepalcingo, Mexico
Row spacing: 1.0 meter
Seeding rate: 30 kg/ha
Experimental design: A bean trial was laid out in a Latin square using four treatments and four replications, with each plot five rows wide (1 meter apart) and 5 meters long (25 m^2). The total plot area was 16 plots, or 400 m^2. The purpose of the trial was to evaluate the effect of two Vitazyme applications on the growth, yield, and quality of bush beans under normal field conditions.

Treatment	Seed treatment[1]	Soil/Foliar treatment[2]
	ml/ha on seeds	liters/ha
1. Control	0	0
2. Vitazyme 1	200	0.5
3. Vitazyme 2	250	1.0
4. Vitazyme 3	300	1.5

[1]For four plots (100m^2), 300g of seed were treated with 2.0, 2.5, and 3.0 ml of Vitazyme along with 3.0, 2.5, and 2.0 ml of water for Treatments 2, 3, and 4, respectively. A total of 5 ml of solution was used for the 300 g of seed in each case.
[2]For four plots (100 m^2), 2 liters of water were sprayed on the plants and soil, mixed with 5, 10, and 15 ml of Vitazyme for Treatments 2, 3, and 4 respectively.

Fertilization: unknown
Vitazyme application: Seed treatments were performed by mixing the Vitazyme and water with 300 g of seeds in a plastic bag; then the seeds were dried for 15 to 30 minutes and planted that day or the following day. The soil and foliar sprays were done using a calibrated backpack sprayer, with a 200 liters/ha output.
White fly control: Confidor 350 SC
Rust control: Manzate 80 WP
Statistical evaluations: The Statistical Analysis System (SAS) was used to evaluate treatment means, and the Tukey test (P = 0.05) was used to separate these means. In all of the following data sets, means followed by the same letter are not significantly different at P = 0.05.

Days to blossom results:

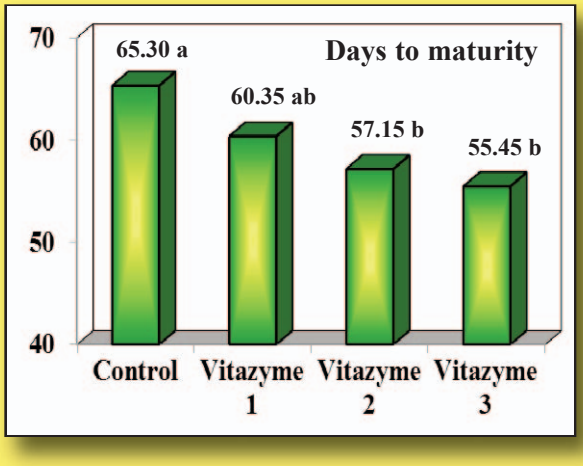


Reduction in Days to Flowering	
Vitazyme 1	4.65 days
Vitazyme 2	6.20 days
Vitazyme 3	7.70 days

Over a week was cut off from the time from planting to flowering for the highest Vitazyme rate, while both of the other rates reduced flowering time by 4.65 and 6.20 days, all significant reductions.

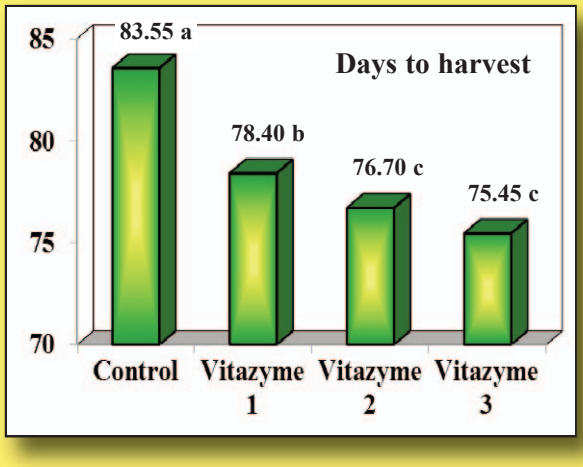
Days to maturity results: The number of days to complete pod formation were counted.

Reduction in Days to Maturity	
Vitazyme 1	4.95 days
Vitazyme 2	8.15 days
Vitazyme 3	7.85 days



Nearly 10 days were cut off the time to pod formation for the highest Vitazyme application, while about 5 and 8 days were removed for the lowest and medium rates. The two highest rates were significantly reduced in time to maturity compared to the control.

Days to harvest results:

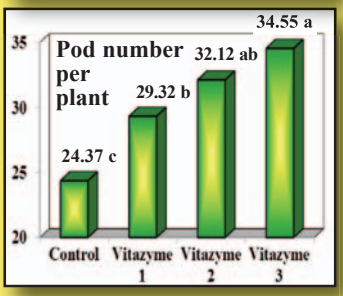


Reduction in Days to Harvest	
Vitazyme 1	5.15 days
Vitazyme 2	6.85 days
Vitazyme 3	8.10 days

All Vitazyme treatments significantly reduced the time to harvest, the time reduction greater as the rate increased, with up to an 8.10 day decrease with the highest rate.

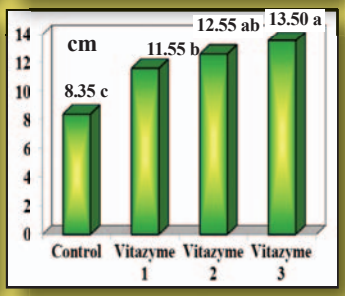
Pod and seed results:

Pods Per Plant[1]



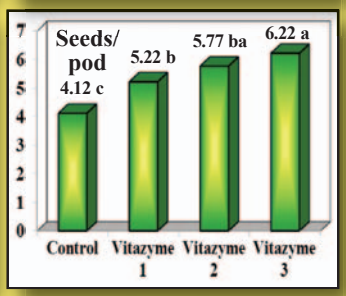
[1]Ten random plants from each plot were counted, 20 days after flowering.

Pod Length[1]



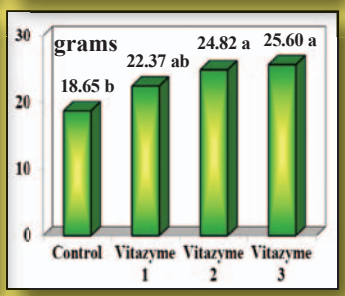
[1]Ten random pods from each plot were selected, and pods were measured from the base of the stem to the pod tip.

Seeds Per Pod[1]



[1]Seed number from ten random pods for each plot were counted.

100-Seed Weight[1]

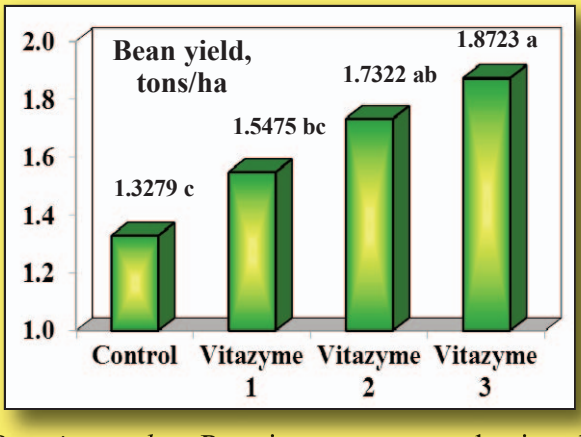


[1]The weight of 100 seeds from the seeds collected in the seeds per pod analysis was determined.

Increase in Pods with Vitazyme	Increase in Pod Length with Vitazyme	Increase in Seeds/Pod with Vitazyme	Increase in 100-Seed Weight with Vitazyme
Vitazyme 1 ..... 20%	Vitazyme 1 ..... 38%	Vitazyme 1 ..... 27%	Vitazyme 1 ..... 20%
Vitazyme 2 ..... 32%	Vitazyme 2 ..... 50%	Vitazyme 2 ..... 40%	Vitazyme 2 ..... 33%
Vitazyme 3 ..... 42%	Vitazyme 3 ..... 62%	Vitazyme 3 ..... 51%	Vitazyme 3 ..... 37%

All pod and seed parameters improved with Vitazyme application, the higher application rates giving bigger increases. Pod length increased the most — up to 62% — while 100-seed weight increased from 20 to 37%.

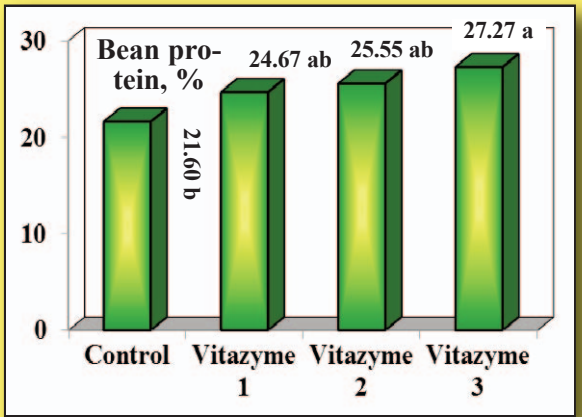
Yield results: Harvesting was completed on October 20, 2013. The seeds produced by 10 representative plants from each plot were weighed.



Bean Yield Increase	
Vitazyme 1	17%
Vitazyme 2	30%
Vitazyme 3	41%

Yield of beans increased with the rate of Vitazyme application, moving from 17% at the lowest rate to 41% at the highest rate.

Protein results: Protein was measured using the Kjeldahl method on beans from each plot.

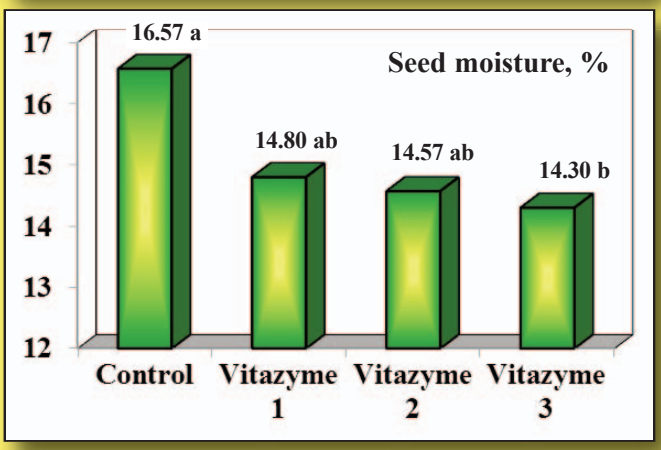


Increase in Bean Protein	
Vitazyme 1	14%
Vitazyme 2	18%
Vitazyme 3	26%

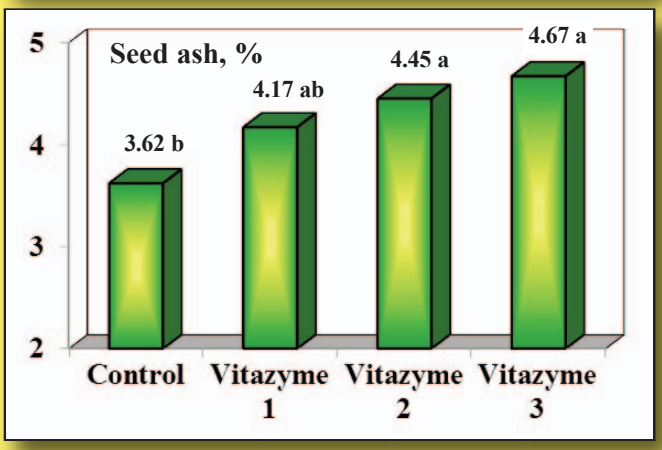
The all-important nutritional parameter of protein increased significantly by a remarkable 26% with the high rate of Vitazyme addition. The low rate resulted in a 14% protein increase, and the medium rate an 18% increase, both large but not significant.

Seed moisture and ash results: Association of Official Analytical Chemists methods were used.

Seed Moisture



Seed Ash



Reduction in Seed Moisture	
Vitazyme 1	-1.77%-points
Vitazyme 2	-2.00%-points
Vitazyme 3	-2.27%-points

Increase in Seed Ash	
Vitazyme 1	15%
Vitazyme 2	23%
Vitazyme 3	29%

Moisture percentage of the seeds was reduced as Vitazyme application levels increased, at the same time that ash levels (mineral contents) increased, showing that the product improves the uptake of soil elements for improved nutritional value.

Conclusions of the Mexican researcher:

1. The Product Vitazyme, applied as a seed treatment at dosages of 200, 250 and 300 ml/30 kg of seeds/hectare, followed by a leaf spray in early bloom at 0.5, 1.0 and 1.5 liters/ha, respectively, induced a significant effect on the variables days to flowering, days to physiological maturity, and days to harvest, as well as on the number of pods per plant, length of pods, and the number of seeds per pod, recording significant statistical differences as compared to the untreated control.

2. There was a significant effect of the Vitazyme, applied as a seed treatment at dosages of 200, 250 and 300 ml/30 kg of seeds/hectare, followed by a leaf spray in early bloom at 0.5, 1.0 and 1.5 l/ha, respectively, on bean yield, since it recorded statistically higher values than the untreated control.

3. With regard to grain quality variables, only the rate of 300 ml/30 kg of seeds/hectare seed treatment followed by a leaf spray of 1.5 l/ha, induced statistical differences with the control; however, all Vitazyme treatments in every tested rate recorded better values than the untreated control.

4. There were no toxic effects on the dry bean crop after applying Vitazyme, in seed treatment at rates of 200, 250 and 300 ml/30 kg of seeds/hectare, followed by a foliar spray in early bloom at 0.5, 1.0 and 1.5 liters/hectare, respectively.