

MICROBIAL INOCULANT BIO SEED AND BIOSTIMULANT VITAZYME ON ONION YIELD AND QUALITY. LEON, GUANAJUATO, MEXICO, 2017-18

Lucero B. Fernandez¹, Antonio Medina² & Juan C. Diaz³. ¹Química Lucava S.A. de C.V. lucero-fernandez@quimicalucava.com.mx; ²MEDFER; ³AG BioTech Inc., jcdiaz1949@yahoo.es

Location: Los Pinos, Leon, Guanajuato, Mexico

Farm manager: Mr. Hugo Medina

Crop and variety: Carta Blanca onion

Soil textural classification: clayey loam

Planting distance: seedlings planted on ridge in a double row, separated 10 cm between rows and 10 cm between plants along the row and 80.5 cm between adjacent double rows.

Transplanting date: September 13th, 2017

Date of first Bactiva and Vitazyme and sole of Bio Seed applications: Sep 14th, 2017.

Dates of following Bactiva 250 g /ha applications: October 14, November 13 and December 13.

Dates of following Vitazyme applications: October 14 and November 13.

Date of 1st surface irrigation: September 15th (1 day after treatment application).

Harvest dates: January 18-19, 2018 (4 months and one week or 127 days of transplanting).

Each experimental unit or plot had 4 rows 0.805 m wide (total 3.22 m wide) by 98 m length, divided into two halves of 49 m separated by a 2.5 m transvers corridor at the middle, for a treated area of 315 m² per plot.

Area per treatment (2 plots or repetitions of 315 m², see above) = 630 m²

Evaluation area: the 2 central rows of each plot (157.5 m² per plot, 315 m² per treatment), discarding the two outer rows per plot for possible product carryover.

Treatments, variants or programs

1. Untreated Control (with conventional fungicide applications).
2. Bio Seed: 1 drench at 125 g /ha after transplanting + 3 monthly Vitazyme sprays at 1 L/ha.
3. Bactiva: 4 drenches, cumulative 1.25 kg/ha (initial 500 g/ha + 3 monthly 250 g/ha drenches).
4. Bio Seed: 1 drench at 125 g/ha, after transplanting.

The volume per hectare in drench to each of the two rows of onion seedlings (two runs per ridge) of water + Bio Seed / ProtecSem and water + Bactiva was 1200 liters per hectare (10 liters per backpack for a full double row of 98 m length or 78.89 m²). The volume per hectare of water + Vitazyme in foliar sprays using a Pulmic Tropic backpack sprayer attached to a hollow cone nozzle spraying at once the double row of onion plants per ridge was 200 liters per hectare.

Amounts of each product in first application (September 14th, 2017):

Product	Rate per ha	Total rate per program (2 plots) 630 m ²	Rate per plot (315 m ²)	Amount product per backpack (78.89 m ²)
Bio Seed	125 g/ha	8 grams	4 g	1 g
Vitazyme	1000 mL/ha	64 mL	32 mL	8 mL
Bactiva	500 g/ha	32 grams	16 g	4 g

In the following three monthly applications of Bactiva, 250 g/ha, in drench, were applied, while in the next two of Vitazyme were sprayed with the same previous rate (1 L/ha) on leaves and soil.

Applications of fungicides were made as necessary, when the first symptoms of disease showed. Fungicides used were, in the Control: those usually used by the farm, while in the new programs Quimica Lucava MM 64-8 was used, since its active ingredients metalaxyl and mancozeb are reported as having high compatibility with the beneficial *Trichoderma* fungi contained in both pesticide - biofertilizer products BioSeed / ProtecSem and Bactiva (<http://infoagro.com/mexico/que-funcion-tienen-las-trichodermas-en-agricultura/>).

The following fertilization was evenly applied to the entire area: Oct 3: MAP 11-52-0 (200 kg/ha) + ammonium phosphonitrate (400 kg/ha) + granular potassium sulphate (200 kg/ha); Oct 25: 50 kg/ha of Mg + 50 kg/ha of Ca; Nov 3: 50 kg/ha of Mg + 50 kg/ha of Ca; Nov 10: 100 kg/ha of potassium nitrate; Nov 17: 100 kg/ha of NKS; and Nov 24: 100 kg/ha of NKS.

At harvest, carried out on January 18-19, 2018, at 127 days from transplanting, all individual bags from the two central rows of each plot, classified according to the categories of bulb sizes in "extra", "large", "medium", "small" and "waste", with farmer prices of 0.243, 0.0.162, 0.135 & 0.027 US\$ per kg, respectively, were weighed.

Vitazyme is a natural biostimulant (organic certifications by OMRI and KIWA-BCS), with COFEPRIS registration No. RSCO-158/XII/14. It is distributed in Mexico by Quimica Lucava, of Celaya, Guanajuato. It is manufactured in the USA by a process of fermentation from vegetable materials, and includes 4 brassinosteroids: homobrassinolide, dolicholide, homodolicholide and brassinone, the 30 carbon atom alcohol 1-triacontanol; and 3 B-vitamins: B1 (thiamine), B2 (riboflavin) and B6 (pyridoxine), which increases chlorophyll content, photosynthesis, population of beneficial organisms in the rhizosphere, and consequently, improves nutrition efficiency, and resistance to various types of stress, resulting in greater crop growth, flowering, fruit set, yields and quality.

Bio Seed (in United States) or ProtecSem (name proposed in Spanish-speaking countries), is a microbial inoculant fertilizer, which improves nutrition and guards against diseases, for seed treatment, containing *Paenibacillus azotofixans*, *Bacillus megaterium*, *B. mucilaginosus*, *B. subtilis*, *Trichoderma harzianum*, each at 1×10^8 CFU/g and *mycorrhiza*, at 1×10^2 IP/g, certified for organic agriculture by OMRI in the USA <https://www.omri.org/mfg/abh/certificate/10223> and by APOF in India, and developed in USA by Ag BioTech Inc., of Lakeville, NY.

Bactiva, manufactured by Bactiva Inc. of Laredo, Texas, and distributed by Tecnologias Naturales Internacional, S.A. de C.V., of Celaya, Guanajuato, is also a biopesticide and biofertilizer (improving nutrition and guarding against diseases) containing 1×10^8 CFU/g of *Trichoderma harzianum*, *T. reesei*, *T. viride*, *Gliocladium virens*, *Bacillus megaterium*, *B. subtilis*, *B. polymyxa*, and *Pseudomonas fluorescens* gibberellins, cytokinins, seaweed and *Yucca schidigera* extracts, amino acids, fulvic acids and various vitamins.

RESULTS

Treatment No. 2 (Bio Seed + Vitazyme), followed by treatment No. 4 (Bio Seed alone), showed the highest yields: 24.7% and 19.3% (9.7 and 7.5 t/ha) higher, respectively, than the untreated Control, while the latter received greater number and cost of fungicide applications (Tables 1 and 3 and Fig. 1). In addition, it was observed (Table 2 & Fig. 3) that the former two quoted treatments showed better quality, in greater percentage of larger size bulbs (from "extras" to "medium") and lower percent smaller ("small") and "waste" than those of Bactiva and Control.

Table 1. Applications of fungicides by the studied programs and untreated Control.

Program/treatment	date	product	rate/ha	\$US/liter	\$US/ha
1. Control	09-Oct-17	MM 64-8	2 kg	18.92	37.84
	24-Oct-17	MM 64-8	2 kg	18.92	37.84
	31-Oct-17	Econil	4 L	9.73	38.92
	07-Nov-17	Econil	4 L	9.73	38.92
	14-Nov-17	Consent	2 L	21.62	43.24
	20-Nov-17	Econil	4 L	9.73	38.92
					Total
4. Bio Seed	31-Oct-17	MM 64-8	2 kg	18.92	37.84
	20-Nov-17	MM 64-8	2 kg	18.92	37.84
					Total
2. BioSeed+Vitazyme	20-Nov-17	MM 64-8	2 kg	18.92	37.84
					Total

Lucava MM 64-8 (64% mancozeb + 8% metalaxyl WP; (640 & 80 g a.i./kg, resp.).

Lucava Econil 720 (52% chlorthalonil AS; 52% per wt equals 72% wt/v).

Bayer Consento (7.50% fenamidone + 37.50% propamocarb SC).

As a result of the higher yields, the reduced number and costs of fungicides required to maintain good plant health, and the higher Bactiva program cost, greater net profits/revenues were recorded by Bio Seed + Vitazyme and Bio Seed alone, which were greater than the untreated Control in 2177 and 1782 US\$/ha, respectively and greater than the Bactiva program in 1543 and 1148 US\$/ha, respectively (the latter as differences of treatments 2 and 4 with treatment 3).

Only in cost of fungicides required the Bactiva treatment was slightly better than Bio Seed + Vitazyme and Bio Seed alone (Tables 1 and 3), but by its much smaller effect on yields than the last two (Table 2 and Fig. 1) it's additional profits were 3 to 4 times lower than with Bio Seed alone and with Bio Seed + Vitazyme, respectively (Fig. 2 and Table 3).

CONCLUSIONS

The programs of Bio Seed / ProtecSem, in a 125 g/ha drench at transplanting, plus three monthly 1 L/ha Vitazyme sprays on leaves and soil and Bio Seed alone, in one 125 g/ha drench show very marked (24.7% & 19.3%, resp.) yield increases, better quality in percent of greater size bulbs, and a marked reduction of required fungicides for good plant health, resulting in marked increases in added profits (2177 and 1782 US\$/ha, resp.) above the untreated Control (with standard fungicide treatments), and also much larger (3-4 times) yields and net profit increases than with Bactiva in 4 monthly drenches: one at 500 g/ha and three at 250 g/ha.

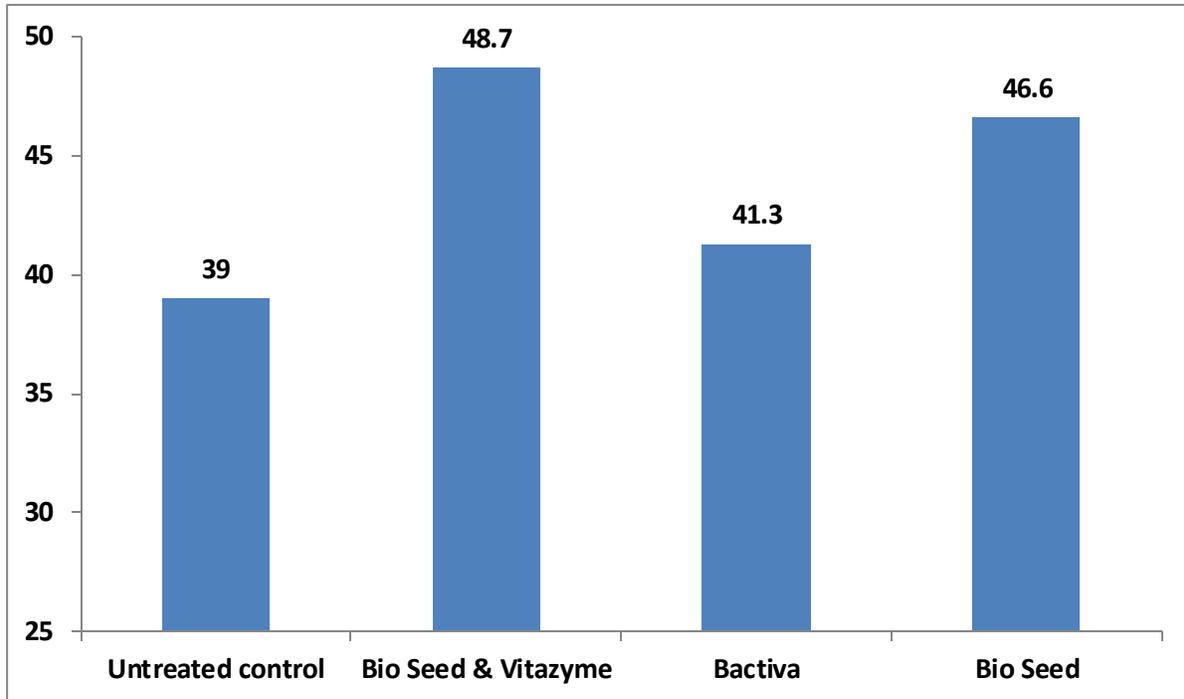


Fig. 1. Total onion yield (MT/ha) by studied programs and Control.

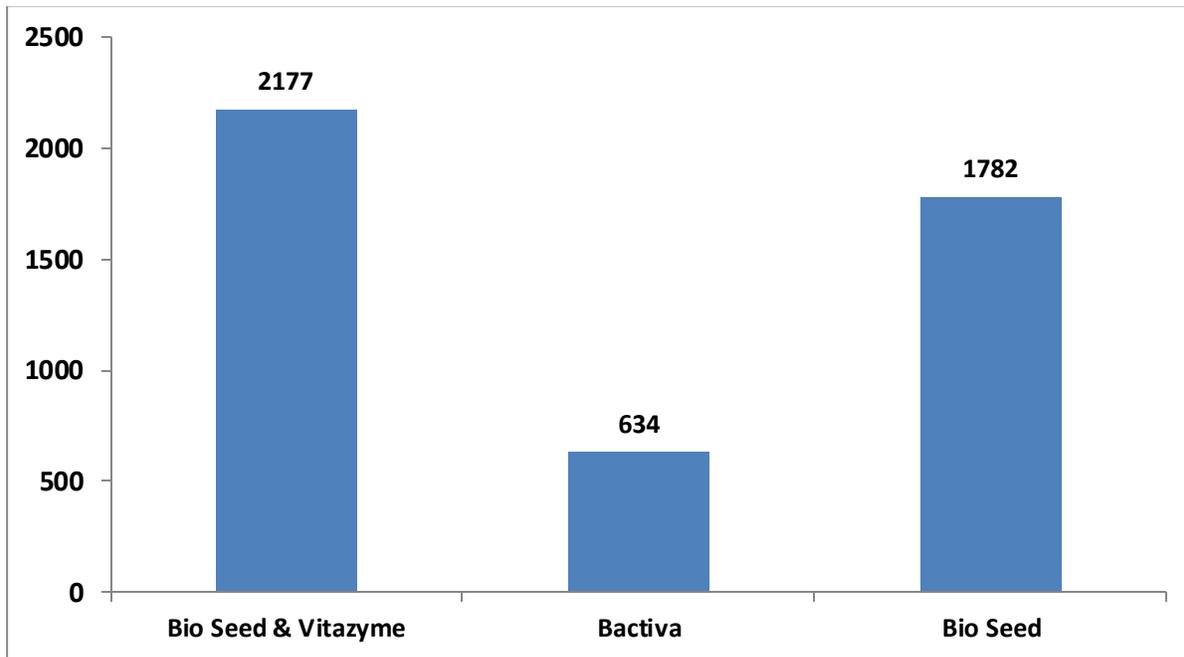


Fig. 2. Added revenues (US/ha) of the studied programs above the Untreated Control.

Table 2. Total onion yields and percentage of bulb size range, according to treatments.

Treatment	Total MT/ha	Dif. vs. Control MT/ha	% dif. with Cont.	% extras to medium	% small & waste	total %
1. Untreated control	39.0	0.0		91.6	8.4	100
2. Bio Seed 1 drench at 125 g/ha + 3 monthly 1 L/ha Vitazyme sprays	48.7	9.7	24.7	92.2	7.8	100
3. Bactiva 4 monthly drenches, cumulative 1.25 kg/ha (500 g/ha + 3 at 250 g/ha)	41.3	2.3	5.9	91.1	8.9	100
4. Bio Seed 1 drench at 125 g/ha	46.6	7.5	19.3	93.6	6.4	100

Table 3. Total value (US\$/ha), cost of evaluated products, fungicides and total profits for treatments.

Treatments/Programs	US\$/ha					
	Total Value	Product cost	Fungicide cost	Total Cost	Profits or Revenues	Added revenues
1. Untreated control	8210,67	0,00	235,68	235,68	7974,99	
2. Bio Seed 1 drench at 125 g/ha + 3 monthly 1 L/ha Vitazyme sprays	10300,61	110,95	37,84	148,78	10151,82	2176,83
3. Bactiva 4 monthly drenches, cumulative 1.25 kg/ha (500 g/ha + 3 at 250 g/ha)	8738,97	130,41	0,00	130,41	8608,56	633,57
4. Bio Seed 1 drench at 125 g/ha	9857,63	25,00	75,68	100,68	9756,95	1781,96

Exchange rate US dollar January/2018: 18.50

Bio Seed price: 200 US\$/kg, 3700 \$MX/kg

Bactiva price: 104.32 US\$/kg, 1930 \$MX/kg

Vitazyme price: 28.65 US\$/L, 530 \$MX /L



Fig. 3. Greater yield and percentage of larger bulbs with Bio Seed + Vitazyme (left) and with Bio Seed alone (center) than with Bactiva (right).