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Bio-Gro, Inc.

Field Research Division

Mexico- Research Report



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*A Look at New Alternatives to Boosting
Yields and Biological Disease Suppression*

PART ONE: IBR Liquid, Microbe Package, Chicken "Tea" and Combination



14 February 2001



Field Research Division Mexico- Research Report

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Introductions and Objectives of Project

As is the case most often "Seeing is Believing". Rancho Los Pinos has tried many new technologies over the years without being able to really determine which methods or products will assist them in obtaining their desired yields and corrected problems such as severe disease pressure. Even though the head agronomist and Director of Technical Services wanted to make some major changes the rest did not want to without first being assured that such changes would in fact make improvements. At stake are tens of millions of dollars of tomatoes and cucumbers.

The cost of controlling diseases has risen dramatically while the success in doing so has fallen short allowing the loss of millions of dollars. While it is common knowledge that Verticillium wilt always exists that was never really clear how much economic damage it has caused. This trial is PART ONE of a two-part demonstration and study trials that show the potential of biological suppression of verticillium and effect yield loss due to disease.

Traditional ag chemicals haven't been controlling disease and nematodes adequately. The yields although as high as other growers in the area it has been common knowledge that yields could be considerably higher if the limiting factors are corrected. At the same time it was assumed that a complete nutritional program would both lend to increased yields but also healthier plants. First study project (Lot 22) was to evaluate several biological and natural products for **disease and nematode suppression** compared against the traditional control chemicals

Report Summary

The results of the disease suppression trial were very impressive even though the evaluation was objective. There was a very strong correlation between yield and the incidence of verticillium wilt. The combination of products showed a 68% yield increase over the control and 293% increase in net profit. Genica yielded 30% higher than the control with 146% more net. Activate (bacteria inoculum) was 27% higher than the control in yield.

However, this field has very poor fertility and strong disease pressure. Therefore, it is good chance to demonstrate the effect of biological products against nematode and verticillium pressure. However, it should not be assumed this level of difference

should be expected in other fields. In the USA, a farmer would be out of business if his fields were as bad as these were.

The nematode suppression was not significant but encouraging to try to do a better job of making timely applications. Since this was a demonstration trial and not a formal replicated scientific research it was a 100% success. That is to say the sole purpose was to show to the owners and operators of the tomato ranch that there is a significant disease problem. And that it can be controlled using alternative less costly methods with a high degree of confidence.

Methods

Disease and Nematode Suppressive Product Evaluation (Lot 22)

The most recently transplanted round slicing drip-irrigated tomatoes were selected from among 750 staggered planted acres. But because of an internal administrative mix up the trial was not allowed to start until the plants were about 12 inches tall (about 45 days old) instead of the first application at planting. We were allowed only two 100 meter rows per treatment. The treatment products were as follows:

1. **Activate I & II** -- Four freeze-dried strains of bacteria; 2 of which are known to be disease suppressive, one a soil residue decomposer and the last producer of rhizosphere PGRs. Rate was 125 gm/Ha twice (1.75 oz / ac. twice). Activate's food source was applied at the rate of 2 kg per Ha.
2. **Soil Amigo** -- A liquid composted chicken and steer manures with added humic acids, and natural phosphate (analysis is 11-1-2). Rate 20 Lt / Ha. twice.

Subdue (companion product to Soil Amigo) is a natural soil fungicide according to claims applied at 1 qts / acre.

Detour (companion to Soil Amigo) a natural soil bio-control of nematodes. Rate of 1 qt / acre.

3. **Genica** -- A Canadian liquid digested organic matter high in organic matter, amino acids, calcium, dissolved solids and microbial fermentation by products which is obtained from city bio-recovered solids. Rate was 20 Lt per Ha twice (2.1 gal / acre (gpa) twice)
4. **Combination A** -- Is a combined application of treatments numbers 1 & 2, plus Soil Amigo from #3 above applied each in their per acre rate and all at once .
5. **Combination B** -- is the same Combined A above with Subdue and Detour added.
6. **Control** -- Even though it was supposed not receive any treatment what so ever, it did receive 80% of the normal fungicides & nematicides
7. **Ranch Norm** -- The traditional fungicide and nematicide norm. For a list ag chemicals see the included list of products in *Appendix B*.

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Each treatment was two 100-meter rows with 2 applications, each which were injected into each row during irrigation. When the normal agricultural chemicals were applied the trial area was disconnected so that chemicals were not applied to the block.

Results and Data

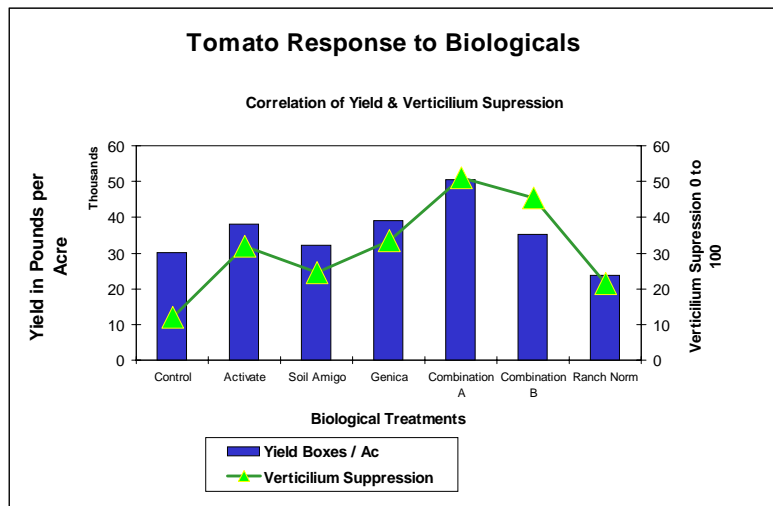
The Results from Disease Suppression Trial are impressive.

Although visually, there did not seem to be large differences, the numerical data shows the effect of small incremental differences in the blocks generalized to an acre is in deed significant.

There is a direct correlation between the suppression of verticillium wilt and the yield (graph 1). Combination A did much better than any of the three separate. Since the evaluation was objective, close results cannot be considered significant in the individual treatment of Activate and Genica but they were significantly better than the 2 controls (control & Ranch Norm). The control had the least suppression but because there were 20% more plants the calculated yield didn't follow the trend. Combination B had 15% fewer plants per row and thus affected the yield calculation adversely.

Since verticillium wilt doesn't initially kill the plant but increasingly impedes the vascular pathway tissues, if early growth is unrestrained by other factors like nematodes, stress etc. the yield will not be as greatly affected through first 2/3 harvest. It is the last 1/3 where the real yield gains occur.

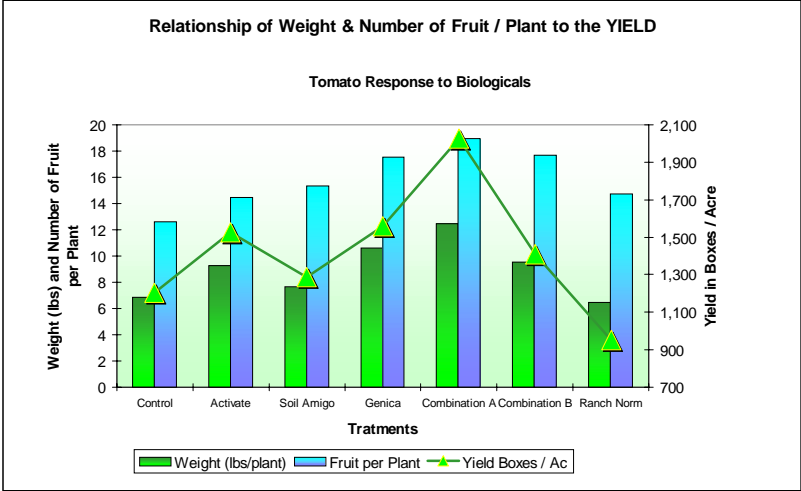
The treatments were applied to each individual row with 3 hp backpack sprayer used as an injector while the irrigation was in process (see picture – Appendix C). All products combinations were applied mixed together.



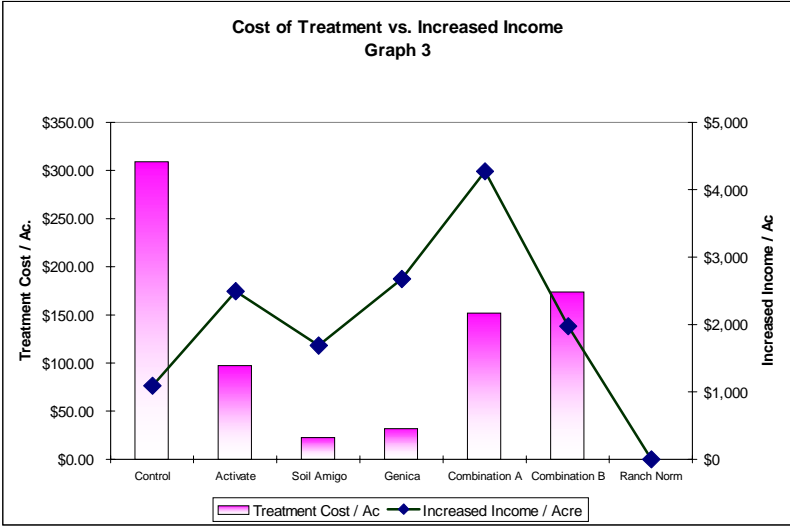
GRAPH 1 is a graphic representation of data found on TABLE 1 (Appendix A – Data Table). It is the Correlation of Yield and Verticillium Suppression. The greater the suppression was the greater the yield. There is almost a perfect correlation.

Verticillium was evaluated qualitatively by visual inspection of 3 random 10 consecutive plant samplings. Yield was quantified by counting all the fruit on 10 consecutive plants in 3 random samplings in each treatment. The fruit was

categorized into 3 sizes. The size weight was multiplied by 10 plant counts then divided by 10 for an average per plant production. The actual number of plants in each treatment was used to find the number of plants per acre for the total yield. The yield difference seems to have been affected by both the size of fruit and the weight per plant. The Ranch norm had many but small fruit (see **Graph 2**). Yield correlates to weight per plant rather than number of fruit per plant.



Using the treatment Ranch Norm as a base zero for comparison since it has the lowest yield the cost of treatment are compared to the increased income for each treatment (see **Graph 3**).



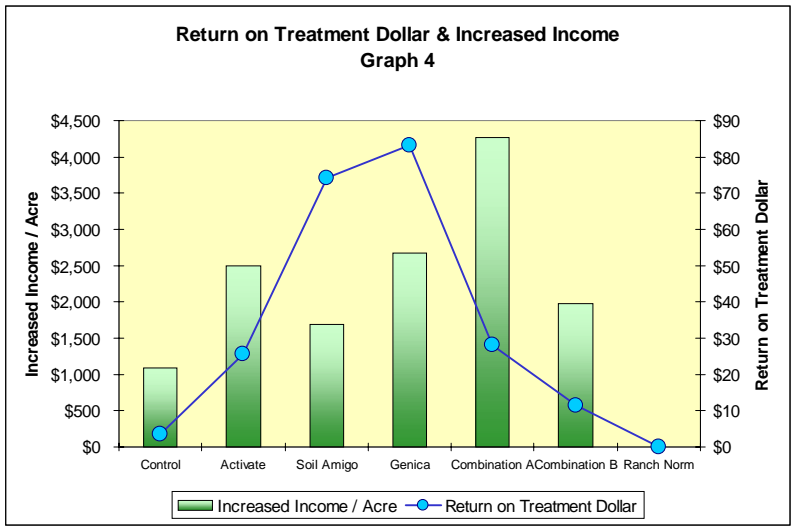
The cost of each treatment is the based on the actual cost in the area, which includes freight. Activate has no weight to speak of and would more than likely hand carried putting the retail price of treatment per acre for both Activate and food source at \$97/acre.

Genica was calculated on freight from Vancouver, Canada to the Mexican border \$3000 per 5000 gallons, bucketing and labeling \$1.25 / gal., export and import duties into Mexico, handling and distribution costs and commissions on both sides of the border would put the retail price at around \$7.50 / gal.

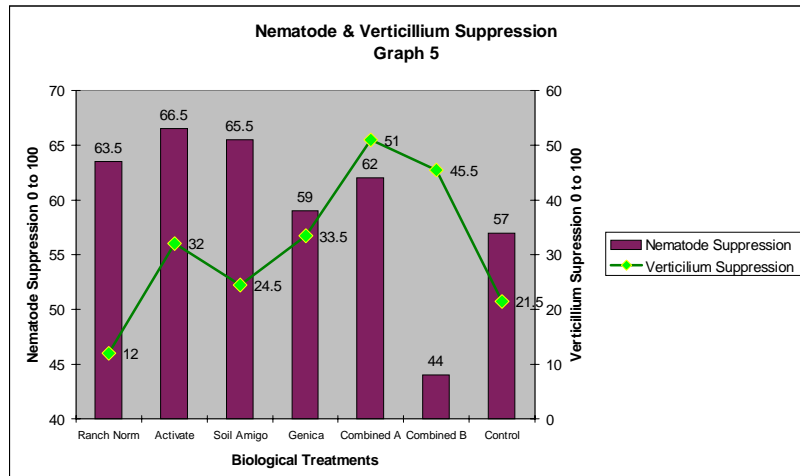
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Soil Amigo is being sold for \$5.50 / gal COD bucketed and labeled, imported. Soil Amigo will be used at higher rates in the future. The traditional fungicides were used at excessive rates trying to get a response with a cost to the ranch of about \$300 /a acre.

Graph 4 shows the return on the treatment dollar.



The nematode damage in the block was spotty and affected some rows more than others, which showed up, as a yield reduction but is unrelated to verticillium wilt. The nematode evaluation was also qualitative, with two 10-plant samples from each treatment straight across the field. The tomato roots were dug up and inspected for root knots. They were given an evaluation of 1 to 10 with 10 being totally infested with nematode galls and knots. The 10-plant average were totaled and subtracted from 100 to get the suppression value (see Graph 5). It appears that possibly the roots were already infested when the first applications were made but even so the treatments still bettered the traditional treatment which did precede the transplanting. Even with this and other deficiencies in the mechanics of the test there is a strong correlation both in data and the visual appearance all season long.



Conclusions

1. The economic damage verticillium is doing is devastating but can be suppressed using alternative and biological methods. This proved to be very profitable.
2. Combination biological products proved to be better than any one alone.
3. Timing is important in biological controls for early infestation problems. That is to say prevention is better than trying to cure once infested especially with nematodes.
4. These treatments definitely have a future for both the grower and the service provider.

Please forward questions and comments to;

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Appendix A – Data Table

TABLE 1




Treatment	Yield Boxes /Ac	Total Sale Value / Ac.	Field Production Costs	Total Costs	Net Profit	Treatment Cost / Ac	Increased Income / Acre	Return on Treatment Dollar	Yield % Above Control	% Increase Net over Control
Control	1,203	\$7,820	\$3,036	\$6,423	\$1,397	\$308.86	\$1,088	\$3.52		
Activate	1,526	\$9,920	\$3,036	\$7,333	\$2,588	\$97.17	\$2,490	\$25.63	27%	129%
Soil Amigo	1,287	\$8,368	\$3,036	\$6,660	\$1,707	\$22.67	\$1,685	\$74.31	7%	55%
Genica	1,559	\$10,132	\$3,036	\$7,425	\$2,708	\$32.19	\$2,676	\$83.13	30%	146%
Combination A	2,025	\$13,162	\$3,036	\$8,737	\$4,425	\$152.02	\$4,273	\$28.11	68%	293%
Combination B	1,408	\$9,149	\$3,036	\$6,999	\$2,150	\$174.02	\$1,976	\$11.36	17%	82%
Ranch Norm	952	\$6,190	\$3,036	\$5,717	\$473	\$0.00	\$0	\$0.00		

Appendix B

1. The Traditional agri-chemical products used—fungicides and nematocides.
 - a. Rugby at rate of 8-10 Lts per ha.
 - b. Vidate 8-10 Lts. per ha.
 - c. Namacur 8 Lts per ha.
 - d. Tecto 60 (ai- tiabendazol) 1 kg per ha.
 - e. Carbendazim 2 Lts.
 - f. Basan 30 W 2-3 Lts

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Appendix C - Pictures

	<p>This demonstrates how the products were injected into the drip lines.</p> <p>This system works well for treating a row, through a drip system, without causing problems.</p>
	<p>Genica</p> <p>These roots are an example of the ones used for the nematode evaluation.</p>
	<p>Combination A</p>



Ranch Norm



This root is an example of a plant extremely infested by nematodes.