

Investigation of production increases in strawberries with the addition of technical organic soil amendments to usual grower practice.

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Abstract: Refinement methods have allowed the latest generation of Technical Organic Acids (TOA) to resolve the reliability in field results from basic leonardite extractions (humic, fulvic acids). Two market leading products are independently tested under scientifically valid and commercial relevant field conditions to increase the production of garden strawberries.

At a cost of US\$80/acre, the first TOA increased nett return to the farmer by \$1,145/acre (1,356% ROI). The second TOA at a cost of \$60/acre increased profit by \$1,048/acre (1,653% ROI)

Key Words: strawberry, production, technical organic acids, soil amendments

Background: The opportunity to increase production using organic soil amendments has been known to farmers since before recorded history¹. Extracts of organic acids (humic, fulvic, ulmic) from leonardite ore have long been touted as useful, though met with varied success, since first adopted in the late 18th Century².

The efficacy of commercial products, generally classed as humic and fulvic acids, is governed by a wide array of factors including; mother ore composition, extraction method, refining method, and filtration. Many commercially produced products are “basic” extractions using a hydroxide bath method, settling, some filtration and little else. The variability in end product active ingredients using basic methods is a lead cause of variability in field results from this class of products.

Several modern manufacturers have developed method to further refine basic products to produce “technical organic acids” (TOA). TOA refinement can include manipulation of functional groups, pore size and distribution, molecular surface area and exchange capacity characteristics as well as add other biocatalysts, mineral elements, and biostimulants.

Unfortunately, these refinements are difficult to differentiate at the farm level as different from the underperforming basic method products which may look and feel the same. It is this reason that farmers must be presented results and information for testing conducted under three strict criteria:

- 1) Conducted by Independent Research Company/Organisation
- 2) Scientifically Valid method
- 3) Commercially Relevant operations

This investigation looks at two related Technical Organic Acid products, supplied by EcoCatalysts Pty Ltd, ability to increase production economics (dollar returns to the farmer), by adding TOAs to the usual fertilizer and soil program.

Location: Ventura, CA (Terry Farms)

Crop: *Fragaria x ananassa* – Garden Strawberries.

Treatments:

1. Grower Standard Program (GSP)
2. GSP + EnhancePlus @ 1.6 gal/acre (15L/ha)
3. GSP + EnhanceTHA @ 1.6 gal/acre (15L/ha)

Application Method: Fertilizer was applied via drip irrigation system diluted in 21 gal/acre (200L/ha) water at planting October 4th, 2013. Amendments were applied November 5th via the same application method.



Treatments are placed as close as possible in the same general area of the field, same variety of strawberries, produced by the same nursery with the same dig and plant dates and lot numbers to reduce any variable that could occur with these parameters.

All other farm operations (e.g. irrigation, pest and weed control, machinery and implements, etc.) were conducted as normal on the entire farm.

Plots: 6 replications of each treatment, complete randomised block design, each plot 20' x 13' (6m x 4m). Test area represented 1.5ac (0.63ha) of a 20ac (8ha) field on an 82 acre (33ha) farm.

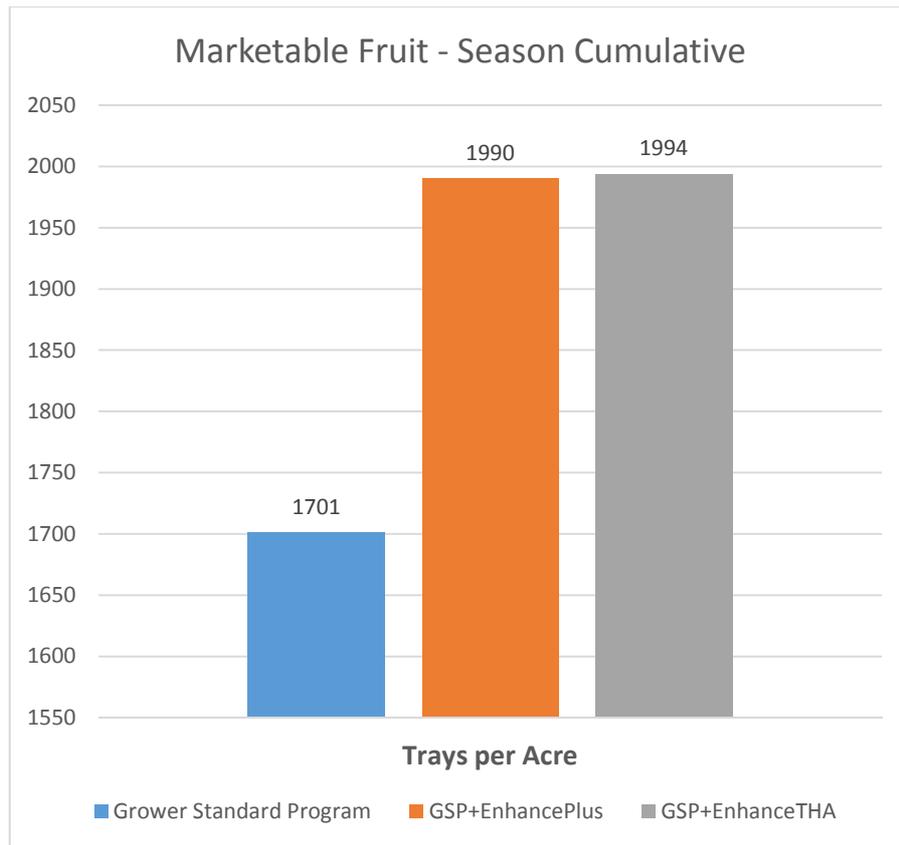
Results and Discussion:

Pre-pick analysis of flower and fruit sets was taken weekly prior to the start of picking, though no significant difference was evidenced, EnhancePlus treated plots recorded a ~4.5% increase of fruits per plant over the GSP non-amended plots.

1 month after amendment application (on December 5th), 1 plant from each replication was pulled and the root fresh weight measured and averaged. Whilst no statistical significance was measured between treatments, the GSP averaged 9.1g/plant root mass, EnhancePlus 11.9g and EnhanceTHA 10.9g suggesting a trend that Enhance amended plots cause a greater root mass.

Picking began on January 13th, 2014 with final pick on April 8th, 2014. Whilst little to no difference in trays of marketable fruit per acre occurred early in the picking season, the gap between amended and non-amended plots became clearly evident in March with the gap widening further until final pick.

After final picking the cumulative trays (10lb) per acre of marketable fruit was GSP 1701 trays per acre (19.06t/ha), EnhancePlus recorded 1990 trays (22.3t/ha) (↑17%) and EnhanceTHA recorded 1994 trays (22.34t/ha) (↑17.2%).



From the yield data we can extrapolate the economic impact of the treatments. Pricing over the season varied from starting at approx. US\$13.00 per tray, dipping to below US\$2.00 late in the season but recovering to US\$4.00. Using the USDA Shipping Point Market Prices for each day of picking, this represents the net back to grower after costs of approximately \$6.00 per tray were removed that would represent picking labour, carton and tray costs, transportation to the cooler, and cooling costs associated with picking the strawberries.

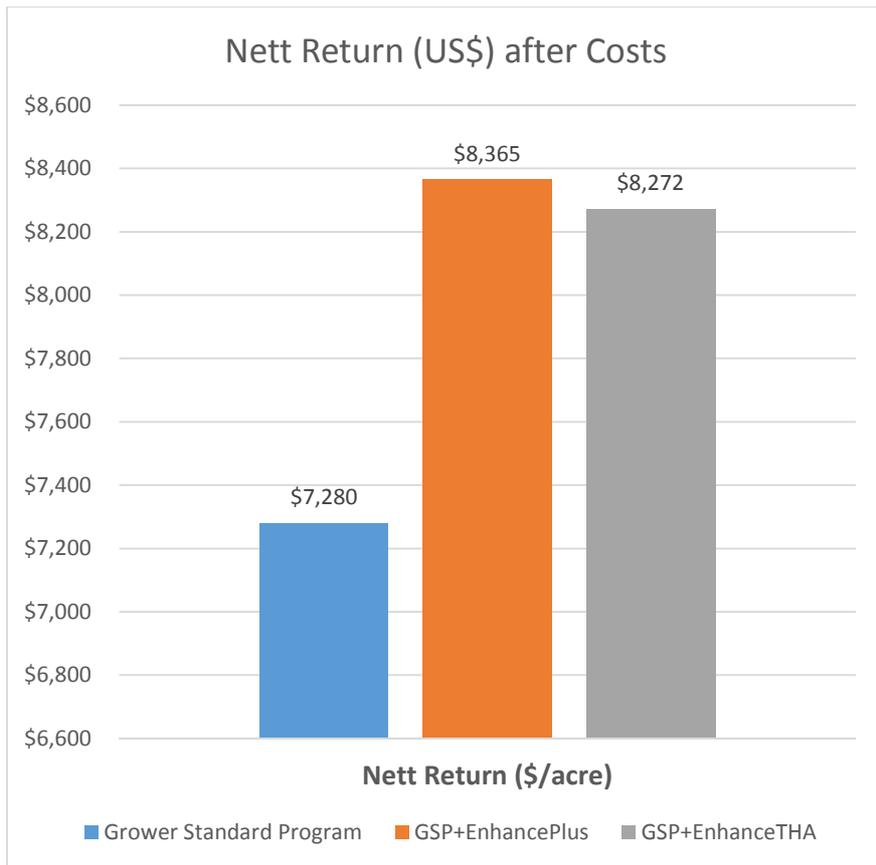
The return to the farmer for each of the treatments is US\$7,280 per acre (*A\$23,353/ha) for Grower Standard Program, US\$8,445 per acre (*A\$27,090/ha) for GSP + EnhancePlus and US\$8,332/acre (*A\$26,727/ha) for GSP + EnhanceTHA.

The costs of amendment above the GSP is US\$80 per acre (*A\$104/ha) for EnhancePlus and US\$60 per acre (*A\$78/ha) for EnhanceTHA. This produces a net return on investment of US\$1,085/acre (*A\$14,091/ha) (1,356% ROI) for EnhancePlus and US\$992/acre (*A\$12,883/ha) (1,653% ROI) for EnhanceTHA.

*A\$ calculated at 0.77 exchange rate

The daily market utilization for the berries picked during the season, which is the percent of marketable berries to the total weight of berries picked, the Grower Standard Program and Enhance Plus program showing a 57.6% utilization and the Enhance THA at 61.8% utilization on average.

Some small improvements with average berry weight were seen with both of the Enhance products over the grower standard. The GSP berries averaged 24.14 grams for the season compared to 25.01 grams for the Enhance Plus treated berries and 27.49 grams for the Enhance THA treated berries.



An end of season soil samples was taken and analyzed by A&L Western Agricultural Laboratories in Modesto, California. Report 14-093-015 shows low supplies of nitrate nitrogen residual in the Enhance treated soils (12ppm and 7ppm respectively), with more than 3 times higher results (44ppm) found in the GSP soil suggesting a marked increase in nitrogen use efficiency where Enhance treatments are applied. This is a typically expected of highly refined TOA products.

Report 14-051-006 taken mid-season and reports on leaf levels of all the major elements at the time of the analysis. Slightly better supplies of nitrogen, phosphorous, potassium, manganese, and zinc were found in the plants grown in the Enhance treated soils. Though not seen as significant, the consistency of these elements in the Enhance treated soils is a very positive sign.

All data rated as significant was done so utilizing the New Duncan's Multiple Test Range at a 90% confidence level.

Conclusion:

The addition of the two TOA amendments delivered a sum of small gains to generate a large economic return. Improvements in flowering, fruiting and root development early on produced significant improvements in marketable yield and even greater returns economically at the end of season. Other improvements suggested by the data that contributed to the production success include great marketable fruit percentage, greater weight per berry and improved fertilizer use efficiency.

With returns on investment well over 1000%, the addition to EnhancePlus or EnhanceTHA to a grower stand program is an economic and environmental win in this farming system.

REFERENCES

¹ Lapedes, Daniel N., ed. (1966). "McGraw-Hill encyclopedia of science and technology: an international reference work, Volume 12". McGraw-Hill. p. 428. ISBN 0070452652. The value of adding organic matter to the soil in the form of animal manures, green manures, and crop residues for producing favorable soil tilth has been known since ancient times"

² Achard, F.K. *Crell's Chem. Ann.* 2, 391-403 (1786)