

Blueberry Growth Trial

Performed by

Microbial Matrix Systems Inc.

Summer/Fall 2006

33935 HWY 99E STE. B, Tangent, Oregon 97389;
Tel. (541) 967-0554

Lynn Rogers, B.Chemistry, Biochemistry and Biophysics
Chief Scientist

Blueberry Variety: Reka



Client: Great Pacific Bioproducts Ltd
7963 Webster Road, Delta, BC Canada
T. 604.952-4333 W. www.greatpacificbio.com

Introduction

The use of organic sources of Nitrogen has called for research to demonstrate the "mechanism of action" of how this type or source of fertilizer with a "lower" guaranteed NPK analysis than conventional synthetic fertilizers compares on performance indicators such as crop yield, root development, plant health and soil condition.

Prior research conducted by Microbial Matrix Systems Inc. has shown that some sources of organic fertilizers encourage the growth of some key soil microorganisms with beneficial properties. One type, Ericoid Mycorrhizal Fungi (EMF), when encouraged to proliferate, have demonstrated better or more efficient uptake of required plant nutrients.

Selecting inherent inoculums that are present in the environment must then be encouraged to grow. EMF enhances the uptake of water, Nitrogen, Phosphorus, Potassium, Sulfur and Calcium. EMF has also been demonstrated to help to protect plant roots from disease.

There are no known commercially available Ericoid Mycorrhizal Fungi products.

Trial Objective

Great Pacific BioProducts, a producer of liquid organic fresh fish fertilizer in Delta, BC Canada, approached Microbial Matrix Systems to quantify the mechanisms of action of its main fish bioproduct, Pacific Natural 2-3-0 liquid fish fertilizer. A trial protocol was set up to establish:

- effect on nutrient availability, using different fertilizer treatments
- plant uptake of Nitrogen
- effect of different fertilizer treatments on quantities and vitality of Ericoid Mycorrhizal colonies
- effect of different treatments on plants of varying vigor types

Growth Trial Design

An open-air potted plant trial was designed to evaluate 5 different fertilizer treatments across a number of variables of interest to growers, utilizing replicates of 7 potted blueberry plants per treatment. Thirty-five potted plants were used:

- Total number of berries per treatment
- % Nitrogen in leaves of each plant
- % Ericoid Micorrhizal Fungus
- Total number of berries per plant vigor type (using the criteria Best, Better, Good, Average, Poor, Poorer and Poorest)
- Results were averaged across the replicates for each of the 5 treatments.

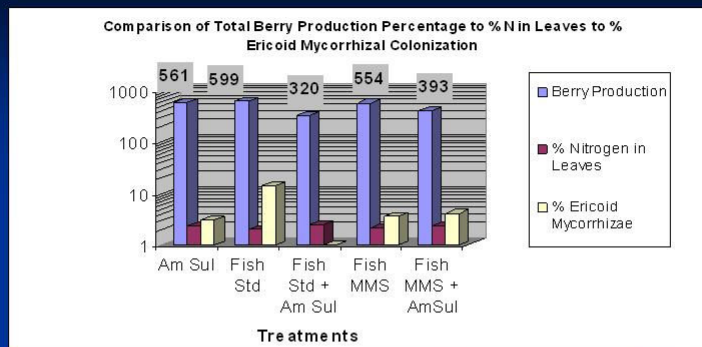
The variety of blueberry plant selected was Reka, a mid-bearing northern variety described as: *Early. Ripens between Earliblue and Bluecrop, upright, very vigorous bush, extremely productive. Fruit is dark blue, medium size, small scar, and firm.*

The 5 treatments were as follows:

Am Sul	Standard Ammonium Sulfate(45% N)	120 lbs/Ac total for Season (applied 3x)
Fish Std	Great Pacific BioProducts Pacific Natural liquid fish hydrolysate 2-3-0	10 gal/Ac 2x soil drench, diluted 10:1 water to fish [first prior to bud break, second prior to fruit set]; and 1X 5 gal/Ac Foliar application, diluted 50:1, or higher (total 25 gal fish concentrate/Ac). Avoid foliar application during bloom.
Fish Std + Am Sul		Same rates for each, as above, combined.
Fish MMS	GPB's Pacific Natural at more frequent applications (MMS = Microbial Matrix Solutions rates)	1 gal/Ac soil drenches every 2 weeks to equate to Fish Std for season (20 -25 gal fish/acre for season).
Fish MMS + Am Sul		1 gal/ac 1x every 2weeks to add up to a total of 20 gal/Ac for the whole season plus 120 lbs/Ac rate of Am Sul.

Results

Two summary tables were prepared from the results. The first table shows the 5 treatments, total berries/treatment, % nitrogen in plant leaves and % ericoid Mycorrhizal fungi (EMF).



- Fish Standard 2%N shows similar % Nitrogen in leaves as Ammonium Sulfate with 45% N. Plant will only take up the amount of Nitrogen that it needs
- Fish Standard treatment had highest berry production with Organic Nitrogen of only 2% N
- Ericoid Mycorrhizae (EM) was highest in Fish Standard treatment. Important since there is no known commercially available EM product. EM are beneficial plant fungi that enhance uptake of N,P,K, Ca, S and water
- The increase in EM production this year will help with next year's yield

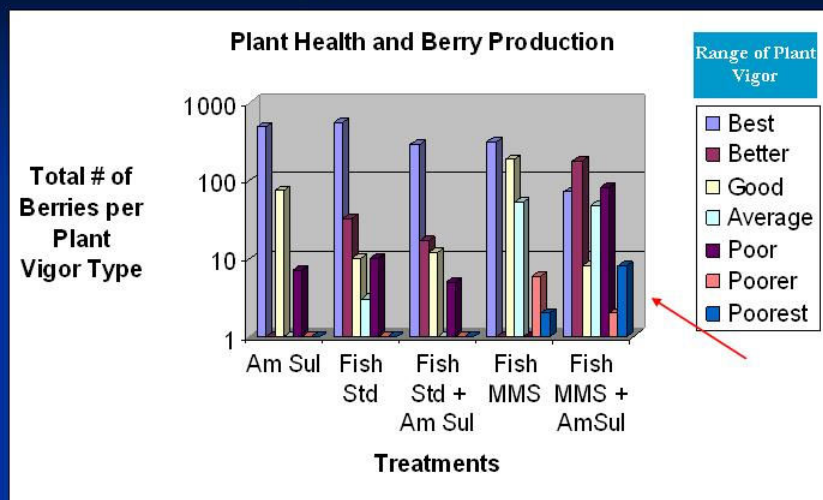
While the Ericoid Mycorrhizal (EMF) levels are variable in each treatment above, the highest level¹ occurred in the Fish Standard Treatment (GPB's Pacific Natural), at the Manufacturer's recommended rates.

The above data indicates that irrespective of the source of Nitrogen or the application rate, the degree of Nitrogen uptake² into the leaves was about the same for each of the 5 treatments. However, the affect that each treatment had on EMF did correlate positively with berry yield.

The Fish Standard Treatment showed the highest EMF levels and also the highest berry production.

It is noteworthy, that the Fish MMS + Ammonium Sulfate Standard and the Fish MMS treatment had higher levels of EMF than the Fish Standard + Ammonium Sulfate Standard (lowest).

Increased Plant Vigor and Production in Poor Areas



- Using Pacific Natural fish product will increase poorer producing fields to same level or close to the same level as best producing fields resulting in even production throughout field

- Enhance the potential for yield kicker by evening out production throughout field

¹ Ericoid Mycorrhizal only colonizes roots. The plants used in the trial were bare root at start of experiment – no significant root structure was present for EM to colonize, so EM at start was 0. EM measured is % EM at end of experiment.

² Both NH₄ and NO₃ were measured in the leaves at end of experiment. Blueberries prefer the NH₄ form.

It is the objective of every grower to maintain a field in which the plant growth and vigor is even. However, in most fields there is usually a section of poor growth and an area of good growth and some additional variability across the acreage.

In this outdoor potted growth trial, berry counts were distinguished by the type of plant vigor (best to poorest). Notice that treatments Fish MMS and Fish MMS + AmSul in which the Fish was applied every 2 weeks at 1 gallon/Ac resulted in the poorest vigor plants producing berries.

Thus a grower can experience a "yield kicker" simply by evening out the production in his field. Even the "poor" section of his field can have a higher yield. Various sources of organic nutrients can help to bring the level of a poorer producing area up to or close to the level of a good producing area or field.

In perennial crops, a grower must "harvest today but farm for next year's production". Since the poorest vigor plants in this trial started to produce berries in Year 1, they will continue to do so as their vigor and health increases.

Thus, a grower will continue to have a steady increase in yield and the yield will be more even from year to year because all plants will be producing berries.

Conclusions

1. The highest berry yields in the trials were from plants treated with GPB's Pacific Natural liquid fish product with 2% N, approximately 6% higher than the Ammonium Sulphate conventional treatment with 45% N, applied at 120 lbs of N per season.
2. Leaf tissue levels of N were similar across all 5 treatments indicating that blueberry plants (or this variety) only synthesize and uptake the amount of N required for plant metabolism and fruit production.
3. This trial indicated that although the highest EMF response was with the 100% GPB fish product, a favorable response was also observed with a regular feeding or "spoon-feeding" protocol of this product (MMS rate of 1 gal/acre throughout the growing season, except during bloom) with or without Ammonium Sulphate.
4. It appears that this technique enhances production as well as evening out production of plants of various vigor types.
5. EMF growth and abundance are very sensitive to the sources and types of Nitrogen and Phosphorus (organic fertilizers or synthetic) that they are exposed to. EMF seems to prefer certain carbon food sources that are more constantly available in the soil either from plant roots or organic sources of carbon.
6. Many growers are adopting a combination feeding regimen using a more frequent feeding schedule and are observing that using organic fertilizers (i.e. fish) results in better plant health and better quality berry production.
7. Growers are provided with many application options allowing for the versatility of the GPB's fish product to accommodate the differences in each growers production operation, soil conditions and/or economics.

It should be noted that although this potted plant trial was conducted in outdoor semi-controlled conditions using the Reka variety, other blueberry varieties and plant types may demand different fertilization programs. Soil type also is a factor and should be taken into consideration when designing the best fertility program for the crop in question.