Progress Report – Effective Microorganisms
2007 and 2008 Season

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Cooperators: Coquille Cranberries

Objectives: To determine if EM1® (Effective Microorganisms) impose any beneficial effects on cranberry plant health, fruit yield, or soil pH.

Methods: In 2007, effective microorganisms were applied to research plots on a Stevens cranberry bed in Coos Bay, OR. The trial plots were placed in a randomized complete block design, with 4 replicates. Plot sizes were 10' x 10', with a 10' buffer between treatment plots to minimize treatment spread. Effective microorganisms were applied to one plot in each block at the following rates; 1:25 (5oz./gal), treatment B; 1:42 (3 oz./gal), Treatment C; 1:64 (2 oz./gal), treatment D; and a control plot, treatment A, where no effective microorganisms were applied. Application dates in 2007, were May 18, June 1, June 15, June 29, July 30, August 24, September 7, and September 21. In 2008, applications at the same rates were made on May 28, June 11, June 25, July 23, September 3, and September 17. No application was made in August of 2008 due to high winds and a batch of bad formula. Applications were made by hand using a backpack sprayer and a total of 1 gallon of mix per plot.

On September 10, 2007, and September 8, 2008, leaf tissue samples and soil samples were collected from every plot and analyzed for all major macro and micro nutrients. Soil samples were also tested for pH. On September 26, 2007, and October 2, 2008, cranberry uprights where counted within each plot from a 1 square foot area. On October 2, 2008, fruit samples from a 1 square foot area were collected.

Data was analyzed using SAS 9.1, ANOVA, with mean comparison using Tukey's HSD procedure.

Results:

2007
An initial soil test was conducted on the cranberry bed, prior to the first treatment. At that time, soil pH was 6.6 – a level outside of the optimum range for cranberries, which is 4.2-5.5. Phosphorus (P) levels were at 18 ppm and potassium (K) levels were at 71 ppm.

Soil: Soil pH ranges in September 2007, had dropped to between 5.9 and 6.1, with no statistical differences within any of the plots due to individual treatment effects, however the control plots showed the lowest pH values. All plots remained outside the optimum range of pH for cranberry growth.

Results for soil analyses of phosphorus (P), potassium (K), magnesium (Mg), calcium (Ca), manganese (Mn), boron (B), and zinc (Zn), showed no statistical differences

between treatments. Soil levels of P and K were within optimum ranges. Soil Ca and Mg were slightly below normal, and soil B and Zn were well below normal ranges.

Tissue: Results for tissue analyses of nitrogen (N), phosphorus (P), magnesium (Mg), calcium (Ca), manganese (Mn), boron (B), zinc (Zn), and copper (Cu) showed no statistical differences between treatments. Tissue potassium (K) was the only nutrient to exhibit statistical differences ($p<0.005$), with the lowest levels of soil potassium being in the 1:64 plots, with a mean of 0.39, significantly lower than within the other treatments, where tissue potassium levels ranged between 0.41-0.42. Tissue levels of P, K, Mn, Cu, B, and Zn, were within sufficiency ranges for cranberries. Ca and Mg levels were in the excess ranges for cranberry tissue nutrient levels, and N levels were in the low range for cranberry tissue, ranging from 0.81-0.83% N for all treatments.

Upright numbers: Cranberry upright numbers per square foot were lower in all plots than the recommend standards. Plot upright numbers where between 155 – 269 uprights per one square foot area. There were no statistical differences to upright numbers due to treatments.

Yield: Fruit yield data was not collected due to low numbers of fruit within the bed.

2008

Soil: Soil pH ranges in September 2008 remained similar from 2007 levels. pH ranged from 5.8 to 6.2 in all treatments. There were no statistical differences seen due to treatment rates. Results for soil analyses of phosphorus (P), potassium (K), magnesium (Mg), calcium (Ca), boron (B), zinc (Zn), and copper (Cu) also showed no statistical differences between treatments. Mg and K were within sufficiency ranges for optimum cranberry growth. Zn and B levels were low. Ca levels were extremely high, and P levels were within the sufficiency level for all treatments, except for the 1:64 treatment rate which was in the low range.

Tissue: Results for tissue analyses of nitrogen (N), phosphorus (P), potassium (K), magnesium (Mg), calcium (Ca), manganese (Mn), boron (B), zinc (Zn), and copper (Cu) again showed no statistical differences between treatments. Tissue ranges for N, P, K, B, Mn, and Zn were all within sufficiency ranges for cranberries. Tissue levels of Ca, Mg, and Cu were all in the high range.

Upright numbers: Cranberry upright numbers per square foot were lower in all plots than the recommend standards. Upright numbers were lower than in 2007, averaging 116 – 145 uprights per square foot (see chart 1). There were no statistical differences to upright numbers due to treatments.

Yield: All fruit was hand harvested from a 1 square foot area in October, 2008. Fruit yield was low, averaging 3-13 grams per square foot. There was no statistical differences seen between treatments.

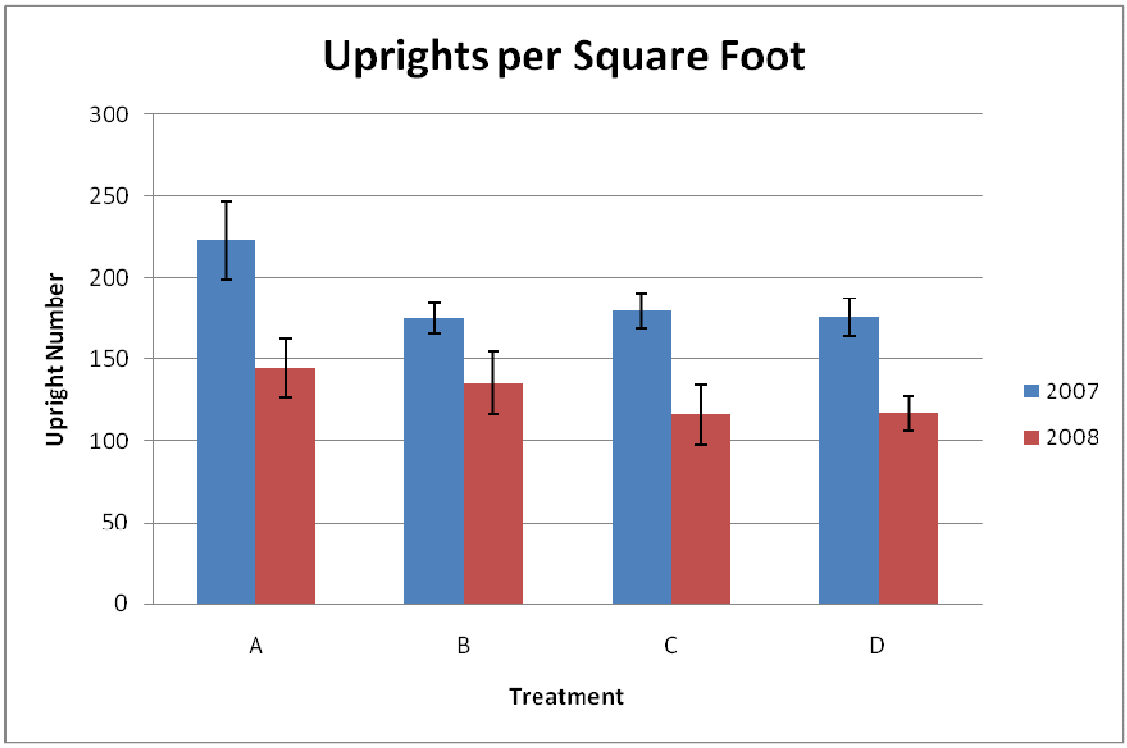

Chart 1. Number of uprights per square foot by treatment effects and year.
Treatment A=control; Treatment B=25:1; Treatment C=42:1; Treatment D=64:1

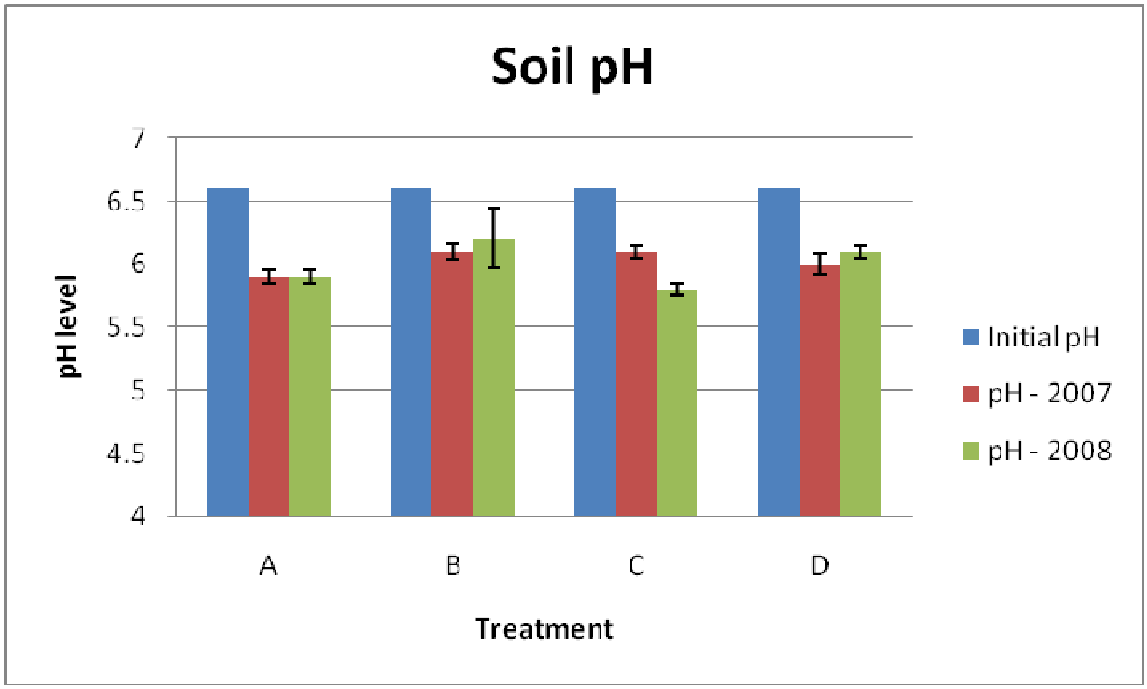

Chart 2. Soil ph across treatments, over 2 years.
Treatment A=control; Treatment B=25:1; Treatment C=42:1; Treatment D=64:1

Discussion: The treatment plots received a standard fertilizer regime in both 2007 and 2008; the EM applications were in addition to standard practices. Based on the 2007 and 2008 data on soil and tissue analyses, EM applications showed no beneficial effects. In 2008, no statistical differences were seen in tissue samples, so the standard fertilizer regime was likely the main source of nutrients for the cranberries. In 2007, there was a difference seen in tissue K – but in the lowest EM treatment plots (Treatment D<C<B<A). The control plots contained the greatest amount of tissue K. There is some possibility that this is due to level of concentration within the plant, however upright growth was not monitored for this experiment. If there was more upright growth within the EM plots, nutrient levels of K could be different within treatments, however, the expected response would be that the plots receiving the higher rates of EM would have the lowest levels – not the low rate of application. A similarity of nutrient status was not seen with other tissue nutrient levels, nor where there significant differences in soil K.

While there were no statistical differences seen within upright numbers in either 2007 or 2008, there was a general trend of the control plots having more uprights per square foot than the treatment plots. This trend was more apparent in 2007 than in 2008. In 2008, the control plots and the highest rate of EM (B treatment, 1:25) where very similar in upright numbers. All upright numbers decreased in 2008, which was not generally considered a productive year in Oregon. A lack of uprights is a large area of concern as yield is directly tied to the number of uprights per square foot, so any lowering of upright numbers is detrimental.

Soil pH is extremely important for cranberries. They are an acid-loving plant, requiring pH ranges between 4.2 and 5.5. The research bed had an initial soil pH of 6.6. pH levels were reduced in all treatment plots in 2007, implying that something other than EM applications changed the pH. It is likely that the standard fertilizer regime brought the soil pH level down, In 2008, pH levels remained the same as in 2007 in the control plots, but rose slightly in the B and D treatments. The C treatment lowered slightly. Only the 2008 C treatment had a lower pH than the treatment plots; however this treatment effect did not correlate to an increase in upright number.

Conclusions: Since cranberries are a perennial crop, it is not unusual for it to take two years to see any affect from treatment changes. However, EM applications were made for two years and there were no apparent beneficial effects – in fact, upright numbers decreased over the two years and soil pH rose in the same time. While the very long term effects of EM may be beneficial (soil microflora were not analyzed), the short term effects, especially given the extra cost of product and application time, appear to be unfavorable for optimum cranberry growth and yield.