

Year End Report for Two-Year Project to Control Verticillium Wilt

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Introduction

The Maine Potato Board funded a project last year to evaluate two methods to reduce the effect of verticillium wilt in potatoes. The original design was to do strip trials in two fields in Aroostook county: one comparing chloropicrin and high glucosinolate mustard compared to a check and another comparing vapam, high glucosinolate mustard (HGM) and a check. Erica Fitzpatrick and Matt Porter were our cooperating farmers, and we worked with McCain Foods staff to monitor the trial development.

The project involved splitting two fields into three strips. The plan was to plant HGM after barley harvest, disk and treat the soil with either chloropicrin or vapam, and to have a check plot. Instead we used a field planted to a barley pea silage mix, and a field that was in forage grass. The fields that were selected by our cooperating farmers were fields that the growers felt they were underperforming and likely had significant amounts of verticillium.

Methods

The fields were identified at both farms, and we collected replicate samples from each of the three treatments to establish background levels of fertility, soil microbial processes and disease. The soil samples were tested for microbial respiration, potentially mineralizable N, organic matter content, and ammonium and nitrate-N. These were collected in July. We split the samples in half, and Alicyn is currently analyzing those samples.

At the Fitzpatrick farm, the soil was prepared in the HGM strip and sown to HGM at 10 lbs/ac rate on 7/31. Rainfall, after planting and through the early development, was very light and emergence and growth was slower and less than we found in previous work. The remainder of the silage was cut from the Fitzpatrick field in August. The mustard was mowed and disked into the soil on 9/26, and the remainder of the field was worked with vapam applied on 9/28. On the 10/16, we pulled soil samples from the field for the post treatment comparisons. The HGM was sown at the Porter field in Easton on 8/3/18. Weather was also drier than normal and the mustard development was even slower at Easton than at Houlton. Biomass was sampled at both Houlton and Easton on 9/18. Unfortunately, that was all we were able to do at the Porter field. Due to very wet weather, the mustard was never mowed and disked, and no chloropicrin was applied. The best of intentions were there, but the weather and timing was horrible this past fall.

Results

Add discussion of mustard biomass!

Although the experiment was not replicated, we took four replicate samples before and after treatments were applied. We performed statistical analysis of the samples before

treatments, after treatments, and the actual differences in levels from before and after. All of these results of course came from the Fitzpatrick site.

When we analyzed the samples post treatment samples for soil respiration, I was impressed by the level of CO₂ respiration (Figure 1). Respiration was lower following Vapam application, but not statistically different. But the ~30% reduction in microbial activity might indicate that the Vapam had reduced microbial activity compared the check or mustard treatments.

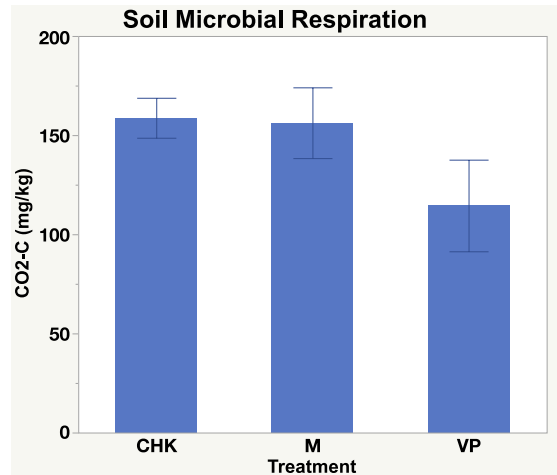


Figure 1. Comparison of post-treatment pathogen control compared the check plot at Erica Fitzpatrick's field.

When we took pre and post treatment level differences, we did see a statistical difference (Figure 2). The mustard had the highest respiration post treatment compared to the Vapam treatment. This suggests either that the Vapam treatment was more effective at reducing pathogenic bacteria, or that the mustard and vapam were similar but after 17 days, the soil microbes have recovered and due to the carbon input, their populations have grown and respiration has recovered and is higher than the initial levels. There was no difference between the control and the HGM post-pre levels.

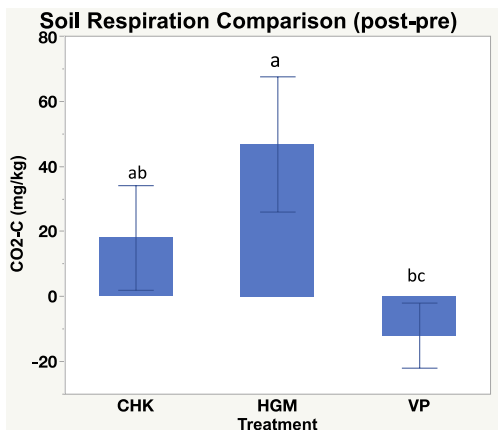


Figure 2. Post-pre levels of soil respiration after pathogen control treatments applied.

Both the potentially mineralizable N and the organic matter levels in the HGM treatment were not statistically higher as there was a great amount of variability in the samples. But the ammonium and nitrate content was statistically higher post treatment. This was likely due to the mineralization of the HGM biomass releasing the N from that biomass. The difference in ammonium concentration was highest in the vapam treatment. As we sampled this two weeks after application, it is likely that the microbial cells killed by the fumigant were likely being decomposed at the time releasing ammonium. This is may be the best indicator that the Vapam may have more effect than the HGM.

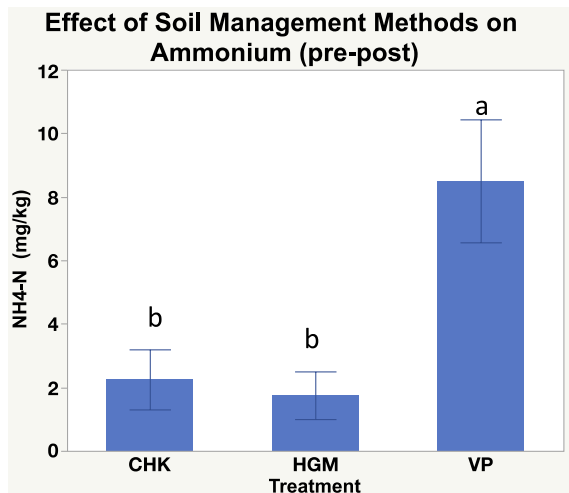


Figure 3. Difference in soil ammonium content post treatment compared to pre.

Discussion

The true test of which of these methods will have impact will be found in the potato production year. We chose to try to assess the effectiveness of HGM using equipment that the farmers of Aroostook county have. A flail mower would have shredded the material more completely, but most farmers do not have that equipment. So for HGM to work in Aroostook county, we need it to work for the farmers with the equipment available to them. If the method turns out to be effective, this would be a viable method to control soil borne pathogens. If the Vapam treatment is more effective, it was applied mixed and sealed in an ideal manner.

We will report on the verticillium data at the potato conference in late January.