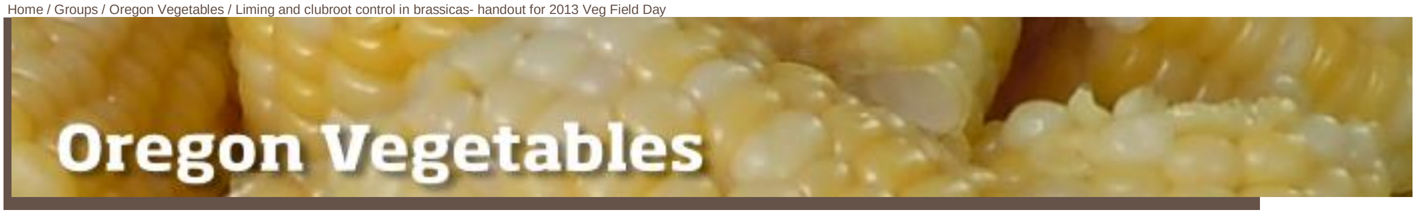

Liming and clubroot control in brassicas- handout for 2013 Veg Field Day

Publication Date:
07/29/2013

Clubroot is becoming an increasing problem on Willamette Valley vegetable farms. Most cultivated brassica crops (broccoli, cauliflower, cabbage, etc.) are highly susceptible to the disease, which is caused by the soilborne fungus Plasmodiophora brassicae. In severe cases it can cause significant crop losses, and heavily infested fields may be taken out of production. Once a field is infected, eliminating the pathogen is difficult if not impossible because its thick walled resting spores have been shown to remain viable in soil for up to 18 years. As a result, once pathogen populations have developed to economically damaging levels, the goal of the farmer is to manage rather than eradicate the disease. One effective control strategy is to raise the soil pH to ≥7.2 through liming.

Liming and Clubroot Control

(Handout from 2013 Processed Vegetable Field Day at OSU Veg research farm August 1, 2013)

Aaron Heinrich and Alex Stone
OSU Dept. of Horticulture

Clubroot is becoming an increasing problem on Willamette Valley vegetable farms. Most cultivated brassica crops (broccoli, cauliflower, cabbage, etc.) are highly susceptible to the disease, which is caused by the soilborne fungus *Plasmodiophora brassicae*. In severe cases it can cause significant crop losses, and heavily infested fields may be taken out of production. Once a field is infected, eliminating the pathogen is difficult if not impossible because its thick walled resting spores have been shown to remain viable in soil for up to 18 years (Wallenhamar, 1999). As a result, once pathogen populations have developed to economically damaging levels, the goal of the farmer is to manage rather than eradicate the disease. One effective control strategy is to raise the soil pH to ≥7.2 through liming.

Disease Cycle

As a brassica crop grows, its roots release chemicals (known as root exudates) which increase the germination of resting spores. Once germinated, the pathogen becomes mobile, swimming to and infecting root hairs. Following infection, the disease causes the root to grow abnormally (**Fig. 1**). When these clubs decay, spores are released back into the soil, continuing the disease cycle.

Figure 1. Clubroot infected roots showing typical "clubbing". Copyright NSW Dept. of Primary Industries. Illustration by Margaret Senior

Liming and Clubroot Control

In the Salinas Valley of California, a major fresh market brassica growing region, clubroot has been almost completely controlled through liming (personal communication with Steve Koike, Monterey County plant pathologist). Liming does not kill the spores, but rather prevents their germination. Liming has been shown to be most effective when the pH is increased to ≥7.0 (i.e Myers and Campbell, 1985; Webster and Dixon, 1991). Research conducted this summer at OSU shows that liming will not completely eliminate infection, but it does significantly reduce infection (**Fig. 2**) as well disease severity (results not shown). With less infection, there will be fewer clubs to supply the soil with spores, potentially reducing disease severity in the future.

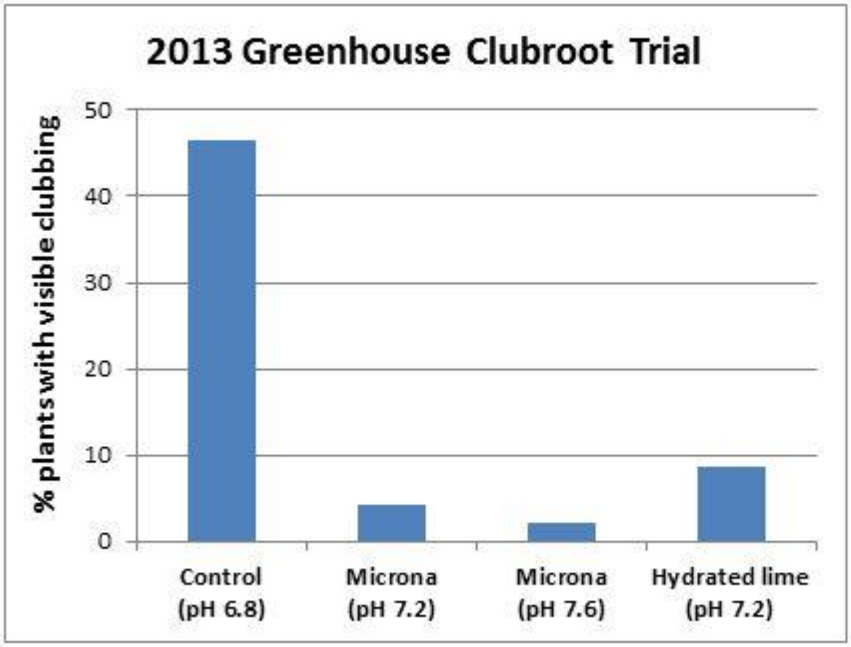

Figure 2.

Visual clubbing of Chinese cabbage (*Brassica rapa* spp.) grown on a clubroot infected soil (Malabon silty clay loam) with and without liming materials.

Lime was added to the soil 6 wks and 2 wks before planting for the Microna™ Ag H_2O lime and the hydrated lime, respectively. The pH of the soil at planting is given in parenthesis below the treatment. Plants were grown in the greenhouse and were evaluated for visual symptoms of clubbing at 5 wks.

Microna™ Ag H_2O is an ultrafine lime that is highly reactive.

Liming Challenges

In the Willamette Valley, traditional liming materials and practices are unlikely to achieve the high pH needed to control the disease. To raise the pH to ≥7.0, hydrated lime ($Ca(OH)_2$), which is highly reactive, can be applied several weeks prior to seedling/transplanting. But, due to the health risks of using hydrated lime, there are no companies in the valley (that we are aware of) that apply it. To overcome this limitation, we have been working with an ultrafine "traditional" ($CaCO_3$) lime (Microna™ Ag H_2O, Columbia River Carbonates) **that we have found to be as effective as hydrated lime in raising the soil pH**. Researchers have suggested that a combination of normal liming (i.e. current liming practices) in combination with the application (possibly only in the row) of a rapid liming material before planting the susceptible crop, might be the most effective and financially viable strategy. In this strategy, the target pH raised to ≥7.0 for only the month or two in which the young plant is at its most susceptible.

Future Research Goals

We plan to conduct field trials over the next year to determine lime application and incorporation strategies that will give us the best control at the lowest cost. For example, due to the high cost of "High-Score" or highly reactive lime products, we will look at the possibility of banding and strip tilling the lime into the seedbed, thus reducing the amount of lime that would need to be applied per acre.

Additional Online Resources

Zitter, TA. 1985. Clubroot of Crucifers. Cornell University Cooperative Extension. Fact sheet 730.11. Available online at**:**
http://vegetablemdonline.ppath.cornell.edu/factsheets/Crucifers_Clubroot.htm

References

Anderson, WC, RL Gabrielson, WA Haglund, and AS Baker. 1976. Clubroot control in crucifers with hydrated lime and PCNB. Plant Disease Reporter. 60:561-565Myers, DF and RN Campbell. 1985. Lime and the control of clubroot of Crucifers: Effects of pH, Calcium, Magnesium, and their interactions. The American **Phytopathological Society**. 75: 670-673Wallengamer, AC. 1999. Monitoring and control of *Plasmodiophora brassicae* in spring oilseed brassica crops. Acta **Universitatis Agriculturae Sueciae**, Agraria 183. Swedish University of Agricultural Science, Uppsala. p. 53Webster, MA and GR Dixon. Calcium, pH and inoclum concentration influencing colonization by Plasmodiophora brassicae. Mycol. Res. 1:64-73

Author:
Aaron L. Heinrich
Alexandra Stone

Tags: Disease and related disorder management, Fresh Market Vegetable Production, Organic Vegetable Production, Processed Vegetable Production, Specialty Seed Production, Willamette Valley, Broccoli, Brussels sprouts, Cabbage, Cauliflower, Chinese cabbage, Collards, Kale, Kohlrabi, Mustard, Rutabagas, Turnips