



Aster Yellows in Garlic

Staff Contact:

Tomoko Ogawa – (515) 232-5661
tomoko@practicalfarmers.org

Web Link:

http://bit.ly/pfi_horticulture

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The CERES Foundation

Cooperators:

- Thomas Burkhead and Jordan Clasen, Grade A Gardens, Johnston
- Andy and Melissa Dunham, Grinnell Heritage Farm, Grinnell
- Sally Gran, TableTop Farm, Nevada
- Gary Guthrie, Growing Harmony Farm, Nevada
- Susan Jutz, ZJ Farm, Solon
- Tim Landgraf and Jan Libbey, One Step at a Time Gardens, Kanawha
- Derek Roller, Echollective, Iowa City
- Ben Saunders, Wabi Sabi Farm, Granger
- Ellen Walsh-Rosmann, Pin Oak Place, Harlan

In a Nutshell

- An outbreak of aster yellows impacted garlic crops in the Midwest in 2012.
- The disease persisted in saved seed planted for the 2013 crop - and many farmers saw poor germination and crop failure.
- Nine Practical Farmers of Iowa farms submitted samples for testing.
- Eight out of nine cooperators' garlic samples tested positive for aster yellows.
- In garlic, the most important preventative measure to avoid aster yellows is to start with uncontaminated seed.



Garlic from TableTop Farm in Nevada, Iowa tested positive for aster yellows. Infected garlic seen here was planted from garlic saved in 2012. Photo courtesy of Sally Gran.

Background

An outbreak of aster yellows—a chronic, systemic plant disease—impacted garlic crops across the Midwest U.S. in 2012, including the crops of many PFI farmers. Because aster yellows is very rare in garlic (2012 was the first known incidence of aster yellows infecting garlic in Iowa), vegetable growers did not know how to treat the disease. Since garlic is expensive to purchase, many farmers chose to plant healthy-looking bulbs in fall 2012 for their 2013 garlic crop. Some farmers planted ½ they saved and purchased ½ from other sources.

In 2013, garlic planted from saved bulbs suffered poor germination. Initially, it was speculated that poor germination was due

to dry soils, and thus poor establishment over the winter. As the season progressed, aster yellows-like symptoms appeared in garlic crops again. Some farmers saw half or fewer of their cloves emerge from the soil. Sally Gran, of TableTop Farm, started a discussion on our horticulture discussion list, and a group of PFI farmers started to share the issues they were facing.

Although the symptoms pointed to aster yellows, again, this is a disease Iowa farmers are not familiar with; many are not adept at diagnosing and treating the disease in garlic. Rick Hartmann, of Small Potatoes Farm, suggested further investigation by conducting diagnostic testing. Garlic is a popular and valuable crop that many members produce and is often a

favorite among CSA members, market shoppers and chefs. Therefore, Practical Farmers began the ad hoc investigation, reported here.

Testing

Nine PFI farms submitted their garlic samples to University of Minnesota Plant Disease Clinic to test for aster yellows (see map and list of cooperators above). Disease testing for aster yellows was not available at Iowa State University.

Farms submitted only garlic that appeared to have symptoms of aster yellows. Eight out of nine cooperators' garlic samples tested positive for aster yellows. Only the sample from Derek Roller tested negative. Derek's garlic crop expressed

few symptoms of aster yellows in 2012 compared to many other Iowa garlic crops; so perhaps the mild symptoms in his garlic this year were due to dry soil conditions.

Comments from University of Minnesota Plant Disease Clinic

Farmers need to determine whether or not the people they purchase their garlic from have a diagnostic test for aster yellows, since it is not regulated pathogen. Since this disease was only seen in Iowa and Minnesota last year, there is not enough collective experience to advise whether it is safe to save seed on their own or purchase in Iowa or Minnesota. Aster yellows in garlic may be a sporadic event due to weather but we will not know until we see what happens the next couple years.

What is aster yellows?

Aster yellows is a disease that can infect over 300 different kinds of plants. It is caused by a bacterium-like organism, aster yellows phytoplasma. Because aster yellows is usually not fatal, infected perennials can survive and become a source of aster yellows phytoplasma for many years. The most common symptom is the change of foliage color to yellow or red. Infected plants are also usually stunted and/or twisted. However, the symptoms vary depending on variables, such as the strain of aster yellow organism or the time of infection. Therefore, it is hard to know which plant is infected using visual symptoms alone. Some symptoms that our cooperators reported before the diagnosis of aster yellows included: poor emergence, stunting, unhealthy look, yellowing, curling, yellow streaking, cracking, dying back of the lower leaves, smaller and softer bulbs, brownish skin, not drying down properly, and wrinkling.

How is aster yellows spread?

Aster yellows is spread mostly by the

insect the aster leafhopper (*Macrostelus spp*). Aster leafhoppers inoculated with the phytoplasma migrate from southern states and spread the disease by feeding on plants. Because of its small size, ~4 mm long, individual leafhopper species are difficult to identify. Aster leafhopper populations also arise when their overwintered eggs, often deposited in winter grains the previous year, hatch in late spring. Aster leafhopper does not like cold, and with 2013's cooler spring, there are very few aster leafhoppers present compared to the population in the Midwest in 2012 (Mollov 2013). Aster

yellows overwinters in infected perennial and biennial hosts. Weeds that commonly host the disease in Midwest over winter include thistles, plantains, wild carrot, wild chicory, dandelion, fleabanes, wild lettuce, daisies and black-eyed Susan (O'Mara and Gast 1993). The bacterium in the insect vector and on plants is inactivated by high temperatures. This explains why this disease is rare or absent in hot areas of the world.

What to do when plant is infected?

Useful measures include early detection, removal of infected plants, and control of the insects and weeds that could be spreading and hosting this disease. Once a plant is infected, it is not curable. The only solution to eradicate the disease once present is to remove all infected plants. Removing the weeds that most commonly host the pathogens may help limit the spread of this disease. Controlling aster leafhoppers is also an effective form of control. However, these leafhoppers are



Aster leafhopper (*Macrostelus quadrilineatus*) - Adult
- Photo by Whitney Cranshaw

hard to distinguish, and their occurrence can be sporadic. Some research has shown that the use of aluminum foil or oat straw mulch may reduce the number of aster leafhoppers (Hahn 2000).

In garlic, the most important measure to avoid spread or impact of this disease is to start with plant seed that is not infected with aster yellows. With a warm weather in spring 2012, leafhoppers appeared earlier than usual in March, and garlic and small grains were the only green things available, which resulted in massive aster yellows infections in these crops. Hopefully, spring 2013 was cool enough so that when the leafhoppers appeared they went to alfalfa and ornamentals instead of garlic or small grains. If you saw aster yellow problems or if your garlic tested positive for aster yellows, it is most likely because the seed stock was already infected. There did not seem to be high hopper pressure in 2013 and problem was greatly minimized if not eliminated where clean seed was used (Mollov 2013).



This photo shows Minnesota garlic afflicted with aster yellows



Cooperators Jordan Clasen and Thomas Burkhead of Grade A Gardens pose with a bountiful garlic harvest.

From the Field: Garlic crop reports from PFI farmers

Laura Krouse saved her own garlic seed last year and tried to choose only big healthy bulbs. However, in the rush of planting, she thinks some infected bulbs got stuck in the ground. They came through winter with a survival rate about 80%, but by early spring she noticed the yellowing had started on a few plants.

Jordan Clasen and **Thomas Burkhead** purchased about 600 lbs from a grower in Washington state in fall 2012. The crop looked perfect all season long, with close to 95-100% germination. However, in the beginning of May 2013 they noticed some yellow streaking, cracking, and dying back of the lower leaves. Applying a foliar feed had a positive effect on yellowing plants. They also noticed that plants grown in and around other cover, (weeds, under trees, tall grasses) seemed not to be affected.

Rick and Stacy Hartmann had over 98% mortality with saved garlic and the opposite with newly purchased garlic. A neighbor who used to exclusively self saved garlic had a near total loss of his crop. Hartmanns also noted the softneck varieties were completely destroyed before season's end in 2012, while the hardneck varieties seemed more durable and resistant to the phytoplasma.

Mustard Seed Community Farm self-saved their own garlic in 2012 and planted the cloves that didn't look diseased. The garlic had a poor survival rate over the winter. They had noticed some of the common symptoms of aster yellows in 2012, but saved seed because theirs was a favored garlic variety they'd hoped to continue using, and additionally, they wanted to see if plants that didn't show symptoms were resistant to the disease. Financially, it was worth the risk to save seed rather than invest in new seed stock.

Joe Lynch and **Lonna Nachtigal** planted half saved garlic and half new seed stock from New York. Thought they selected the best, germination for their saved garlic was at 10-20%. While some were fine, others showed disease symptoms.

Ellen Walsh-Rosmann says she will not save garlic as she lost over 95% of her crop this year from her saved stock. She was surprised to find out her garlic was infected because she didn't notice anything wrong with her garlic last year. However, only four out of about 15 pounds that she saved from last year came up, and even those showed aster yellow symptoms early on. She will not risk planting infected seed again so she will be selling everything this year. She has already purchased some new garlic stock from California.

Gary Guthrie will be buying completely new seed stock this year. He does not want any diseased garlic left on the farm from his old stock. When he planted his seed he had no idea how it would affect germination. If Gary had known earlier about the germination factor, he says he would not have saved any seed.

Joe Monahan will also be buying all new garlic this year as last year's seed stock seemed infected. He planted 100% saved seed last year and only 5% emerged this spring. He certainly noticed some of the common symptoms of aster yellows, but didn't know any measures to take against it. Joe wonders if farmers might have to take measures to try to keep garlic from emerging so early, such as by using heavy mulch to keep the ground cool.

Derek Rollers's sample was the only one that did not test positive. He will be saving his own stock and also purchasing new. Derek used 95% saved seed and he had to cull out the 5% purchased product because of aster yellow-like symptoms.

Susan Jutz is planning to use her own garlic stock using same seed stock selection process she did in 2012. She selected for large heads without visible symptoms. Although her garlic tested positive for aster yellows, she says she's going to take a chance on using her own stock again because her loss was minimal. She may purchase a small amount of "clean" new stock as a backup. Given the volume she plants and the minimal loss she experienced this year, this plan makes the best financial sense for her operation. After talking with ISU plant pathologist Mark Gleason about "the perfect storm" scenario that occurred in 2012, she is hopeful that 2012 was a fluke occurrence. Interestingly, due to a miscommunication with the farmer who did her early spring tillage in 2012 she had a beautiful crop of oats emerging at the same time as the garlic so the leafhoppers had more food to eat. Mark suggested that perhaps this was one of the reasons that may have led to minimal loss even though her garlic tested positive.

Ben Saunders is not going to save any of his garlic this year, and instead will be ordering new stock from California. Last year, he saved various softneck and hardneck garlic, and also purchased new stock from Wisconsin. He purchased 'Music', which is a hardneck variety that is known for consistent production and began to notice aster yellow-like symptoms during the last week of May or early June 2013. He sent in a sample from his newly purchased stock which tested positive.

References

Hahn, J. 2000. Aster leafhoppers. University of Minnesota Extension. <http://www1.extension.umn.edu/garden/insects/find/aster-leafhoppers/>

Jaspter, C. Phytoplasma. Plum Creek Farm blog. Published July 31, 2012. <http://www.plumcreekgarlic.com/phytoplasma>

Mollov, D. Director, Plant Disease Clinic. University of Minnesota. Personal communications. July 30 and 31, 2013.

O'Mara, J. and K. L.B. Gast. 1993. Aster Yellows. Cooperative Extension Service, Kansas State University. Manhattan Kansas. <http://www.ksre.ksu.edu/bookstore/pubs/mf1086.pdf>

University of Illinois Extension. 1988. Report on Plant Disease: Aster Yellows. RPD No. 903. <http://ipm.illinois.edu/diseases/rpds/903.pdf>

PFI Cooperators Program

PFI's Cooperators' Program gives farmers practical answers to questions they have about on-farm challenges through research, record-keeping, and demonstration projects. The Cooperators' Program began in 1987 with farmers looking to save money through more judicious use of inputs.