

Final SARE Grant Report

FNE06-586 “Sudden-rot Syndrome” in Garlic Seed in New England

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Our grant request was precipitated by two extraordinarily bad years for garlic growers in New England; the years were 2004 and 2005. In 2004 many small retail growers were finding that their seed stocks were deteriorating or rotting coming into the fall planting season. These growers in desperation, sought out seed from other professional seed growers only to find that they were receiving in garlic in a similar state of disease, or they were informed by their seed sources that they too were out, due to similar problems. Some less experienced growers went ahead and planted some of this suspect seed stock with even greater losses in 2005 than they had the year previous. After many phone calls from growers from Maine to Rhode Island, it became apparent that something was occurring on a scale and with enough regularity to be more than just a seasonal aberration. At the urging of Vern Grubinger, Wishing Stone Farm sent off some garlic to Dr. Wade Elmer at the Conn Ag. Extension Lab. Dr. Elmer's first

conclusion was that the seed garlic he receive did have some indication of Fursarium. He also offered that he had seen other pathogens in other samples from his state that indicated there were increasing problems with Penicillium and Scolerotinia as well.

Our goal in this grant was to facilitate gathering a small collection of growers in different regions, and try to replicate similar growing conditions and to experiment with different procedures that might mitigate various infections that might arrive on seed pieces bought-in or collected from ones own yearly harvest. As a technical adviser, we had a commitment from Dr. Wade Elmer to take a look at any garlic displaying any suspicious signs of disease. We also enlisted Vern Grubinger, an extension agent from the state of Vermont as a general technical adviser.

Farm Profile:

Wishing Stone Farm is an organic farm situated in Rhode Island right along the south coast. Our proximity to the ocean gives us a uniquely long growing season. We manage over 32 acres of mixed vegetables and maintain healthy crop rotations and fallow periods to best manage any soil diseases. Our garlic crop always follows a two year fallow period of various green manures; the last of which is a mid-summer mix of peas and oats that are turned in during september in preparation for a late October/November

planting deadline. We always incorporate fresh compost and add some additional nutrients with “Cheap Cheap” 4-2-3 chicken manure based fertilizer.

Participants:

The following participants were gathered purposely from different New England locations so we might have our garlic samples exposed to as many different soil types and weather conditions as possible.

Erik Eacker: Ledge Ends Produce, East Greenwich, RI

Mark Fulford: Monroe, ME

Jason Kafka: Checkerberry Farm, Parkman, ME

Skip Paul: Wishing Stone Farm, Little Compton, RI

Doug Bowne: Little Falls, NY

Jack & Julie Rawson: Many Hands O F; Barre, MA

Paul Arnold: Pleasant Valley; Argyle, NY

Pat McNiff: Casey Farm; Saunderstown, RI

Boots Wardinski: Ryegate, VT

Dave Ruzcidlo: Dayville, CT

Sam Hammer: Holcomb Farm; Hartford, CT

Project Activities:

We started off by purchasing 130lbs of seed garlic from Doug Bowne; a reputable grower with a history of producing a consistently stable and clean product.

Each participant was instructed to break up their samples only on the day of planting to be sure they were not exposed to any other diseases, or caused to dry out. We also conferred with Jason Kafka and Mark Fulford, who added to our project the concept of creating a 'pre-plant seed dip treatment'. Our goal in doing this was to create a control to see if the dip treatment would have any measurable effect on any diseases that might show up on the untreated garlic seed. The dip treatment was 4 oz of Oxidate (an organic OMRI approved hydrogen peroxide specialty chemical) and 4 oz of white wine vinegar. These were put together with a gallon of tap water. Most growers put up three plus gallons to have enough to dip their seed pieces. We noticed right away that up to 15% of the seed pieces would float to the top of the seed dip bucket. We concluded that it might be an indicator of some malady in the seed piece and asked that the growers keep track of these "floaters", as we called them, for further studies. Each participant received two 5lb. bags of Doug Bowen's garlic and were instructed to dip half in the seed treatment and to plant the other half, as is. Each was asked to give anecdotal information on their own growing situation and history of successes and failures with growing garlic. We asked that all participants give at least one hydro-fish or other organic form of foliar side-dressing or nitrogen boost preferably about a month before the scapes started their upward push.

Though the garlic was sent out a bit later than we had wished, most participants reported getting the treatment exercise done and the garlic planted before the end of October. No one used black plastic or other forms of artificial weed control.

The 2007 growing season was an average growing year. Some growers did some irrigation on lighter soils but, for the most part, growers relied on the weather and ample straw to hold-up the moisture capacity of their soils and to keep weeds in check. During the winter months some of the group discussed the project and decided to add some other rubrics to the groups list of things to think about. One of the most significant observations came about during a discussion on harvesting techniques that the group might follow. It was concluded that many of the small growers used pitch forks to facilitate loosening the bulb so it could be more easily removed from the soil. When asked what technique people should use to remove the excess soil in the field, it suddenly occurred to us that many growers tap their garlic bulbs on the shaft of their spading tool or fork. A conclusion was quickly reached that maybe we were damaging the garlic bulb at its most fragile point in the harvesting process. We concluded that the garlic bulb was not unlike a freshly picked apple. Thinking in those terms, it made sense that we should consider or be worried about bruising. We postulated, what apple

grower would rap a fresh apple on a hard object and not expect it to be rotten and/or damaged within weeks. With this in mind, we strongly urged all growers to handle the garlic with extra care; at least for the period representing this grant and especially during harvest and the first week of its curing phase. Harvesting began during the mid July period for the southern most growers in Rhode Island and Connecticut.

Just for arguments sake, we harvested one bushel of garlic our old fashion way of tapping off the excess soil on the handle of the digging fork. All the other garlic was harvested, but given the extra care we concluded it now deserved. (Of all the garlic in the project, the bulbs that were banged against the fork handle were the only ones to show some problems!) In discussions during the month of June, almost everyone was sharing that their garlic was looking very good and that there seemed, on the surface, to be no difference in the growth of the treated or the non-treated plants. During this period the only report of disease occurred at Wishing Stone Farm. We saw some sporadic yellowing in the general crop and in our experimental block as well. Upon inspection by the R.I. Extension it was discovered that we had an infestation of Corn Seed maggot in our garlic crop. Though rare, it was not unheard of, but decidedly insignificant to our research and so the effected plants were culled from the field.

About this time we started looking at other harvest and even post harvest protocols that might help the group have a more statistically stable research. It was concluded that we should experiment with some new concepts in 'power drying' or accelerated garlic drying. We concluded that, the traditional model of gathering of eight to ten bulbs and drying them tied and hung over a cable in an airy barn, might not be the best solution for curing the garlic.

Three problems we saw with this system were: 1.) the bulbs would not get even access to dry air. 2.) because they were touching each other, their ability to share infections was heightened. 3.) the barn approach did not offer a consistent low humidity environment for drying; especially, if there were a prolonged period of rain, or if the general climate (like living next to the ocean) was already extra humid or fluctuated dramatically.

There is information about the large California growers using large specially build rooms with trays of garlic that are power vented with large fans and additional low levels of heat. Their goal is controlled but rapid curing and then maintenance of that moisture level till shipping. In an attempt to achieve these goals on a more modest budget, we decided to take inventory of what many of us already possessed; greenhouses. We then developed a protocol, where we would bring the newly harvested garlic back to the farm and 1.) gently power-wash off any remaining soil.

2.) cut off the top stalk down to six inches above the bulb. 3.) place the bulbs upside down between the cross wires of the greenhouse benches. 4.) Provide some fans to directly blow the ambient dry greenhouse air across the individually suspended garlic bulbs.

Our thought process was, that though the main stem and its accompanying leaves could be very important in the curing process; they were not any more important than the root system, that was now totally exposed to the wicking effect of the drying fans. There was also an obvious added advantage in removing the stem and leaves; it was that it afforded a dramatic utilization of space that could be taken up in the greenhouse. It is worth mentioning that most of us have greenhouses with roll-up sides and very few if any plants in them during the late July/August period. The greenhouses afford a great arid environment for the curing process to proceed. Some of us went to the added expense of pulling shade cloths over our houses, to not only lessen the heat levels in the houses, but to keep the sunlight from bleaching out some of the subtle colors on the garlic outer covering layers. The next and last step we decided would be beneficial was 'post-harvest storage parameters'. We noted the lengths California growers went through to maintain their cured crops moisture levels after curing. In an effort to do the same we concluded two main objectives: 1.) provide a storage container that

was perforated enough to maintain good aeration. 2.) provide a storage room or environment that will not allow the bulbs to rehydrate! This last point we felt was a particularly important. Especially for those farms that store their garlic on or near concrete floors. The main problem with this approach is that concrete floors often sweat or creates beads of moisture on their surface whenever there is high humidity, rain or a substantial weather related low in the forecast. Our bottom-line was to store garlic as far away from concrete or moisture sources as possible; preferable in some second story room with window or an ability to control humidity.

It was August before the northern most growers were done with their harvest and curing. Once we started comparing notes on the first evaluation of the crop it seemed that: 1.) the crop looked great and 2.) there was no immediately discernible difference between the treated garlic and the non-treated. Even the 'floaters' that we suspected might be indicators of some inherent problems seemed of equal grade and quality as the rest of the crop. At this juncture I reminded our participants that part of their participation in the grant was for them to keep track of the treated and non-treated garlic and to mail a 3-4 lb sample of each back to me by the end of September. I also reminded them about filling out the questionnaire about growing techniques and other parameters. By

October 15th only half of our participants had complied with these requests. After some phone calls and arm twisting by Mid-November we had 85% compliance; at least with the return of the garlic samples. It was harder to get the technical information that we sought after, but in the big picture, it was more anecdotal than critical for the success of the grant. If there had been a great disparity between the treated or non-treated garlic, or if the crop had totally failed at a number of farms, and then done well at others it may have played a more important part.

By early November we had passed the time that the 'sudden rot syndrome' would have manifested itself. In a last phone call to all participants, I found that everyone had had good quality garlic from the 2007 growing season; except for one grower who had experienced some personal difficulties and admitted not being careful enough with monitoring his curing procedures and, as it turns out, did store their garlic in a dirt floor barn not adequately far away from sources of excess moisture. They felt that their loss was more from just general exterior surface fungus than an internal malady, like *Fusarium* or *penicillium*. We found ourselves at the end of the first year wondering what to do next! Everything seemed to have gone almost too well! Plus the return of our test garlic, and other info was so late, that it was getting almost too late to try and launch our second year of testing out of our original thesis of chasing down this

disease or combination of diseases effecting New England garlic growers.

After a last round of phone calls, we had come to a series of conclusions that encompass many of the lessons all the growers shared.

Conclusion:

The problems that prompted the original decision for the grant, may have been generated by a series of issues. A couple of unusual growing conditions in New England, may have put unusual disease pressure on many growers, who may have under estimated the attention to details that a crop, like garlic, demands. Through poor harvesting, resulting in damaged cloves, which subsequently rotted, which may have been exacerbated by poor or inadequate curing and further exacerbated by poor post-harvest storage. The list of points at which the crop could have been compromised is quite lengthy.

It is also important to start with a good reputable seed producer. It has come to the attention of quite a few growers, that some of the larger, well known seed producers have had, to their own admission, a series of problems over the last three years. I believe, too many growers accepted garlic seed from some of these growers, and made the mistake of planting it rather than sending it back. They relied on the seed producers reputation, rather than common sense. All

the participants agreed the seed treatment is an insurance policy for treating good quality seed. If one inspects your seed pieces and finds a consistent level of disease or an inconsistent level of quality. Send it back or don't plant it.

As a group, our biggest take away lesson, was that the diseases that we were seeking are all already present in our soils, barns and storage facilities. It is no surprise that in the correct environment they will flourish, and present themselves as problems or rot in our garlic. However, if one understands, the need to first start with a good seed source, and second, to understand the physical needs of the garlic from harvest to final storage, one should have a fairly stable level of production and profit.....

Grant Production Costs:

Telephone Long Distance 2006 - 2007

\$195.00

UPS original mailing of 10# boxes of Garlic. \$125.00

Doug Bowen: 130lbs. 2.75" grade "A" Music Garlic.

\$985.00

Total:\$1305.00

As you can see we are substantially under our budget! Since we cut it short we saved quite a bit on materials. The growers success in producing good garlic precluded spending any funds with Dr. Elmer at UConn.

The idea of utilizing our greenhouses as rapid drying areas also precluded spending any money on creating a dryer.

Oxidate, we were told could not be sent through the mail, so we instructed our participants, if they did not already have some, to use some over the counter hydrogen peroxide from a local drug store.

Farm visits seemed to be another moot point with things going so well. It also was too difficult to schedule a trip that would find everyone at home on their farms when I needed to swing through.

Fulfilling our commitment to share the grant with others.

As you can see, I already did a talk on garlic at the last New England Vegetable Growers get together in December. I would gladly turn the findings into an article published in one of the local AG email letters. For example Ruth Hazards 'UMass Vegnotes'.