

Cornell University Cooperative Extension



Garlic Post-Harvest Study *Year One*

Garlic is a \$20 million industry in New York, and it represents an important and growing niche crop across the Northeast. As the numbers of garlic growers and acreage in garlic have increased, the number of diseases associated with this once trouble-free crop have also increased. Nearly 25% of growers surveyed in 2011 indicated they have lost 30% or more of their garlic crop at least once in the last five years.



Aspergillus (black mold) Image: Crystal Stewart

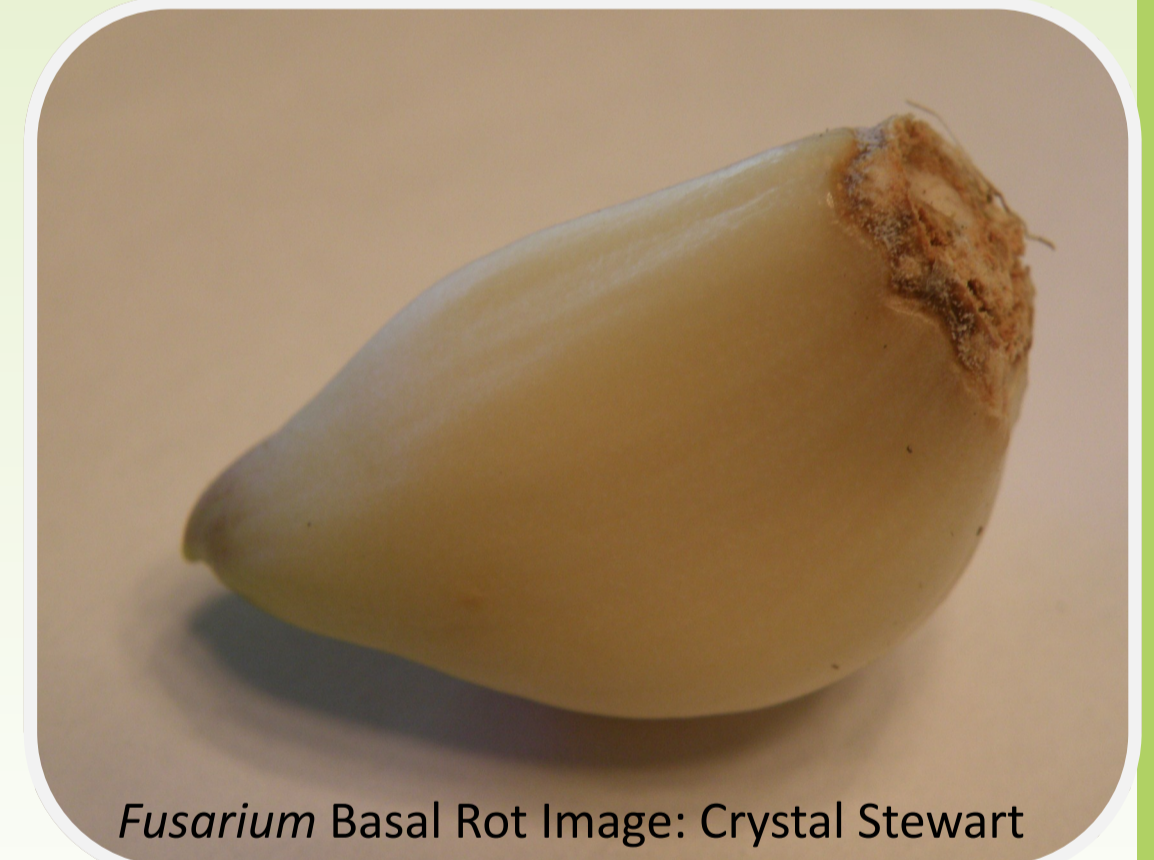


Embellisia
Image: Crystal Stewart

Diseases such as Botrytis neck rot, Penicillium, and surface molds such as Embellisia Skin Blotch and Aspergillus are common in curing areas with variable moisture, such as barns and sheds. Effects of poor post-harvest treatment can be devastating. The simplest way to address issues with post-harvest diseases is to change the environment where garlic is cured. Based on the research available and consultation with the Garlic Seed Foundation, a series of treatments were developed to test this hypothesis:



Botrytis Neck Rot. Image: Crystal Stewart



Fusarium Basal Rot Image: Crystal Stewart

Hypothesis: Optimizing post-harvest handling of garlic will reduce post-harvest loss and improve seed stock.

Treatments used to test hypothesis:

A	Trim Roots flush with basal plate
B	Trim tops to 6" long
C	Wash
D	Cure in High Tunnel
E	Cure in open-air structure
F	Leave Roots and tops un-cut

Treatments were combined in all possible ways so that we could examine the effects of each separately and in combination. All treatments were compared to curing uncut in an open-air structure such as a shed or a barn. Each treatment was either applied to a ten pound sample or on an 8 foot piece of bed, averaging about 46 heads per sample. The trial was replicated on three farms.

Materials & Methods

Three farms were included in year one of the post-harvest study; two in the Hudson Valley and one in the Mohawk Valley. Treatments were replicated at the three farms, with the exception of top-cutting, which was accomplished using a sickle-bar mower at one farm while the garlic was still in the field and using pruning shears at the other two farms after garlic had been harvested. Details of the treatments are shown below.



A. Root Pruning.
Roots were cut while garlic was still moist using a knife or pruning shears. Care was taken not to damage the basal plate.



B. Top cutting. Tops were cut to a height of six inches while garlic was green. The mechanical cutting showed some variation of height.



C. Washing was completed using a garden hose and a nozzle. Power washers were not used. After washing, garlic was air dried before being placed in the curing area. Garlic was washed until dirt was removed from the bulb.



D. Curing in high tunnels: Garlic was moved to high tunnels immediately after other treatments were completed. All high tunnels had a shade cloth and were ventilated with fans, preventing temperatures from exceeding 110 degrees F.



E. Open-Air Curing: These treatments were placed in solid but well-ventilated buildings such as barns and sheds to dry without supplemental heat from the sun.



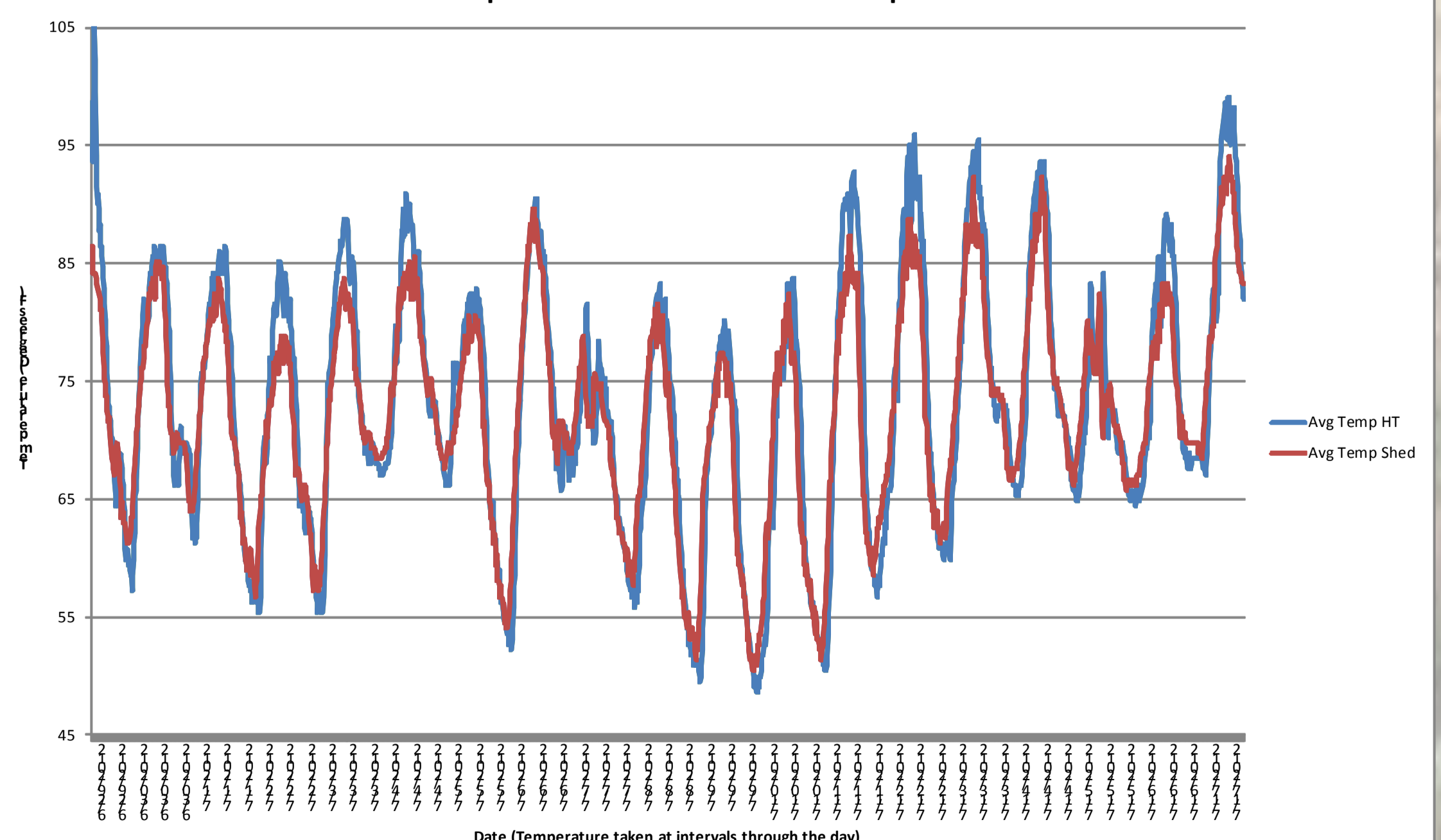
F. Leaves roots and tops uncut: Garlic was left completely uncut in this treatment. It was spread out on drying racks to leave space for the bulbs to be one layer deep or it was tied into bundles of 6-10 and hung.

About High Tunnel Drying

The high tunnel drying temperatures for this year were kept conservatively cool, relative to the outdoor temperatures. Temperatures inside only averaged about 5 degrees warmer in the tunnel than outside. Next year temperatures will be increased to an average of 110°F during the day in the high tunnel. Overall this was a warm, dry curing season whether drying in a tunnel or in an open air system. Increased benefits of the high tunnel system are expected in cooler years.

Garlic dryness was rated numerically on a scale of 1 to 4 from green (1) to roots and tops completely dry (4). Garlic was observed every 3-4 days until all treatments were dry.

Temperature over time: HT versus open air



Results

High Tunnel vs. Open Air: Across the three trials, garlic in high tunnels dried an average of three days faster in high tunnels than in open air structures. Garlic dried in high tunnels had slightly better wrapper quality (tighter, less discoloration) at one site. Garlic dried in tunnels also had slightly lower disease incidence (*Aspergillus* and *Embellisia*) in two of the three sites, though disease was not severe in any site or treatment. No garlic treatments showed damage from being dried in the high tunnel.

Roots trimmed vs. roots untrimmed: No statistically significant differences were observed between these treatments in regards to bulb quality, weight, or disease incidence.

Tops trimmed vs. tops untrimmed: Trimming the tops mechanically in the field greatly increased the speed of harvest, and reduced the space needed for drying. Top trimming did not have a significant effect on disease incidence in cured bulbs, but there were differences in bulb weight at two of the farms, with un-cut bulbs being slightly heavier (Table 1). It is unclear if this difference is due to weight loss or to double bulbs, since the number of bulbs is greater in the treatments with lower weights. Bulb quality was comparable between treatments.

Table 1: Bulb weight comparison for cut versus uncut garlic plant tops.

Farm	Average Weight/ Bulb Tops Cut	Number of bulbs in sample	Average Weight/Bulb Tops Uncut	Number of bulbs in sample
1	0.11	386	0.15	375
2	0.11	346	0.1	365
3	0.12	304	0.14	232

Washed vs. unwashed: Washed garlic looked very good initially, but became more discolored than the unwashed garlic during the drying and curing process. Most discoloration could be removed by removing 1-3 wrapper leaves, but this extra step is time consuming. Disease incidence, particularly *Aspergillus* and *Embellisia*, was slightly higher in washed garlic.



Garlic immediately after washing (far left), and after curing with no wrapper leaves removed, (0), one wrapper leaf removed (1) and two wrapper leaves removed (2).

Next Steps

- Replicate post-harvest trial, increasing temperature in the high tunnel treatment and reducing humidity at night
- Complete fertility trial on three farms from the Mohawk Valley to Long Island, NY. Report results in fall 2013
- Complete weed control trial on three farms. Includes mulches, cultivation, and chemicals



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