Garlic Post-Harvest Practices Survey, 2019

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PROCEDURES

Garlic Production and Sample Preparation

The garlic used for this project was grown by a commercial garlic grower in Holley, NY. It was a German hard neck type that was planted in mid-October in 2018 and harvested on July 30, 2019. Unfortunately, it should have been harvested a week earlier and was slightly overripe and was a bit thin-skinned and purplish in color. After mechanical undercutting, it was harvested by hand into plastic RPC bins, which were placed inside an open-sided barn with very good natural ventilation. Then, it was sorted by bulb color into white, light pink, pink and dark pink colored bulbs.

Each treatment consisted of 5 samples of 10 garlic plants in mesh onion bags that would be subjected to different curing/storage conditions. Each treatment contained equal proportions of the different colors of garlic: Samples 1 & 2 contained 1 white bulb + 6 light pink bulbs + 3 pink bulbs, and Samples 3-5 contained 6 light pink bulbs + 3 pink bulbs + 1 dark pink bulb. Garlic was left with the tops on, or was topped to specified length, as per grower's standard practices. In some cases, the growers were interested in learning whether there was a difference in topped vs. not topped garlic. Each sample bag was labeled with its treatment information and an Omega temperature and relative humidity data logger was secured inside the bag of Sample 1.

The remaining garlic was graded by color-class (white, light pink, pink & dark pink) into 1-2", 2-2.5" and >2.5" size classes. After topping the neck to 1" and pruning the roots, every bulb in each color by size class was weighed. These measurements were later used to estimate fresh weight at harvest prior to post-harvest practices.

Sample Dissemination and Pick Up

A total of 21 unique post-harvest practices of curing and storage (= treatments) were set up among 12 grower cooperators, of which 6 and 16 were in Eastern and Western NY, respectively (Table 1 & 2). Treatments were distributed to the growers as soon as possible after harvest from Aug 1-7 (Table 1). The grower cooperators were instructed to leave the garlic samples in the mesh bags, but to otherwise treat them as they did the rest of their garlic. For example, if the garlic was hung in bundles from the rafters of a barn, the samples were also hung by the rafters inside the mesh bags. If the garlic was topped after curing, then the grower would take the garlic out of the sample bags, top it and return it to the bags. The growers were to inform us of the dates when the garlic was moved to a different location and/or when heat was turned off, etc.

The sample bags were picked up from the grower cooperators from Oct 1-9 and were evaluated shortly after. Unfortunately, none of the treatments that were sent to Eastern NY were returned with labels, so we do not know what the treatments were. But, we evaluated the bulbs and summarized the temperature and relative humidity data from the data loggers anyway.

Post-Curing and Storage Evaluation
Prior to making any evaluations, all of the bulbs were topped to 1" neck length, cleaned and roots pruned.

Evaluations for various quality traits were made from Oct 7-11 for the following characteristics:
1) **Bulb density:** Each bulb was weighed and its bulb diameter measured in order to roughly calculate bulb density in gram/inch of neck diameter (Table 4).
2) **White (scale 1-8) and pink** (scale 0-4) b**ulb color** – see Table 5.
3**) Bulb firmness (scale 1-9)** by squeezing the bulbs by hand – see Table 5
4) **Wrapper leaf tightness (scale 1-7), r**ated when handling bulbs to evaluate firmness. Other wrapper leaf qualities (few, split, or brittle) were also noted - see Tables 5 & 7.
5) **Overall bulb quality (scale 1-14):** judged visually and tactilely – Table 5.
6) **% shrink (weight loss during curing and storage):** First, the average fresh weigh at harvest per bulb size per color class was calculated. In sample bags 1 & 2, the lightest colored bulb was assumed to be the white bulb and the 3 pinkest bulbs were considered to be the pink bulbs, while in samples 3-5, the darkest pink bulb was assumed to be the dark pink bulb and the 6 lightest colored bulbs were assumed to be the light pink bulbs. From this information, the original fresh weight of garlic bulbs topped to 1" neck and pruned roots was estimated and then % shrink calculated (Table 4).

Bulbs were considered unmarketable culls if they showed symptoms of Fusarium infection or other rot, or severe infestation with Eriophyid mites (e.g. bulb soft). The presence of black surface mold (*Embellisia allii*) was recorded but not considered sufficient reason to cull the affected bulb.

Clove Evaluation
During the October bulb evaluation, 2 cloves were removed from the worst non-cull bulb per 10-bulb sample. One was placed into a plastic bag, which was then stored in a refrigerator (= cold plastic storage), and the other was placed into a paper bag and stored at room temperature (= dry paper storage). Thus, there were a total of 5 cloves per storage type per treatment.

The cloves stored in plastic bags in the refrigerator were evaluated on Dec 18, after 72 days in storage. The cloves stored paper bags at room temperature were evaluated on Feb 3, 2020, after 118 days in storage. The wrapper of each clove was removed, and the bare cloves were evaluated as follows:
1) **% clove covered with Fusarium disease**, which was visually estimated.
2) **clove color** was visually evaluated (scale 1-4, where 1 was white and 4 was brown) – Table 8.
3) **Clove firmness** scale 1-3 where 1 was firm and 3 was soft – Table 8

Analysis
Since the rating scales were linear, all of the variables could be analyzed using General Analysis of Variance and the treatment means were separated using Fisher's Protected LSD test with 95% level of confidence.

To compare the overall quality of the garlic among treatments, 9 bulb quality traits and 4 disease traits (3 Fusarium + 1 black mold) were ranked using a scaled ranking system for which the rank value of the best and worst treatments were 0.00 and 1.00, respectively, and the individual rankings were

proportionate to the differences between the actual values/treatment means. For variables where a low value was the best, the scaled ranking was equal to the difference between the treatment mean and the lowest treatment mean in the trial for that variable divided by the span of the treatment means (high minus low) for the variable. For variables where a high value was the best, the difference between the treatment mean and the highest mean in the trial was divided by the span of the treatment means. The scaled rankings were then summed to give final rank scores for overall performance and then ranked from best (lowest scaled rank score) to worst (lowest rank score) (Tables 9-11).

For each treatment, temperature and relative humidity data from the data loggers were summarized for the curing and storage periods separately when feasible, as well as for the duration of curing and storage combined. The average, minimum and maximum values were calculated, and the total number of hours broken out into increments of ten per treatment.

RESULTS

Best treatment – naturally ventilated (passive) high tunnel curing fb. passive storage in steel barn. Two of the top three highest ranking treatments (No. 7 & 9, Table 11) were cured in a high tunnel with the sides rolled up and the doors open (natural/passive ventilation) (Table 1) and then stored just inside an open door of a steal barn (passive ventilation) (Table 2). The only difference between the two treatments was that No. 1 was cured and stored with the tops on and No. 3 was topped to 1.5 inch necks prior to curing. The garlic was cured in a single layer on top of wooden pallets and stored in a pile 5 layers deep. The temperatures during curing were some of the hottest in the trial (average: 75 ^{o}F, maximum: 123 ^{o}F) (Table 12). During storage, temperatures never dropped below 50 ^{o}F, did not exceed 90 ^{o}F and averaged 65 ^{o}F (Table 13). The relative humidity during curing had more hours with RH < 40% than most other treatments and averaged 64 % (Table 15). During storage, RH did not drop below 45% and averaged 76% (Table 16). The treatment cured with the tops on (Trt. No. 7) had the least shrink and densest bulbs out of storage, had above average white-colored bulbs, tight wrapper leaves and overall highest bulb quality rating (Table 4). This treatment had below average Fusarium at the October evaluation (8%, Table 5)) and following cold storage of cloves (6% clove coverage), but above average clove coverage after storage at room temperature (27%) (Table 8). In the October evaluation, this treatment had 4% of bulbs infested with Eriophyid mites (Table 4).

Trt. No. 8 an anomaly. Treatment No. 8 was cured and stored under the same conditions as the 1st and 3rd place treatments but ranked 17th out of 20 for overall disease (Table 11). This treatment had above-average incidence of Fusarium at the October evaluation (14%, Table 5), after cold storage of cloves (10% clove coverage) and after room temperature storage of cloves (46% clove coverage) (Table 8). The higher incidence of Fusarium appeared to reduce the bulb quality, especially bulb firmness (Table 5 & 9). The only difference between this treatment and Trts. 7 & 9 is that it was topped to 6” necks prior to curing, while Trt. No. 7 was not topped and Trt. No. 9 was topped to 1.5” necks. We do not believe that the higher levels of Fusarium and reduced bulb quality in Trt. No. 8 was a treatment effect (e.g. due to 6” tops), especially since we did not see similar differences among the same topped, 6” neck and 1.5” neck treatments with grower No. 7.

Other greenhouse curing treatments. There were no other treatments that were handled similarly to the 1st and 3rd best treatments. Of the other treatments that were cured in a high tunnel or greenhouse (trts 10-12 & 16), their final rankings were 7, 6, 15 and 10. All of these treatments used active ventilation (fans) during curing. Temperature and RH were similar between Trts. 7 & 9, and Trts. 10-12

during curing, although Trts. 10-12 had many more hours with 90-99% RH (Table 12 & 15) and temperatures dropped below 50 ^{o}F during storage (Table 13). The most notable difference between these greenhouse curing treatments was that the bulb firmness was not as good in Trts. 10-12, as it was in Trts 7 & 9, despite disease being low. Since the orientation of the garlic in single layers was similar between these treatments, perhaps the key difference that attributed to the reduced bulb quality in Trts. 10-12 was the use of fans during curing (active ventilation). Trt. No. 4 from Eastern NY ranked 4th overall, ranking 2nd for bulb quality, and 12th for disease (Table 11). Although the tags were not returned with this sample, form the temperature data, it appeared to have been cured in a high tunnel. Aside from having 16% Fusarium in October, it had above average bulb density and below average % shrink and very tight wrapper leaves.

When the total scaled rank sums were averaged for the treatments where garlic was cured in a high tunnel/greenhouse (trts. 7-12, 16) and compared to all other types of curing conditions (trts. 13-15, 17-20, basement curing omitted), there was very little difference (5.35 vs. 5.66).

Hard bulbs with brownish/pink color & brittle wrappers. Trt. No. 1 from Eastern NY ranked 2nd overall including 4th for overall bulb quality and 2nd for low disease (Table 11). Since the tags were not returned with this sample, all we know about this treatment are the temperature and RH conditions during curing and storage. Notably, the temperatures during curing did not exceed 90 ^{o}F (Table 12). Although the bulbs were the hardest in the trial with tight wrapper leaves, the bulbs were also the most brown and pink in color, and had the most brittle wrapper leaves of all of the treatments in the trial, (Table 7 & 9). We wonder if the bulbs in this treatment were washed, as a possible cause for their discoloration and brittle wrapper leaves.

Worst treatments - Cool temperatures and high humidity during curing

The worst treatment in the trial was No. 21, which was staged to be the worst treatment by placing it in a damp basement with no ventilation (Table 1 & 2). It had the highest disease (Fusarium and black mold, Table 5 & 10) and the softest bulbs in the trial (Table 4). This treatment had the most consistent temperature and RH in the trial where it stayed between 66 and 68 ^{o}F, and between 75 and 100% during the entire curing and storage process (Table 14 & 17). It also had the highest RH of all treatments in the trial (average 94%, Table 17).

Trt. No. 2 was the second worst treatment in the trial, but it was also from Eastern NY and returned without its labels. Like the treatment that was stored in the basement, it also experienced cooler temperatures and higher humidity during curing and storage, but with much wider temperature and RH swings (Tables 12-16). This treatment had the highest % shrink, the lowest bulb density and the brownest bulbs in the trial, but the bulbs were very firm and wrapper leaves were very tight (Table 4). It also ranked 18th out of 20 for Fusarium (Table 10).

Along with treatment No. 1, both treatments No. 21 and 2 also had significantly higher incidence of brittle wrapper leaves than the other treatments in the trial (Table 7). Perhaps cool and humid conditions during curing result in brittle wrapper leaves. The issue with brittle wrapper leaves is that they fall off easily when garlic is cleaned, so they can quickly become thin-skinned.

Cool and dry curing resulted in soft bulbs with very low disease

Treatment No. 15 was staged for a cool cure by placing it in front of an air conditioning vent (Table 1). This treatment had very poor bulb quality (ranked 20th, Table 9) with especially soft bulbs, but unlike the other two cool treatments, it ranked No. 1 for having the lowest disease (Table 10). It had the coldest

conditions during curing in the trial (Table 12), but unlike the other two cold treatments, the humidity was the lowest in the trial (Table 15).

Storage in greenhouse resulted in poor bulb quality

Treatment No. 17 ranked 18th overall (Table 11). This was the only treatment that was stored in a greenhouse, which got very hot (123 ^{o}F), and it had the warmest storage conditions in the trial (Table 13). Although the garlic was very white, the bulbs were not firm , the wrapper leaves were not tight and this treatment had one of the highest incidences (8%) of Eriophyide mites in the trial (Table 9).

Fusarium worse when stored in warm and dry conditions

There were no differences in incidence of unmarketable bulbs due to Fusarium at the October evaluation, which ranged from 2 to 24% (Table 5). Clove coverage with Fusarium disease after storing the cloves in paper at room temperature was 3-times higher (average 21%) than it was when the cloves were stored in plastic in the refrigerator (average 7%), although there were no significant differences among these treatments either (Table 8).

Possible trend that not topping garlic during curing improves quality

At the two farms (No, 6 & 7) where the only difference between treatments was whether and to what extent the garlic was topped prior to curing (not topped, topped to 6" neck, topped to 1.5"neck), we did not see any consistent differences between topping and not topping. When the total scaled rank sums were averaged for the treatments where bulbs were topped prior to bulbing (trts. 8, 9, 11, 12, 14, 15, 16 & 18) and compared to the treatments where the tops were left on (trts 7, 10, 13, 17, 19 and 20, basement treatment No. 21 omitted), leaving the tops on (average scaled rank score: 4.08) was better than topping them (average scaled rank score: 5.46, low score is best).

Curing with passive/natural ventilation better than active/fan-ventilated

Similarly, when passive curing with no or natural ventilation (trts. 7-9, 13, 17, 19, 20, basement curing omitted) was compared to active curing with fans, etc. (trts. 10-12, 14-16, 18), the average total scaled rank score was more favorable for passive curing (5.55) than active curing (6.26).

Table 1. Post-harvest practices garlic project, **2019**: **Treatments – <u>Curing</u> Conditions.**

Trt.	Grower			Curing Conditions						
No.	**No.**	**Location**	**County**	**Type[1]**	**Garlic Tops**	**Garlic Orientation**	**Structure**	**Ventilation**	**Start Date**	**Total No. Days of Curing**
1	1	unknown	unknown	unknown	?	unknown	unknown	unknown	Aug 1	20
2	2	unknown	unknown	unknown	?	unknown	unknown	unknown	Aug 2	21
3	3	unknown	unknown	unknown	?	unknown	unknown	unknown	Aug 1	13
4	4	unknown	unknown	unknown	?	unknown	unknown	unknown	Aug 1	29
5	5	unknown	unknown	unknown	?	unknown	unknown	unknown	Aug 1	30
6	**Not returned**									
7	6	Oakfield	Genesee	Passive	Tops on	Single layer on pallets on floor	High tunnel, shade cloth	Sides rolled up, ends open	Aug 1	28
8	6	Oakfield	Genesee	Passive	Topped to **6" neck**	Single layer on pallets on floor	High tunnel, shade cloth	Sides rolled up, ends open	Aug 1	28
9	6	Oakfield	Genesee	Passive	Topped to **1.5" neck**	Single layer on pallets on floor	High tunnel, shade cloth	Sides rolled up, ends open	Aug 1	28
10	7	Churchville	Monroe	Active	Tops on	Single layer on wooden shelf	High tunnel	Big fans	Aug 7	19
11	7	Churchville	Monroe	Active	Topped to **6" neck**	Single layer on wooden shelf	High tunnel	Big fans	Aug 7	19
12	7	Churchville	Monroe	Active	Topped to **1.5" neck**	Single layer on wooden shelf	High tunnel	Big fans	Aug 7	19
13	7	Churchville	Monroe	Passive	Tops on	Single layer on wooden floor	Old wooden barn	None, poor ventilation	Aug 7	Not moved

Table 1 cont. Post-harvest practices garlic project, **2019**: **Treatments – Curing Conditions.**

Trt.	Grower			Curing Conditions						
No.	**No.**	**Location**	**County**	**Type[1]**	**Garlic Tops**	**Garlic Orientation**	**Structure**	**Ventilation**	**Start Date**	**Total No. Days of Curing**
14	8	Holley	Orleans	Active	Topped to **3" neck**	Single layer in stacked bread trays	Wooden shed	Fan	Aug 1	Not moved
15	8	Holley	Orleans	Active, **cool**	Topped to **3" neck**	Single layer on floor	Wooden floor of house	In front of AC vent	Aug 1	24
16	8	Holley	Orleans	Active	Topped to **3" neck**	Single layer in stacked bread trays	Small greenhouse	Fan	Aug 1	10
17	9	Batavia	Genesee	Passive	Tops on	Single layer on wagon	Steel barn	Doors open, no fans	Aug 1	18
18	10	Oakfield	Genesee	Active	Topped to **2" neck**	1-foot deep pile in 1-ton bin	Steel barn	Fan inside box, front door open	Aug 1	Not moved
19	11	Macedon	Wayne	Passive	Tops on	Bundles of 10 plants hung from ceiling	Old wooden barn	Doors open on both sides, no fans	Aug 2	Not moved
20	12	Sodus	Wayne	Passive	Tops on	2-3 layers in stacked RPC containers	**Outdoors**	Natural	Aug 2	24
21	6	Albion	Orleans	Passive, **cool**	Tops on	Single layer on cement floor	House basement	None, poor ventilation	Aug 2	Not moved

[1]**Type of curing: Active** indicates use of fans/dehumidifiers, etc. **Passive** indicates natural ventilation (open doors, outdoors, etc.).

Comparison of two "treatments" (e.g. tops on vs. topped to 6" tops or wash or no wash) on same farm.

Table 2. Post-harvest practices garlic project, **2019: Treatments – Storage Conditions.**

Trt.	Grower			Storage Conditions						
No.	**No.**	**Location**	**County**	**Type**	**Garlic Tops**	**Garlic Orientation**	**Structure**	**Ventilation**	**Pick Up Date**	**Total No. Days in Storage**
1	1	unknown	unknown	unknown	?	unknown	unknown	unknown	Oct 1	42
2	2	unknown	unknown	unknown	?	unknown	unknown	unknown	Oct 1	40
3	3	unknown	unknown	unknown	?	unknown	unknown	unknown	Oct 1	49
4	4	unknown	unknown	unknown	?	unknown	unknown	unknown	Oct 1	33
5	5	unknown	unknown	unknown	?	unknown	unknown	unknown	Oct 1	32
6	**Not returned**									
7	6	Oakfield	Genesee	Passive	Tops on	5 layers deep on pallet on dirt floor	Steel barn	Inside open overhead door	Oct 4	35
8	6	Oakfield	Genesee	Passive	Topped to **6" neck**	5 layers deep on pallet on dirt floor	Steel barn	Inside open overhead door	Oct 4	35
9	6	Oakfield	Genesee	Passive	Topped to **1.5" neck**	5 layers deep on pallet on dirt floor	Steel barn	Inside open overhead door	Oct 4	35
10	7	Churchville	Monroe	Active	Tops on	Single layer on wooden shelf	High tunnel	Big fans	Oct 4	38
11	7	Churchville	Monroe	Active	Topped to **6" neck**	Single layer on wooden shelf	High tunnel	Big fans	Oct 4	38
12	7	Churchville	Monroe	Active	Topped to **1.5" neck**	Single layer on wooden shelf	High tunnel	Big fans	Oct 4	38
13	7	Churchville	Monroe	Passive	Tops on	Single layer on wooden floor	Old wooden barn	None, poor ventilation	Oct 4	Not moved

Table 2 cont. Post-harvest practices garlic project, **2019: Treatments – Storage Conditions.**

Trt.	Grower			Storage Conditions						
No.	**No.**	**Location**	**County**	**Type**	**Garlic Tops**	**Garlic Orientation**	**Structure**	**Ventilation**	**Pick Up Date**	**Total No. Days in Storage**
14	8	Holley	Orleans	Active	Topped to **3" neck**	Single layer in stacked bread trays	Wooden shed	Fan	Oct 4	Not moved
15	8	Holley	Orleans	Active, **cool**	Topped to **3" neck**	Single layer on floor	Wooden floor of house	In front of AC vent	Oct 4	39
16	8	Holley	Orleans	Active	Topped to **3" neck**	Single layer in stacked bread trays	Small greenhouse	Fan	Oct 4	53
17	9	Batavia	Genesee	Passive	Topped to **1" neck**	Single layer on wagon	Steel barn	Doors open, no fans	Oct 4	45
18	10	Oakfield	Genesee	Active	Topped to **2" neck**	1-foot deep pile in 1-ton bin	Steel barn	Fan inside box, front door open	Oct 4	Not moved
19	11	Macedon	Wayne	Passive	Tops on	Bundles of 10 plants hung from ceiling	Old wooden barn	Doors open on both sides, no fans	Oct 9	Not moved
20	12	Sodus	Wayne	Passive	Topped to **1" neck**	2-3 layers in stacked RPC containers	**Outdoors**	Natural	Oct 9	43
21	6	Albion	Orleans	Passive, **cool**	Tops on	Single layer on cement floor	House basement	None, poor ventilation	Oct 6	Not moved

[1]**Type of storage: Active** indicates use of fans/dehumidifiers, etc. **Passive** indicates natural ventilation (open doors, outdoors, etc.).

Garlic was cured with tops on, and then topped prior to storage.

Table 3. Post-harvest practices garlic project, **2019: Grower Cooperators.**

No.	Trt. Nos.	Grower Name	Farm Name	Address	County
1-6	1-6	Unknown – Eastern New York[1]			
6	7-9 21	Christy Hoepting	CCE – Cornell Vegetable Program	7550 Lewiston Road, Oakfield, NY 1 Lydun Drive, Albion, NY	Genesee Orleans
7	10-13	Ed Fraser	Fraser's Garlic Farm	1379 Johnson Road, Churchville, NY	Monroe
8	14-16	Adam McAllister	A & L Garlic Farms	49 Geddes Street, Holley, NY	Orleans
9	17	Paul Fenton	Fenton's Produce	3323 Pratt Road, Batavia, NY	Genesee
10	18	Andy Harrington	Harrington's Produce	7550 Lewiston Road, Oakfield, NY	Genesee
11	19	Anita Amsler	Old Home Farm	4897 Lincoln Road, Walworth, NY	Wayne
12	20	Mike Johnson	Abe Datthyn Farms	4791 NY-88, Sodus, NY	Wayne

[1]Samples shipped to Crystal Stewart, Eastern NY Commercial Horticulture Program. She distributed to different growers, treatments 1-5 were returned, but samples were not labeled.

Table 4. Post-harvest practices garlic project, **2019: Bulb evaluation after curing and storage – weight, shrink and density.**

Trt.	Grower	Curing		Storage	BEFORE Curing & Storage (Aug 1, 2019)		AFTER Curing & Storage (Oct 7-11, 2019)				
No.	No.	Building	Type[1]	Building	Estimated[2] Average Bulb Weight (lb)	Estimated[2] Total Weight (lb/10 bulbs)	Average Bulb Weight (lb)	Total Weight (lb/10 bulbs)	% Shrink (weight loss)[3]	Average Bulb Diameter (inch)	Average Bulb Weight per Diameter Inch (g/inch)
1	1	unknown	unknown	unknown	0.169	1.69	0.152	1.52	9.8	2.06 ab[4]	33.1 abc
2	2	unknown	unknown	unknown	0.161	1.62	0.133	1.33	17.9	1.96 c-f	30.3 d
3	3	unknown	unknown	unknown	0.166	1.66	0.143	1.43	13.6	2.02 abc	31.7 bcd
4	4	unknown	unknown	unknown	0.168	1.69	0.150	1.50	11.4	2.07 a	32.6 abc
5	5	unknown	unknown	unknown	0.162	1.62	0.140	1.40	13.9	2.01 a-d	31.2 cd
7	6	High tunnel – tops on	Passive	Steel barn, open	0.160	1.60	0.149	1.49	6.8	1.95 c-f	34.3 a
8	6	High tunnel – 6" tops	Passive	Steel barn, open	0.160	1.60	0.140	1.40	12.8	1.92 ef	32.7 abc
9	6	High tunnel – 1.5" tops	Passive	Steel barn, open	0.164	1.64	0.146	1.46	11.0	1.95 c-f	33.6 ab
10	7	High tunnel – tops on	Active	High tunnel (white), open	0.161	1.57	0.142	1.42	9.7	1.96 c-f	32.3 a-d
11	7	High tunnel – 6" tops	Active	High tunnel (white), open	0.167	1.67	0.150	1.50	10.0	2.01 a-e	34.2 a
12	7	High tunnel – 1.5" tops	Active	High tunnel (white), open	0.169	1.70	0.147	1.47	13.3	1.94 c-f	34.1 a
13	7	Wood barn loft – tops on	Passive	Same, poor ventilation	0.164	1.64	0.144	1.44	12.4	1.97 c-f	32.9 abc
14	8	Wooden shed, 3" tops	Active	Wooden shed, closed	0.164	1.64	0.146	1.46	10.6	1.97 b-f	33.6 ab
15	8	Cool Wood floor by AC, 3" tops	Active	Wooden shed, closed	0.160	1.60	0.136	1.36	15.1	1.90 f	32.1 a-d
16	8	Greenhouse, 3" tops	Active	Wooden shed, closed	0.165	1.66	0.145	1.45	12.3	1.92 def	33.7 ab
17	9	Wagon in steel barn – tops on	Passive	Greenhouse, fans – 2" tops	0.160	1.61	0.139	1.39	13.8	1.92 f	32.4 a-d
18	10	Steel barn in 1-ton bin – 2" tops	Active	Same, fan off, door open	0.162	1.62	0.143	1.43	11.2	1.95 c-f	33.0 abc
19	11	Wooden barn, hanging – tops on	Passive	Same as curing, doors open	0.166	1.66	0.152	1.52	8.1	2.02 abc	33.8 ab
20	12	Outside in covered RPC bins – tops on	Passive	Steel barn, open – 1" tops	0.175	1.75	0.159	1.59	9.6	2.08 a	34.2 a
21	6	Cool Basement floor – tops on	Passive	Cool - Same as curing	0.164	1.64	0.147	1.47	10.6	1.95 c-f	33.4 ab
	P value (α = 0.05), Fisher's Protected LSD test.				*0.5280*	*0.2179*	*0.1556*	*0.1299*	*0.4026*	*0.0002*	*0.0209*
	transformation				normal	normal	normal	normal	normal	normal	normal
	Trial Average[5]				**0.164 lb**	**1.64 lb**	**0.145 lb**	**1.45 lb**	**11.7%**	**1.98"**	**33.0 g/inch**

[1]**Type of curing: Active** indicates use of fans/dehumidifiers, etc. **Passive** indicates natural ventilation (open doors, outdoors, etc.).

[2]**Estimated bulb weight prior to storage:** Bulb weight was taken on 141 bulbs with roots trimmed and topped to 1-inch necks shortly after harvest on Aug 1, 2019. Bulbs were divided into several categories based on color and diameter. Since all 10-bulb samples were divided evenly among the different colors of pink (6 light pink, 3 pink and 1 no pink/white), the bulb weight prior to storage was estimated by assuming that the lightest bulb was originally white, the next six lightest bulbs were light pink and the three darkest bulbs were pink, and then the out-of-storage bulb diameter was used to determine the pre-storage bulb weight by pink-color category – see Table x.

[3]**Shrink %** = ([total estimated weight/10 bulbs prior to curing/storage (Aug 1)] – [total weight/10 bulbs after curing/storage (Oct 7-11)]/[total estimated weight/10 bulbs prior to curing/storage (Aug 1)] x 100.

[4]Numbers in a column followed by the same letter are not significantly different, Fisher's Protected LSD test, $p<0.05$.

[5]**Trial Average:** Of 10 bulbs/sample x 5 samples x 20 treatments (= 1000 bulbs), or 5 samples x 20 treatments = 100 data points.

Not significantly different than the best treatment. Or, more favorable then trial average.

Table 5. Post-harvest practices garlic project, **2019: Bulb evaluation after curing and storage – Bulb quality.**

Trt.	Grower	Curing		Storage	Presence of Surface Black Mold[2] (% bulbs)	Unmarketable Bulbs		Bulb Color		Bulb Firmness		Overall Bulb Quality (Scale 1-14)[7]
No.	No.	Building	Type[1]	Building		Fusarium (% bulbs)	Eriophyid Mites (% bulbs)	White (Scale 1-8)[3]	Pink (Scale 0-4)[4]	Wrapper Leaf Tightness (Scale 1-7)[5]	Bulb Firmness (Scale 1-9)[6]	
1	1	unknown	unknown	unknown	0.0 c[8]	14.0	0.0 b	6.60 a	2.52 a	1.49 fg	1.64 g	8.05
2	2	unknown	unknown	unknown	4.0 bc	18.0	0.0 b	6.52 a	1.78 fgh	1.38 fg	2.08 fg	8.52
3	3	unknown	unknown	unknown	0.0 c	22.0	0.0 b	5.84 bc	1.52 hi	1.64 efg	2.20 fg	8.45
4	4	unknown	unknown	unknown	4.0 bc	16.0	0.0 b	5.68 cd	2.22 a-d	1.12 g	2.38 ef	8.05
5	5	unknown	unknown	unknown	8.0 bc	10.0	0.0 b	5.90 bc	2.10 b-f	1.14 g	2.90 cde	8.63
7	6	High tunnel – tops on	Passive	Steel barn, open	6.0 bc	8.0	4.0 ab	4.56 ghi	1.80 fgh	1.76 def	3.56 b	7.84
8	6	High tunnel – 6" tops	Passive	Steel barn, open	2.0 c	14.0	2.0 b	4.74 fgh	1.95 c-g	2.24 bcd	3.82 ab	8.69
9	6	High tunnel – 1.5" tops	Passive	Steel barn, open	4.0 bc	10.0	4.0 ab	4.76 fgh	1.92 c-g	2.08 cde	3.26 bcd	8.33
10	7	High tunnel – tops on	Active	High tunnel (white), open	6.0 bc	12.0	0.0 b	5.00 efg	1.84 e-h	2.10 cde	3.50 bc	8.63
11	7	High tunnel – 6" tops	Active	High tunnel (white), open	6.0 bc	8.0	0.0 b	4.90 e-h	1.49 hi	2.43 abc	4.31 a	8.98
12	7	High tunnel – 1.5" tops	Active	High tunnel (white), open	4.0 bc	12.5	4.0 ab	4.90 e-h	1.66 gh	2.58 abc	3.78 ab	8.68
13	7	Wood barn loft – tops on	Passive	Same, poor ventilation	6.0 bc	12.0	2.0 b	5.18 def	2.00 c-g	2.30 a-d	3.84 ab	8.42
14	8	Wooden shed, 3" tops	Active	Wooden shed, closed	0.0 c	10.0	4.0 ab	4.70 f-i	2.26 abc	2.30 a-d	3.88 ab	8.65
15	8	Cool Wood floor by AC, 3" tops	Active	Wooden shed, closed	2.0 c	2.0	0.0 b	4.98 efg	2.52 a	2.38 abc	4.28 a	9.00
16	8	Greenhouse, 3" tops	Active	Wooden shed, closed	0.0 c	6.0	8.0 a	4.32 hi	2.21 a-e	2.84 a	4.30 a	9.02
17	9	Wagon in steel barn – tops on	Passive	Greenhouse, fans – 2" tops	10.0 bc	16.0	8.0 a	4.14 i	1.15 i	2.76 ab	4.30 a	8.89
18	10	Steel barn in 1-ton bin – 2" tops	Active	Same, fan off, door open	4.0 bc	10.0	0.0 b	4.96 efg	2.26 abc	2.08 cde	3.90 ab	8.35
19	11	Wooden barn, hanging – tops on	Passive	Same as curing, doors open	0.0 c	8.0	2.0 b	6.76 a	2.44 ab	1.56 efg	3.40 bc	7.93
20	12	Outside in covered RPC bins – tops on	Passive	Steel barn, open – 1" tops	16.0 b	12.0	0.0 b	6.34 ab	1.86 d-h	1.40 fg	2.70 def	8.18
21	6	Cool Basement floor – tops on	Passive	Cool - Same as curing	52.0 a	24.0	0.0 b	5.46 cde	0.04 j	1.66 efg	4.32 a	10.07
	P value (α = 0.05), Fisher's Protected LSD test.				*0.0000*	*0.1518*	*0.0350*	*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.0531*
	transformation				Arcsin[9]	normal	Arcsin[9]	normal	normal	normal	normal	normal
	Trial Average[10]				**6.7%**	**12.2%**	**1.9%**	**5.31/8**	**1.88/4**	**1.96/7**	**3.42/9**	**8.57/14**

[1]**Type of curing: Active** indicates use of fans/dehumidifiers, etc. **Passive** indicates natural ventilation (open doors, outdoors, etc.).

[2]**Black surface mold:** caused by *Embellisia allii*, a superficial mold caused by moist conditions.
[3]**White Bulb Color Scale 1-8: 1** = Very White; **2** = White; **3** = Off-white – level 1; **4** = Off-white – level 2; **5** = Off-white – level 3; **6** = Brown-White – level 1; **7** = Brown-White – level 2; **8** = Brown-White – level 3. **Low score is best.**
[4]**Pink Clove Color Scale 0-4: 0** = No pink; **1** = Very light pink; **2** = Light pink; **3** = Pink; **4** = Dark pink. **High score is pink.**
[5]**Wrapper Leaf Tightness Scale 1-7: 1** = Tight; **2** = Tight-Moderate; **3** = Moderate-Tight; **4** = Moderate; **5** = Moderate-Loose; **6** = Loose-Moderate; **7** = Loose. **Low score is best.**
[6]**Bulb Firmness Scale 1-9: 1** = Very Hard; **2** = Very Hard-Hard; **3** = Hard-Very Hard; **4** = Hard; **5** = Hard-Moderate/Moderate-Hard; **6** = Moderate; **7** = Soft-Moderate/Moderate-Soft; **8** = Soft; **9** = Very Soft. **Low score is best.**
[7]**Overall Bulb Quality Scale 1-14: 1 = Excellent**; **2** = Excellent-Very Good; **3** = Very Good-Excellent; **4 = Very Good**; **5** = Very Good – Good' **6** = Good – Very Good; **7 = Good**; **8** = Good to Mediocre; **9** = Mediocre – Good; **10 = Mediocre**; **11** = Mediocre – Poor; **12** = Poor – Mediocre; **13 = Poor**; **14 = Unmarketable** – see Unmarketable bulbs columns. **Low score is best.**
[8]Numbers in a column followed by the same letter are not significantly different, Fisher's Protected LSD test, $p < 0.05$.
[9]**Transformation:** y = arcsin(x/100)^0.5.
[10]**Trial Average:** Of 10 bulbs/sample x 5 samples x 21 treatments (= 1050 bulbs), or 5 samples x 21 treatments = 105 samples.

Not significantly different from best treatment.
Or, more favorable than trial average.

Not significantly different than worst treatment.
Or, less favorable than the trial average.

Table 6. Post-harvest practices garlic project, **2019: Bulb evaluation after curing and storage – Bulb Color and Firmness.**

Trt.	Grower	Curing		Storage	White-Brown Color			Pink Color		Bulb Firmness	
No.	No.	Building	Type[1]	Building	White (Scale 1-8)[2]	% Bulbs 1-3 (VW, W, OW1)	% Bulbs 7 & 8 (BW2-3)	Pink Color (Scale 0-4)[3]	% Bulbs 4 (Dark Pink)	Bulb Firmness (Scale 1-9)[4]	% Bulbs 1 (Very Hard)
1	1	unknown	unknown	unknown	6.60 a[5]	6.0 def	56.0 ab	2.52 a	10.0	1.64 g	80.0 a
2	2	unknown	unknown	unknown	6.52 a	12.0 def	62.0 a	1.78 fgh	4.0	2.08 fg	76.0 ab
3	3	unknown	unknown	unknown	5.84 bc	4.0 ef	38.0 bcd	1.52 hi	0.0	2.20 fg	62.0 abc
4	4	unknown	unknown	unknown	5.68 cd	14.0 def	40.0 bc	2.22 a-d	8.0	2.38 ef	54.0 bcd
5	5	unknown	unknown	unknown	5.90 bc	10.0 def	36.0 cde	2.10 b-f	4.0	2.90 cde	38.0 c-f
7	6	High tunnel – tops on	Passive	Steel barn, open	4.56 ghi	6.0 def	8.0 f	1.80 fgh	2.0	3.56 b	22.0 e-h
8	6	High tunnel – 6" tops	Passive	Steel barn, open	4.74 fgh	18.0 cde	10.0 f	1.95 c-g	8.5	3.82 ab	20.0 fgh
9	6	High tunnel – 1.5" tops	Passive	Steel barn, open	4.76 fgh	18.0 cde	12.0 f	1.92 c-g	4.0	3.26 bcd	34.0 d-g
10	7	High tunnel – tops on	Active	High tunnel (white), open	5.00 efg	20.0 bcd	16.0 f	1.84 e-h	4.0	3.50 bc	24.0 e-h
11	7	High tunnel – 6" tops	Active	High tunnel (white), open	4.90 e-h	18.4 cde	12.0 f	1.49 hi	2.0	4.31 a	6.0 h
12	7	High tunnel – 1.5" tops	Active	High tunnel (white), open	4.90 e-h	18.0 cde	14.0 f	1.66 gh	4.0	3.78 ab	20.0 fgh
13	7	Wood barn loft – tops on	Passive	Same, poor ventilation	5.18 def	18.0 cde	20.0 def	2.00 c-g	4.0	3.84 ab	18.0 fgh
14	8	Wooden shed, 3" tops	Active	Wooden shed, closed	4.70 f-i	30.0 abc	18.0 ef	2.26 abc	4.0	3.88 ab	18.0 fgh
15	8	Cool Wood floor by AC, 3" tops	Active	Wooden shed, closed	4.98 efg	16.0 c-f	16.0 f	2.52 a	8.5	4.28 a	16.0 fgh
16	8	Greenhouse, 3" tops	Active	Wooden shed, closed	4.32 hi	34.0 ab	4.0 f	2.21 a-e	10.9	4.30 a	10.0 gh
17	9	Wagon in steel barn – tops on	Passive	Greenhouse, fans – 2" tops	4.14 i	44.0 a	4.0 f	1.15 i	0.0	4.30 a	14.0 fgh
18	10	Steel barn in 1-ton bin – 2" tops	Active	Same, fan off, door open	4.96 efg	12.0 def	16.0 f	2.26 abc	12.0	3.90 ab	16.0 fgh
19	11	Wooden barn, hanging – tops on	Passive	Same as curing, doors open	6.76 a	2.0 f	62.0 a	2.44 ab	5.0	3.40 bc	28.0 e-h
20	12	Outside in covered RPC bins – tops on	Passive	Steel barn, open – 1" tops	6.34 ab	6.0 def	54.0 abc	1.86 d-h	0.0	2.70 def	46.0 cde
21	6	Cool Basement floor – tops on	Passive	Cool Same as curing	5.46 cde	8.0 def	20.0 def	0.04 j	0.0	4.32 a	18.0 fgh
	P value (α = 0.05), Fisher's Protected LSD test.				*0.0000*	*0.0000*	*0.0000*	*0.0000*	*0.3392*	*0.0000*	*0.0000*
	transformation				normal	normal	normal	normal	normal	normal	normal
	Trial Average[6]				**5.31/8**	**15.7%**	**25.9%**	**1.88/4**	**4.8%**	**3.42/9**	**31.0%**

[1]**Type of curing: Active** indicates use of fans/dehumidifiers, etc. **Passive** indicates natural ventilation (open doors, outdoors, etc.).

[2]**White Bulb Color Scale 1-8: 1** = Very White; **2** = White; **3** = Off-white – level 1; **4** = Off-white – level 2; **5** = Off-white – level 3; **6** = Brown-White – level 1; **7** = Brown-White – level 2; **8** = Brown-White – level 3. **Low score is best.**

[3]**Pink Clove Color Scale 0-4: 0** = No pink; **1** = Very light pink; **2** = Light pink; **3** = Pink; **4** = Dark pink. **High score is pink.**

[4]**Bulb Firmness Scale 1-9: 1** = Very Hard; **2** = Very Hard-Hard; **3** = Hard-Very Hard; **4** = Hard; **5** = Hard-Moderate/Moderate-Hard; **6** = Moderate; **7** = Soft-Moderate/Moderate-Soft; **8** = Soft; **9** = Very Soft. **Low score is best.**

[5]Numbers in a column followed by the same letter are not significantly different, Fisher's Protected LSD test, $p < 0.05$.

[6]**Trial Average:** Of 10 bulbs/sample x 5 samples x 20 treatments (= 1000 bulbs), or 5 samples x 20 treatments = 100 samples.

Not significantly different from best treatment. Not significantly different than worst treatment.

Table 7. Post-harvest practices garlic project, **2019: Bulb evaluation after curing and storage – Wrapper Leaves.**

Trt.	Grower	Curing		Storage	Wrapper Leaves			
No.	No.	Building	Type[1]	Building	Tightness (Scale 1-7)[2]	% Bulbs With Brittle Wrapper Leaves	% Bulbs With Split Wrapper Leaves	% Bulbs With Few Wrapper Leaves
1	1	unknown	unknown	unknown	1.49 fg[3]	60.0 a	38.0	20.0 cd
2	2	unknown	unknown	unknown	1.38 fg	56.0 ab	34.0	32.0 abc
3	3	unknown	unknown	unknown	1.64 efg	0.0 c	36.0	32.0 abc
4	4	unknown	unknown	unknown	1.12 g	0.0 c	28.0	36.0 abc
5	5	unknown	unknown	unknown	1.14 g	2.0 c	22.0	36.0 abc
7	6	High tunnel – tops on	Passive	Steel barn, open	1.76 def	2.0 c	30.0	20.0 cd
8	6	High tunnel – 6" tops	Passive	Steel barn, open	2.24 bcd	0.0 c	18.0	20.0 cd
9	6	High tunnel – 1.5" tops	Passive	Steel barn, open	2.08 cde	2.0 c	18.0	22.0 cd
10	7	High tunnel – tops on	Active	High tunnel (white), open	2.10 cde	0.0 c	38.0	26.0 bcd
11	7	High tunnel – 6" tops	Active	High tunnel (white), open	2.43 abc	4.0 c	50.9	32.7 abc
12	7	High tunnel – 1.5" tops	Active	High tunnel (white), open	2.58 abc	0.0 c	38.0	22.0 cd
13	7	Wood barn loft – tops on	Passive	Same, poor ventilation	2.30 a-d	0.0 c	36.0	12.0 d
14	8	Wooden shed, 3" tops	Active	Wooden shed, closed	2.30 a-d	22.0 bc	30.0	20.0 cd
15	8	Cool Wood floor by AC, 3" tops	Active	Wooden shed, closed	2.38 abc	0.0 c	24.0	26.0 bcd
16	8	Greenhouse, 3" tops	Active	Wooden shed, closed	2.84 a	2.0 c	26.0	24.0 bcd
17	9	Wagon in steel barn – tops on	Passive	Greenhouse, fans – 2" tops	2.76 ab	0.0 c	24.0	22.0 cd
18	10	Steel barn in 1-ton bin – 2" tops	Active	Same, fan off, door open	2.08 cde	20.0 c	28.0	10.0 d
19	11	Wooden barn, hanging – tops on	Passive	Same as curing, doors open	1.56 efg	0.0 c	28.0	22.0 cd
20	12	Outside in covered RPC bins – tops on	Passive	Steel barn, open – 1" tops	1.40 fg	0.0 c	26.0	42.0 ab
21	6	Cool Basement floor – tops on	Passive	Cool - Same as curing	1.66 efg	48.0 ab	26.0	48.0 a
	P value (α = 0.05), Fisher's Protected LSD test.				*0.0000*	*0.0001*	*0.4413*	*0.0077*
	transformation				normal	arcsin[4]	normal	normal
	Trial Average[5]				**1.96/7**	**11.0%**	**29.9%**	**26.2%**

[1]**Type of curing: Active** indicates use of fans/dehumidifiers, etc. **Passive** indicates natural ventilation (open doors, outdoors, etc.).

[2]**Wrapper Leaf Tightness Scale 1-7: 1** = Tight; **2** = Tight-Moderate; **3** = Moderate-Tight; **4** = Moderate; **5** = Moderate-Loose; **6** = Loose-Moderate; **7** = Loose. **Low score is best.**

[3]Numbers in a column followed by the same letter are not significantly different, Fisher's Protected LSD test, $p < 0.05$.

[4]**Transformation:** y = arcsin(x/100)^0.5.

[5]**Trial Average:** Of 10 bulbs/sample x 5 samples x 20 treatments (= 1000 bulbs), or 5 samples x 20 treatments = 100 samples.

Not significantly different from best treatment.

Not significantly different than worst treatment. Or, less favorable than the trial average.

Table 8. Post-harvest practices garlic project, **2019: Clove quality after cold storage (refrigerator) in plastic bags for 72 days** (Oct 7 to Dec 18, 2019) and **after storage at room temperature in paper bags for 118 days** (Oct 7, 2019 to Feb 3, 2020).

Trt.	Grower	Curing		Storage	COLD storage in Plastic Bags 72 days	DRY storage in Paper Bags 118 days		
No.	No.	Building	Type[1]	Building	Fusarium % Clove Coverage[2]	Fusarium % Clove Coverage[2]	Clove Color (Scale 1-4)[3]	Clove Firmness (Scale 1-3)[4]
1	1	unknown	unknown	unknown	2.8	0.2	1.4	1.2
2	2	unknown	unknown	unknown	21.4	25.2	2.4	2.0
3	3	unknown	unknown	unknown	3.8	21.8	2.0	1.6
4	4	unknown	unknown	unknown	4.5	14.8	2.8	1.6
5	5	unknown	unknown	unknown	1.1	12.2	2.6	2.0
7	6	High tunnel – tops on	Passive	Steel barn, open	4.2	27.6	2.2	1.4
8	6	High tunnel – 6" tops	Passive	Steel barn, open	10.0	46.2	2.4	1.6
9	6	High tunnel – 1.5" tops	Passive	Steel barn, open	3.1	18.2	2.8	1.8
10	7	High tunnel – tops on	Active	High tunnel (white), open	4.2	24.0	2.4	1.8
11	7	High tunnel – 6" tops	Active	High tunnel (white), open	5.0	8.8	2.4	1.4
12	7	High tunnel – 1.5" tops	Active	High tunnel (white), open	16.1	4.0	1.6	1.0
13	7	Wood barn loft – tops on	Passive	Same, poor ventilation	1.7	12.8	2.0	1.2
14	8	Wooden shed, 3" tops	Active	Wooden shed, closed	3.9	12.4	2.4	1.6
15	8	Cool Wood floor by AC, 3" tops	Active	Wooden shed, closed	2.2	4.4	2.6	1.8
16	8	Greenhouse, 3" tops	Active	Wooden shed, closed	4.8	41.2	3.0	2.0
17	9	Wagon in steel barn – tops on	Passive	Greenhouse, fans – 2" tops	19.2	39.4	3.0	1.8
18	10	Steel barn in 1-ton bin – 2" tops	Active	Same, fan off, door open	9.4	5.4	2.6	1.6
19	11	Wooden barn, hanging – tops on	Passive	Same as curing, doors open	5.3	10.2	2.6	1.2
20	12	Outside in covered RPC bins – tops on	Passive	Steel barn, open – 1" tops	1.2	52.2	2.8	1.8
21	6	Cool Basement floor – tops on	Passive	Cool - Same as curing	14.6	44.8	2.6	1.8
	P value (α = 0.05), Fisher's Protected LSD test.				*0.3580*	*0.2896*	*0.7261*	*0.3756*
	Transformation, non-transformed values presented.				arcsin[5]	normal	normal	normal
	Trial Average[6]				**6.9%**	**21.3%**	**2.4/4**	**1.6/3**
	Presence of Eriophyid Mites (% of 100 samples: 20 trts x 5 samples)				**0.0%**	**95%**	--	--

[1]**Type of curing: Active** indicates use of fans/dehumidifiers, etc. **Passive** indicates natural ventilation (open doors, outdoors, etc.).

[2]**Fusarium % Clove Coverage:** Estimation of total surface area per clove that was covered with Fusarium disease Single clove samples collected from poorest non-cull bulbs.
[3]**Clove Color Scale 1-4: 1** = White; **2** = Off-White; **3** = Tan; **4** = Brown. **Low score is best.**
[4]**Clove Firmness Scale 1-3: 1** = Firm; **2** = Soft; **3** = Cull. **Low score is best.**
[5]**Transformation:** y = arcsin(x/100)^0.5.
[6]**Trial Average:** Of 5 cloves per treatment x 20 treatments (= 100 cloves).
Less favorable than trial average. More favorable than trial average.

Table 9. Post-harvest practices garlic project, 2019: **Scaled Treatment Rankings – Bulb quality after curing and storage** (Oct 7-11, 2019),

Trt.	Grower	Curing		Storage	Scaled Rank[2]									Sum Rank Score[4]	*Final Rank*[5]
No.	No.	Building	Type[1]	Building	SHK[3]	DEN	WHT	WT3	BW	TGT	FRM	PVH	QLT		
1	1	unknown	unknown	unknown	0.27	0.30	0.94	0.90	0.90	0.22	0.00	0.00	0.09	3.62	4
2	2	unknown	unknown	unknown	1.00	1.00	0.91	0.76	1.00	0.15	0.16	0.05	0.30	5.34	18
3	3	unknown	unknown	unknown	0.61	0.65	0.65	0.95	0.59	0.30	0.21	0.24	0.27	4.48	10
4	4	unknown	unknown	unknown	0.41	0.42	0.59	0.71	0.62	0.00	0.28	0.35	0.09	3.48	2
5	5	unknown	unknown	unknown	0.64	0.78	0.67	0.81	0.55	0.01	0.47	0.57	0.35	4.85	16
7	6	High tunnel – tops on	Passive	Steel barn, open	0.00	0.00	0.16	0.90	0.07	0.37	0.72	0.78	0.00	3.01	1
8	6	High tunnel – 6” tops	Passive	Steel barn, open	0.54	0.40	0.23	0.62	0.10	0.65	0.81	0.81	0.38	4.55	12
9	6	High tunnel – 1.5” tops	Passive	Steel barn, open	0.38	0.17	0.24	0.62	0.14	0.56	0.60	0.62	0.22	3.55	3
10	7	High tunnel – tops on	Active	High tunnel (white), open	0.26	0.50	0.33	0.57	0.21	0.57	0.69	0.76	0.35	4.24	7
11	7	High tunnel – 6” tops	Active	High tunnel (white), open	0.29	0.02	0.29	0.61	0.14	0.76	1.00	1.00	0.51	4.62	14
12	7	High tunnel – 1.5” tops	Active	High tunnel (white), open	0.59	0.05	0.29	0.62	0.17	0.85	0.80	0.81	0.38	4.55	13
13	7	Wood barn loft – tops on	Passive	Same, poor ventilation	0.50	0.35	0.40	0.62	0.28	0.69	0.82	0.84	0.26	4.75	15
14	8	Wooden shed, 3” tops	Active	Wooden shed, closed	0.34	0.17	0.21	0.33	0.24	0.69	0.84	0.84	0.36	4.03	5
15	8	Cool wood floor by AC, 3” tops	Active	Wooden shed, closed	0.75	0.55	0.32	0.67	0.21	0.73	0.99	0.86	0.52	5.59	20
16	8	Greenhouse, 3” tops	Active	Wooden shed, closed	0.50	0.15	0.07	0.24	0.00	1.00	0.99	0.95	0.53	4.42	9
17	9	Wagon in steel barn – tops on	Passive	Greenhouse, fans – 2” tops	0.63	0.48	0.00	0.00	0.00	0.95	0.99	0.89	0.47	4.41	8
18	10	Steel barn in 1-ton bin – 2” tops	Active	Same as curing, fan off, door open	0.40	0.33	0.31	0.76	0.21	0.56	0.84	0.86	0.23	4.50	11
19	11	Wooden barn, hanging – tops on	Passive	Same as curing, doors open	0.12	0.13	1.00	1.00	1.00	0.26	0.66	0.70	0.04	4.90	17
20	12	Outside in covered RPC bins – tops on	Passive	Steel barn, open – 1” tops	0.25	0.02	0.84	0.90	0.86	0.16	0.40	0.46	0.15	4.05	6
21	6	Cool basement floor – tops on	Passive	Cool – same as curing	0.34	0.23	0.50	0.86	0.28	0.31	1.00	0.84	1.00	5.36	19

[1] **Type of curing:** Active indicates use of fans/dehumidifiers, etc. Passive indicates natural ventilation (open doors, outdoors, etc.)

[2] **Scaled Rank:** Treatments are ranked from best to worst for each metric, where 0.00 is the best treatment and 1.00 is the worst. Ranks are scaled to fall between 0 and 1 while preserving the non-linearity of the data as follows: ***1) When highest value indicates most favorable result*** for the variable

(e.g. density), then scaled rank = [(highest treatment mean per variable) – (treatment mean)] / [span of variable (e.g. highest minus lowest treatment mean per variable)]. ***2) When lowest value indicates most favorable result*** for the variable (e.g. bulb quality scale), then scaled rank = [(treatment mean) – (lowest treatment mean per variable)] / [span of variable (e.g. highest minus lowest treatment mean per variable)].

[3] **SHK** - % shrink after curing and storage (Oct 2019, mean values in Table 4), **DEN** - average bulb density after curing and storage (g/diameter inch, Oct 2019, Table 4), **WHT** - bulb whiteness after curing and storage (scale 1-8, Oct 2019, Table 5), **WT3** - % of bulbs scoring 1-3 (very white - off-white1) on the whiteness scale after curing and storage (Oct 2019, Table 6), **BW** - % of bulbs scoring 7 or 8 (brown) on the whiteness scale after curing and storage (Oct 2019, Table 6), **TGT** - wrapper leaf tightness after curing and storage (scale 1-7, Oct 2019, Table 5), **FRM** - bulb firmness after curing and storage (scale 1-9, Oct 2019, Table 5), **PVH** - % of bulbs scoring 1 on firmness scale (very hard) after curing and storage (Oct 2019, Table 6), **QLT** - overall bulb quality after curing and storage (scale 1-14, Oct 2019, Table 5)

[4] **Sum Rank Score:** Sum of the 9 scaled ranks per treatment.

[5] **Final Ranking:** Linear ranking from best to worst of the 21 treatments based on the sum rank score.

Worst (1.00) Bottom 20% (0.80-0.99) Top 20% (0.01-0.20) Best (0.00)

Table 10. Post-harvest practices garlic project, 2019: **Scaled Treatment Rankings – Fusarium and Black Mold Diseases.**

Trt.	Grower	Curing		Storage	Fusarium					Black Mold[3]	Total Disease	
					Scaled Rank[2]			Sum Rank Score[4]	*Final Rank*[5]	Scaled Rank[2]	Sum Rank Score[4]	*Final Rank*[5]
No.	No.	Building	Type[1]	Building	FUS[3]	CCC	CCD					
1	1	unknown	unknown	unknown	0.55	0.08	0.00	0.63	3	0.00	0.63	2
2	2	unknown	unknown	unknown	0.73	1.00	0.48	2.21	18	0.08	2.28	18
3	3	unknown	unknown	unknown	0.91	0.13	0.42	1.46	15	0.00	1.46	15
4	4	unknown	unknown	unknown	0.64	0.17	0.28	1.08	12	0.08	1.16	12
5	5	unknown	unknown	unknown	0.36	0.00	0.23	0.59	2	0.15	0.75	6
7	6	High tunnel – tops on	Passive	Steel barn, open	0.27	0.15	0.53	0.95	10	0.12	1.07	10
8	6	High tunnel – 6” tops	Passive	Steel barn, open	0.55	0.44	0.88	1.87	17	0.04	1.91	17
9	6	High tunnel – 1.5” tops	Passive	Steel barn, open	0.36	0.10	0.35	0.81	8	0.08	0.89	8
10	7	High tunnel – tops on	Active	High tunnel (white), open	0.45	0.15	0.46	1.06	11	0.12	1.18	13
11	7	High tunnel – 6” tops	Active	High tunnel (white), open	0.27	0.19	0.17	0.63	4	0.12	0.75	5
12	7	High tunnel – 1.5” tops	Active	High tunnel (white), open	0.48	0.74	0.07	1.29	14	0.08	1.37	14
13	7	Wood barn loft – tops on	Passive	Same, poor ventilation	0.45	0.03	0.24	0.73	6	0.12	0.84	7
14	8	Wooden shed, 3” tops	Active	Wooden shed, closed	0.36	0.14	0.23	0.74	7	0.00	0.74	4
15	8	Cool wood floor by AC, 3” tops	Active	Wooden shed, closed	0.00	0.05	0.08	0.13	1	0.04	0.17	1
16	8	Greenhouse, 3” tops	Active	Wooden shed, closed	0.18	0.18	0.79	1.15	13	0.00	1.15	11
17	9	Wagon in steel barn – tops on	Passive	Greenhouse, fans – 2” tops	0.64	0.89	0.75	2.28	19	0.19	2.47	19
18	10	Steel barn in 1-ton bin – 2” tops	Active	Same as curing, fan off, door open	0.36	0.41	0.10	0.87	9	0.08	0.95	9
19	11	Wooden barn, hanging – tops on	Passive	Same as curing, doors open	0.27	0.21	0.19	0.67	5	0.00	0.67	3
20	12	Outside in covered RPC bins – tops on	Passive	Steel barn, open – 1” tops	0.45	0.00	1.00	1.46	16	0.31	1.77	16
21	6	Cool basement floor – tops on	Passive	Cool – same as curing	1.00	0.67	0.86	2.52	20	1.00	3.52	20

[1] **Type of curing:** Active indicates use of fans/dehumidifiers, etc. Passive indicates natural ventilation (open doors, outdoors, etc.)

[2] **Scaled Rank:** Treatments are ranked from best to worst for each metric, where 0.00 is the best treatment and 1.00 is the worst. Ranks are scaled to fall between 0 and 1 while preserving the non-linearity of the data as follows: [(treatment mean) – (lowest treatment mean per variable)] / [span of variable (e.g. highest minus lowest treatment mean per variable)].

[3] **FUS** - % of bulbs with Fusarium after curing and storage (Oct 2019, mean values in Table 5), **CCC** - % of clove covered with Fusarium after storage in a plastic bag in a refrigerator for 10 weeks (Dec 18, 2019, Table 8), **CCD** - % of clove covered with Fusarium after storage in a paper bag at room temperature for 16.5-17 weeks (Feb 3, 2020, Table 8), **Black Mold** – % of bulbs with superficial black mold (*Embellisia allii*) after curing and storage (Oct 2019, mean values in Table 5).

[4] **Sum Rank Score:** Sum of the 9 scaled ranks per treatment.

[5] **Final Ranking:** Linear ranking from best to worst of the 21 treatments based on the sum rank score.

Worst (1.00) Bottom 20% (0.80-0.99) Top 20% (0.01-0.20) Best (0.00)

Table 11. Post-harvest practices garlic project, 2019: **Scaled Treatment Rankings – Summary of All Variables.**

Trt.	Grower	Curing		Storage	Bulb Quality after Curing and Storage[2]		Fusarium Disease[4]		Total Disease (Fusarium + Black Mold)[5]		Total (All Categories)[6]	
No.	No.	Building	Type[1]	Building	Sum Rank Score	*Final Rank*[3]	Sum Rank Score	*Final Rank*	Sum Rank Score	*Final Rank*	Sum Rank Score	*FINAL Rank*
1	1	unknown	unknown	unknown	3.62	4	0.63	3	0.63	2	4.25	2
2	2	unknown	unknown	unknown	5.34	18	2.21	18	2.28	18	7.63	19
3	3	unknown	unknown	unknown	4.48	10	1.46	15	1.46	15	5.93	16
4	4	unknown	unknown	unknown	3.48	2	1.08	12	1.16	12	4.65	4
5	5	unknown	unknown	unknown	4.85	16	0.59	2	0.75	6	5.60	12
7	6	High tunnel – tops on	Passive	Steel barn, open	3.01	1	0.95	10	1.07	10	4.07	1
8	6	High tunnel – 6” tops	Passive	Steel barn, open	4.55	12	1.87	17	1.91	17	6.46	17
9	6	High tunnel – 1.5” tops	Passive	Steel barn, open	3.55	3	0.81	8	0.89	8	4.44	3
10	7	High tunnel – tops on	Active	High tunnel (white), open	4.24	7	1.06	11	1.18	13	5.42	7
11	7	High tunnel – 6” tops	Active	High tunnel (white), open	4.62	14	0.63	4	0.75	5	5.37	6
12	7	High tunnel – 1.5” tops	Active	High tunnel (white), open	4.55	13	1.29	14	1.37	14	5.92	15
13	7	Wood barn loft – tops on	Passive	Same, poor ventilation	4.75	15	0.73	6	0.84	7	5.59	11
14	8	Wooden shed, 3” tops	Active	Wooden shed, closed	4.03	5	0.74	7	0.74	4	4.76	5
15	8	Cool wood floor by AC, 3” tops	Active	Wooden shed, closed	5.59	20	0.13	1	0.17	1	5.77	13
16	8	Greenhouse, 3” tops	Active	Wooden shed, closed	4.42	9	1.15	13	1.15	11	5.57	10
17	9	Wagon in steel barn – tops on	Passive	Greenhouse, fans – 2” tops	4.41	8	2.28	19	2.47	19	6.89	18
18	10	Steel barn in 1-ton bin – 2” tops	Active	Same as curing, fan off, door open	4.50	11	0.87	9	0.95	9	5.45	8
19	11	Wooden barn, hanging – tops on	Passive	Same as curing, doors open	4.90	17	0.67	5	0.67	3	5.57	9
20	12	Outside in covered RPC bins – tops on	Passive	Steel barn, open – 1” tops	4.05	6	1.46	16	1.77	16	5.82	14
21	6	Cool basement floor – tops on	Passive	Cool – same as curing	5.36	19	2.52	20	3.52	20	8.88	20

[1] **Type of curing:** Active indicates use of fans/dehumidifiers, etc. Passive indicates natural ventilation (open doors, outdoors, etc.)

[2] **Bulb Quality after Curing and Storage**: see Table 9 for the characteristics used in the calculation of this scaled rank score.

[3] **Final Ranking:** Linear ranking from best to worst of the 21 treatments based on the sum rank score.

[4] **Fusarium Disease:** see Table 10 for the characteristics used in the calculation of this scaled rank score.

[5] **Total Disease (Fusarium + Black Mold):** Sum Rank Score of Fusarium from Table 10 + Rank Score for Black Mold based on scaled ranking in Table 10.

[6] **Total (All Categories):** Bulb Quality after Curing and Storage + Total Disease Development.

Best! Better than 2nd place by >0.5 points Top category Bottom category

Table 12. Post-harvest practices garlic project, **2019: Temperature during curing.**

No.	Grower No.	Treatment		Total No. days	Temperature (°F)			Total No. Hours						
		Building	Type[1]		Average	Minimum	Maximum	50-59	60-69	70-79	80-89	90-99	100+	Optimum (75-85)
1	1	unknown	unknown	20	70.6	50.6	88.9	62	182	143	93	0	0	136
2	2	unknown	unknown	21	67.9	52.3	81.1	60	251	182	11	0	0	69
3	3	unknown	unknown	13	80.7	55.4	123.6	27	80	71	37	34	63	43
4	4	unknown	unknown	29	71.6	48.6	108.5	99	279	167	78	62	8	121
5	5	unknown	unknown	30	69.8	47.4	103.4	120	264	181	142	3	2	175
7	6	High tunnel – tops on	Passive	28	75.3	53.6	122.7	59	224	179	112	58	40	124
8	6	High tunnel – 6" tops	Passive	28	78.3	50.7	122.2	88	207	115	81	70	111	82
9	6	High tunnel – 1.5" tops	Passive	28	75.5	55.9	108.1	29	211	219	131	65	17	149
10	7	High tunnel – tops on	Active	19	72.3	47.8	102.5	83	120	120	75	48	4	81
11	7	High tunnel – 6" tops	Active	19	73.7	46.7	111.2	94	120	88	57	60	29	57
12	7	High tunnel – 1.5" tops	Active	19	74.0	48.0	108.6	77	122	106	70	58	19	72
13	7	Wood barn loft – tops on	Passive	NA[2]	See Table x. Conditions for duration of all (curing + storage) post-harvest practices.									
14	8	Wooden shed, 3" tops	Active	NA[2]	See Table x. Conditions for duration of all (curing + storage) post-harvest practices.									
15	8	Cool Wood floor by AC, 3" tops	Active	24	66.0	58.2	75.6	21	449	106	0	0	0	1
16	8	Greenhouse, 3" tops	Active	10	73.9	56.3	99.8	24	87	56	42	31	0	54
17	9	Wagon in steel barn – tops on	Passive	18	72.2	54.0	92.2	37	166	123	92	14	0	107
18	10	Steel barn in 1-ton bin – 2" tops	Active	NA[2]	See Table x. Conditions for duration of all (curing + storage) post-harvest practices.									
19	11	Wooden barn, hanging – tops on	Passive	NA[2]	See Table x. Conditions for duration of all (curing + storage) post-harvest practices.									
20	12	Outside in covered RPC bins – tops on	Passive	24	69.3	49.4	89.1	73	222	222	57	0	0	132
21	6	Cool Basement floor – tops on	Passive	NA[2]	See Table x. Conditions for duration of all (curing + storage) post-harvest practices.									

[1]**Type of curing: Active** indicates use of fans/dehumidifiers, etc. **Passive** indicates natural ventilation (open doors, outdoors, etc.).

[2]**NA:** Not Applicable. Curing and storage was the same location/situation.

Table 13. Post-harvest practices garlic project, **2019: Temperature during storage.**

No.	Grower No.	Treatment – Curing		Storage	Total No. days	Temperature (°F)			Total No. Hours					
		Building	Type[1]	Building		Average	Minimum	Maximum	< 40	40-49	50-59	60-69	70-79	80-89
1	1	unknown	unknown	unknown	42	62.9	38.6	87.7	2	88	303	358	235	22
2	2	unknown	unknown	unknown	40	61.1	39.9	82.3	1	76	350	406	120	7
3	3	unknown	unknown	unknown	49	66.2	44.0	83.1	0	20	174	632	325	25
4	4	unknown	unknown	unknown	33	59.5	41.8	78.6	0	62	360	325	45	0
5	5	unknown	unknown	unknown	32	58.9	39.3	78.0	1	104	312	302	49	0
7	6	High tunnel – tops on	Passive	Steel barn, open	35	65.0	50.3	82.2	0	0	219	395	208	18
8	6	High tunnel – 6" tops	Passive	Steel barn, open	35	65.8	52.8	80.9	0	0	176	436	222	6
9	6	High tunnel – 1.5" tops	Passive	Steel barn, open	35	65.1	51.2	80.7	0	0	199	425	210	6
10	7	High tunnel – tops on	Active	High tunnel (white), open	38	64.7	45.6	86.6	0	49	228	358	226	51
11	7	High tunnel – 6" tops	Active	High tunnel (white), open	38	66.1	46.0	88.4	0	15	212	391	244	50
12	7	High tunnel – 1.5" tops	Active	High tunnel (white), open	38	65.7	48.1	88.4	0	17	220	384	255	36
13	7	Wood barn loft – tops on	Passive	Same, poor ventilation	NA[2]	See Table x. Conditions for duration of all (curing + storage) post-harvest practices.								
14	8	Wooden shed, 3" tops	Active	Wooden shed, closed	NA[2]	See Table x. Conditions for duration of all (curing + storage) post-harvest practices.								
15	8	Cool Wood floor by AC, 3" tops	Active	Wooden shed, closed	39	69.2	52.7	91.2	0	0	109	420	329	76
16	8	Greenhouse, 3" tops	Active	Wooden shed, closed	53	68.6	51.0	86.8	0	0	192	535	456	89
17	9	Wagon in steel barn – tops on	Passive	Greenhouse, fans – 2" tops	40*	73.4	49.1	123.0	0	5	169	300	208	128
18	10	Steel barn in 1-ton bin – 2" tops	Active	Same, fan off, door open	NA[2]	See Table x. Conditions for duration of all (curing + storage) post-harvest practices.								
19	11	Wooden barn, hanging – tops on	Passive	Same as curing, doors open	NA[2]	See Table x. Conditions for duration of all (curing + storage) post-harvest practices.								
20	12	Outside in covered RPC bins – tops on	Passive	Steel barn, open – 1" tops	43	61.5	38.5	78.8	2	40	346	541	103	0
21	6	Cool Basement floor – tops on	Passive	Cool - Same as curing	NA[2]	See Table x. Conditions for duration of all (curing + storage) post-harvest practices.								

[1]**Type of curing: Active** indicates use of fans/dehumidifiers, etc. **Passive** indicates natural ventilation (open doors, outdoors, etc.).

[2]NA: Not Applicable. Curing and storage was the same location/situation.

*This treatment was in storage for 45 days, but the battery on the pendant sensor died, so there is only 40 days of data.

Table 14. Post-harvest practices garlic project**, 2019: Temperature during Curing and storage.**

No.	Grower No.	Treatment – Curing		Storage	Total No. days	Temperature (°F)			Total No. Hours							
		Building	Type[1]	Building		Avg.	Min.	Max.	< 40	40-49	50-59	60-69	70-79	80-89	90-99	>100
1	1	unknown	unknown	unknown	62	65.4	38.6	88.9	2	88	365	540	378	115	0	0
2	2	unknown	unknown	unknown	61	63.4	39.9	82.3	1	76	410	657	302	18	0	0
3	3	unknown	unknown	unknown	62	69.3	44.0	123.6	0	20	201	712	396	62	34	63
4	4	unknown	unknown	unknown	62	65.2	41.8	108.5	0	65	459	604	212	78	62	8
5	5	unknown	unknown	unknown	62	64.2	39.3	103.4	1	112	432	566	230	142	3	2
7	6	High tunnel – tops on	Passive	Steel barn, open	63	69.6	50.3	122.7	0	0	278	619	387	130	58	40
8	6	High tunnel – 6” tops	Passive	Steel barn, open	63	71.3	50.7	122.2	0	0	264	643	337	87	70	111
9	6	High tunnel – 1.5” tops	Passive	Steel barn, open	63	69.7	51.2	108.1	0	0	228	636	429	137	65	17
10	7	High tunnel – tops on	Active	High tunnel (white), open	57	67.2	45.6	102.5	0	55	311	478	346	126	48	4
11	7	High tunnel – 6” tops	Active	High tunnel (white), open	57	68.6	46.0	111.2	0	23	306	511	332	107	60	29
12	7	High tunnel – 1.5” tops	Active	High tunnel (white), open	57	68.5	48.0	108.6	0	21	297	506	361	106	58	19
13	7	Wood barn loft – tops on	Passive	Same, poor ventilation	57	68.5	50.9	89.1	0	0	199	571	515	83	0	0
14	8	Wooden shed - 3” tops	Active	Wooden shed, closed	63	69.7	50.3	90.6	0	0	171	611	575	153	2	0
15	8	Cool Wood floor by AC - 3” tops	Active	Wooden shed, closed	63	67.9	52.7	91.2	0	0	130	869	435	76	2	0
16	8	Greenhouse, 3” tops	Active	Wooden shed, closed	63	69.5	51.0	99.8	0	0	216	622	512	131	31	0
17	9	Wagon in steel barn – tops on	Passive	Greenhouse, fans – 2” tops	58*	73.0	49.1	123	0	5	206	466	331	220	94	70
18	10	Steel barn in 1-ton bin – 2” tops	Active	Same, fan off, door open	63	67.3	53.3	86.0	0	0	185	815	503	9	0	0
19	11	Wooden barn, hanging – tops on	Passive	Same as curing, doors open	69	65.6	43.6	90.1	0	36	350	761	470	38	1	0
20	12	Outside in covered RPC bins – tops on	Passive	Steel barn, open – 1” tops	67	64.3	38.5	89.1	2	42	419	763	325	57	0	0
21	6	Cool Basement floor – tops on	Passive	Cool - Same as curing	65	65.8	64.4	68.2	0	0	0	1560	0	0	0	0

[1]**Type of curing: Active** indicates use of fans/dehumidifiers, etc. **Passive** indicates natural ventilation (open doors, outdoors, etc.).

*This treatment was in storage for 63 days, but the battery in the pendent sensor died, so there is only 58 days of data.

Table 15. Post-harvest practices garlic project**, 2019: Relative Humidity during curing.**

No.	Grower No.	Treatment – Curing		Total No. days	Relative Humidity (%)			Total No. Hours						
		Building	Type[1]		Avg.	Min.	Max.	< 40	40-49	50-59	60-69	70-79	80-89	90-99
1	1	unknown	unknown	20	70.4	30.2	96.8	23	42	52	83	114	136	30
2	2	unknown	unknown	21	82.0	52.0	99.0	0	0	18	51	94	229	112
3	3	unknown	unknown	13	57.8	16.0	94.1	87	27	32	40	68	51	7
4	4	unknown	unknown	29	74.1	23.6	98.9	46	74	63	66	82	183	182
5	5	unknown	unknown	30	74.9	31.2	99.4	10	58	104	102	85	199	162
7	6	High tunnel – tops on	Passive	28	63.5	16.0	99.3	98	77	77	99	175	120	22
8	6	High tunnel – 6" tops	Passive	28	61.7	17.0	94.8	186	50	49	45	101	198	42
9	6	High tunnel – 1.5" tops	Passive	28	63.8	23.8	87.6	58	92	91	122	225	84	0
10	7	High tunnel – tops on	Active	19	71.4	23.1	99.7	50	62	45	39	40	81	139
11	7	High tunnel – 6" tops	Active	19	68.0	22.4	99.7	101	36	33	38	51	71	126
12	7	High tunnel – 1.5" tops	Active	19	67.1	21.4	97.0	91	47	32	39	51	124	72
13	7	Wood barn loft – tops on	Passive	NA[2]	See Table x. Conditions for duration of all (curing + storage) post-harvest practices.									
14	8	Wooden shed - 3" tops	Active	NA[2]	See Table x. Conditions for duration of all (curing + storage) post-harvest practices.									
15	8	Cool Wood floor by AC - 3" tops	Active	24	57.7	47.5	70.8	0	6	376	191	3	0	0
16	8	Greenhouse, 3" tops	Active	10	64.5	25.6	94.7	45	24	20	34	46	51	20
17	9	Wagon in steel barn – tops on	Passive	18	69.6	38.6	87.8	4	35	66	72	166	89	0
18	10	Steel barn in 1-ton bin – 2" tops	Active	NA[2]	See Table x. Conditions for duration of all (curing + storage) post-harvest practices.									
19	11	Wooden barn, hanging – tops on	Passive	NA[2]	See Table x. Conditions for duration of all (curing + storage) post-harvest practices.									
20	12	Outside in covered RPC bins – tops on	Passive	24	79.9	39.5	99.9	1	19	56	69	96	149	178
21	6	Cool Basement floor – tops on	Passive	NA[2]	See Table x. Conditions for duration of all (curing + storage) post-harvest practices.									

[1]**Type of curing: Active** indicates use of fans/dehumidifiers, etc. **Passive** indicates natural ventilation (open doors, outdoors, etc.).
[2]**NA:** Not Applicable. Curing and storage was the same location/situation.

Table 16. Post-harvest practices garlic project, **2019: Relative Humidity during storage.**

No.	Grower No.	Treatment – Curing		Storage	Total No. days	Relative Humidity (%)			Total No. Hours						
		Building	Type[1]	Building		Avg.	Min.	Max.	< 40	40-49	50-59	60-69	70-79	80-89	90-99
1	1	unknown	unknown	unknown	42	73.5	30.5	96.8	13	63	124	151	229	361	67
2	2	unknown	unknown	unknown	40	79.9	37.9	99.8	3	9	54	129	173	437	155
3	3	unknown	unknown	unknown	49	81.0	45.2	98.6	0	15	66	126	230	463	276
4	4	unknown	unknown	unknown	33	84.8	55.7	98.2	0	0	3	25	122	487	155
5	5	unknown	unknown	unknown	32	84.6	41.3	96.5	0	4	12	47	127	322	256
7	6	High tunnel – tops on	Passive	Steel barn, open	35	76.3	44.0	95.0	0	18	56	145	247	333	41
8	6	High tunnel – 6” tops	Passive	Steel barn, open	35	74.3	48.1	90.2	0	2	67	131	447	192	1
9	6	High tunnel – 1.5” tops	Passive	Steel barn, open	35	76.0	53.0	91.1	0	0	40	130	371	295	4
10	7	High tunnel – tops on	Active	High tunnel (white), open	38	77.5	37.2	98.8	6	50	70	144	146	305	191
11	7	High tunnel – 6” tops	Active	High tunnel (white), open	38	72.2	36.4	93.5	7	60	108	175	246	295	21
12	7	High tunnel – 1.5” tops	Active	High tunnel (white), open	38	73.1	37.8	94.8	1	37	104	197	272	249	52
13	7	Wood barn loft – tops on	Passive	Same, poor ventilation	NA[2]	See Table x. Conditions for duration of all (curing + storage) post-harvest practices.									
14	8	Wooden shed - 3” tops	Active	Wooden shed, closed	NA[2]	See Table x. Conditions for duration of all (curing + storage) post-harvest practices.									
15	8	Cool Wood floor by AC - 3” tops	Active	Wooden shed, closed	39	62.3	36.9	90.8	3	60	284	451	125	11	2
16	8	Greenhouse, 3” tops	Active	Wooden shed, closed	53	67.6	40.3	96.3	0	65	223	448	417	105	14
17	9	Wagon in steel barn – tops on	Passive	Greenhouse, fans – 2” tops	40*	63.7	14.6	94.6	220	86	68	110	132	279	65
18	10	Steel barn in 1-ton bin – 2” tops	Active	Same, fan off, door open	NA[2]	See Table x. Conditions for duration of all (curing + storage) post-harvest practices.									
19	11	Wooden barn, hanging – tops on	Passive	Same as curing, doors open	NA[2]	See Table x. Conditions for duration of all (curing + storage) post-harvest practices.									
20	12	Outside in covered RPC bins – tops on	Passive	Steel barn, open – 1” tops	43	86.3	55.7	97.1	0	0	5	21	101	644	261
21	6	Cool Basement floor – tops on	Passive	Cool - Same as curing	NA[2]	See Table x. Conditions for duration of all (curing + storage) post-harvest practices.									

[1]**Type of curing: Active** indicates use of fans/dehumidifiers, etc. **Passive** indicates natural ventilation (open doors, outdoors, etc.).

[2]NA: Not Applicable. Curing and storage was the same location/situation.

*This treatment was in storage for 45 days, but the battery on the pendant sensor died, so there is only 40 days of data.

Table 17. Post-harvest practices garlic project, **2019: Relative Humidity during curing and storage.**

No.	Grower No.	Treatment – Curing		Storage	Total No. days	Relative Humidity (%)			Total No. Hours						
		Building	Type[1]	Building		Avg.	Min.	Max.	< 40	40-49	50-59	60-69	70-79	80-89	90-99
1	1	unknown	unknown	unknown	62	72.5	30.2	96.8	36	105	176	234	343	497	97
2	2	unknown	unknown	unknown	61	80.6	37.9	99.8	3	9	72	180	267	666	267
3	3	unknown	unknown	unknown	62	76.1	16.0	98.6	87	42	98	166	298	514	283
4	4	unknown	unknown	unknown	62	79.8	23.6	98.9	46	74	66	91	204	670	337
5	5	unknown	unknown	unknown	62	79.9	31.2	99.4	10	62	116	149	212	521	418
7	6	High tunnel – tops on	Passive	Steel barn, open	63	70.6	16.0	99.3	98	95	133	244	422	453	63
8	6	High tunnel – 6" tops	Passive	Steel barn, open	63	68.7	17.0	94.8	186	52	116	176	548	390	43
9	6	High tunnel – 1.5" tops	Passive	Steel barn, open	63	70.6	23.8	91.1	58	92	131	252	596	379	4
10	7	High tunnel – tops on	Active	High tunnel (white), open	57	75.5	23.1	99.7	56	112	115	183	186	386	330
11	7	High tunnel – 6" tops	Active	High tunnel (white), open	57	70.8	22.4	99.7	108	96	141	213	297	366	147
12	7	High tunnel – 1.5" tops	Active	High tunnel (white), open	57	71.1	21.4	97.0	92	84	136	236	323	373	124
13	8	Wood barn loft – tops on	Passive	Same, poor ventilation	57	66.2	46.9	81.1	0	12	239	680	427	10	0
14	8	Wooden shed - 3" tops	Active	Wooden shed, closed	63	65.9	35.7	95.6	11	113	293	552	422	112	9
15	8	Cool Wood floor by AC - 3" tops	Active	Wooden shed, closed	63	60.6	36.9	90.8	3	66	660	642	128	11	2
16	9	Greenhouse, 3" tops	Active	Wooden shed, closed	63	67.1	25.6	96.3	45	89	243	482	463	156	34
17	10	Wagon in steel barn – tops on	Passive	Greenhouse, fans – 2" tops	58*	65.5	14.6	94.6	224	121	134	182	298	368	65
18	11	Steel barn in 1-ton bin – 2" tops	Active	Same, fan off, door open	63	75.7	46.2	88.7	0	3	35	179	932	363	0
19	12	Wooden barn, hanging – tops on	Passive	Same as curing, doors open	69	75.8	35.6	95.7	5	41	130	253	543	585	99
20	6	Outside in covered RPC bins – tops on	Passive	Steel barn, open – 1" tops	67	84.0	39.5	99.9	1	19	61	90	197	793	439
21		Cool Basement floor – tops on	Passive	Cool - Same as curing	65	93.6	74.7	100.0	0	0	0	0	51	280	1225

[1]**Type of curing: Active** indicates use of fans/dehumidifiers, etc. **Passive** indicates natural ventilation (open doors, outdoors, etc.).
[2]NA: Not Applicable. Curing and storage was the same location/situation.
*This treatment was in storage for 63 days, but the battery in the pendent sensor died, so there is only 58 days of data.