Specialty Crop Competitive Grant: Garlic Production Trials, Preliminary Storage Trials, and Simple Market Analysis- Southeast Alaska

Final Report 11/28/14

Jaspri Sylvan, David Love, Nikki Love and Carol Coyle at the RootSeller Farm table, 2013 Juneau Food Festival

Contact Information:
David and Nikki Love
6740 Marguerite St
Juneau, AK 99801
Email: pandalid@yahoo.com
Phone: 907-789-6833

Table of Contents

List of Tables

List of Figures

List of Figures (cont.)

List of Appendices

Introduction

Garlic is an Alaskan crop that stores and ships well, thus potentially providing economic opportunity for rural residents. Northern hardneck garlic prices are relatively high, providing potential opportunity for profit from sales. Hardneck garlics are more flavorful than the softneck varieties usually found in local grocery stores, and they grow well in the cold, wet soils of Southeast Alaska. Hardneck garlic also store relatively well , potentially extending sales past the growing season. Growing heirloom strains (i.e. cultivar varieties in this document) of hardneck garlic could provide variety and hold consumer's interest. This project was proposed to describe known cultivation methods, identify a few garlic varieties that produce well in Southeast Alaska, define the market acceptance and demand for fresh, organic, locally-grown garlic, and investigate simple storage methods for garlic in Southeast Alaska.

In the past few years, there has been growing interest in gardeners/farmers markets throughout Southeast Alaska. Given the expense of shipping produce to Alaska, and increased awareness of Alaskan food security issues, interest in buying local has grown. This project is timely because it will provide information to some of the basic questions that are needed by potential garlic farmers to begin growing hardneck garlics and take advantage of the increasing interest in locally grown products.

There were three goals identified for this project: Goal 1 was to evaluate a few different garlic varieties that consistently produce acceptable yields and can be profitably grown. Goal 2 was to evaluate simple storage methods and identify storage environment metrics such as temperature and relative humidity in order to quantify successful storage conditions for hardneck garlics. Goal 3 was to complete preliminary market research by identifying local sales venues, evaluating local sales and market acceptance of garlic at Juneau and Gustavus markets through direct sales and standardized questionaires.

Goal 1: Hardneck Garlic Grow-Out Experiments, 2012-2013:

Objectives for Goal 1 were as follows:

1) Determine over-wintering survivals (2012-2013) for 3 to 6 garlic varieties, tracking all expenses, losses due to biotic and abiotic factors, yield per pound planted, etc…
2) Experiment with spring planting schedule (2014) to evaluate summer production of garlic, associated expenses, losses due to biotic and abiotic factors, yields, etc…
3) Prepare written summary including recommendations by variety and timing of plantings.

Goal 1 Growout Methods

Four varieties of hardneck garlic were selected and purchased for seed from a local garlic producer located near Juneau, Alaska (Orsi Organic Produce). Joe and Julie Orsi, the owners of Orsi Organic Produce, have been growing and experimenting with methods of growing hardneck garlics for over 30 years and provided the suggested varieties used in the grow-out experiment based on their extensive growing experience. The varieties used for the grow-out trial included

Russian Giant, Killarney Red, Purple Glazer and Chesnok Red. These varieties represented 4 different hardneck garlic cultivar groups: Porcelain, Rocambole, Glazed Purple Stripe, and Purple Stripe. Using garlic cultivars from the different groups is important as each group has different flavor characteristics and storage shelf-life may influence market acceptance, and certainly continue to hold consumer's interest.

In September of 2012, seed garlic of each variety were distributed to growers in 4 areas of Southeast Alaska: Ketchikan, Juneau (Auke Rec area), Douglas Island (5-mile), Gustavus, and Haines (Mile 27). The intent of the grow-out experiment was to compare growth and survival characteristics across the Southeast region using standardized methods (standard soil amendments, standard plant spacing, use of Infrared Transmitting (IRT) plastic mulch, foliar spraying, seaweed mulching, and plastic covers over the beds in the winter to minimize nutrient leaching from the abundant rainfall in the Southeast region. Soils were supplemented with a mixture of alfalfa meal (N source), calcium (rock) phosphate (P source), and greensand (iron potassium silicate, a K source). Growers in each area planted 25-40 of the largest cloves using standardized methods (standard spacing, use of IRT plastic, seaweed mulching, plastic winter covers) and similar (mostly!) fertilization schedules. Prior to distribution, bulbs of each variety were weighed to obtain an average bulb weight before planting. Since bulb weights of seed garlic are reported to be more closely related to bulb weights of harvested garlic than are individual seed clove weights to harvested bulb weights (Engelund 1998), bulbs for seed were selected that were large and the largest cloves were planted. Garlic beds in each of the 5 areas were tended and garlic grown until harvest in July and August, 2013. Upon harvest, all garlic was shipped to Juneau to the primary investigator's residence where survivals were estimated (Table 1), growth irregularities such as doubling or stunting were noted, and garlic were hung for storage prior to sales and market analysis. Survival estimates, production yields, and market analysis was completed in August of 2013.

Due to the exceptionally wet and cold growing conditions in 2012, insufficient seed garlic of the appropriate sizes were available for conducting spring planting experiments in 2013 (Objective 2). An abbreviated spring/summer grow-out experiment (12 plants of each variety) was initiated in summer of 2014 at a hoophouse installed in Gustavus area. The four varieties grown in 2012/2013 were stored and still viable by the time planting occurred on July 5, 2014. Samples of 4 plants from each variety grown in the greenhouse were collected for growth evaluation in late September, 2014. Unfortunately, due to delays in shipping and construction of the greenhouse, we were not able to plant in March/April as previously planned.

Simple soil chemistry was also measured from samples taken from all of the grow-out areas in Southeast Alaska prior to planting but after soil ammendment in 2012, and following harvest in 2013. Soil test measures included pH, total organics, N,P, K and available trace elements. Each area had slightly different soil characteristics. Soil temperatures were also measured in each experimental plot using ONSET Hobo temperature loggers that logged every 2 hours from January to August, 2013, or essentially throughout the 2013 growing season.
Photographs of culture methods are provided in Appendix A.

Goal 1 Grow-out Results:

I. Overwintering Survivals:

Survivals for the four hardneck garlic varieties grown in Ketchikan, Juneau, Douglas, Gustavus and Haines during trials in 2012/2013 were excellent. The four varieties combined averaged 92% survival. This survival estimate includes the Haines grow-out beds wherein the IRT plastic was damaged when moose entered the plot to eat the seaweed used as mulch, displacing the IRT. This resulted in many garlic bulbs being caught underneath the plastic and not able to grow through the planting holes in the IRT in the spring. If the Haines grow-out results are not included then average survivals for the four varieties combined is 97%. Averaging across the Southeast region, Russian Giant survived at the highest rate, followed by Killarney Red, Purple Glazer and Chesnok Red, although average survival for all varieties was better than 90% (Table 1). Percent survivals were estimated based on total number of plants that sprouted and pushed through the IRT plastic to become fully mature plants which produced harvestable bulbs. No plants that sprouted and became fully mature succumbed to disease, pests, parasites, or herbivores (other than humans upon harvest!). Very few doubles and no stunted plants were observed.

II. Garlic Yields

Garlic yields were good for all 4 varieties, with more than 2 times the yield per ounce of cloves planted (Table 2). Orsi Organic produced the largest bulbs and highest yields per ounce planted for all 4 varieties. Haines and Gustavus produced at similar average yields. Ketchikan and Douglas gardens produced the smallest average bulb sizes. As expected, the Porcelain cultivar Russian Giant yielded the biggest bulbs. The Rocambole Killarney Red produced the second biggest bulbs but had lower yields per ounce planted than Purple Glazer and Chesnok Red. Orsi's production was impressive considering they harvested about 2 weeks earlier than the other areas. Planting at Orsi Organic produce occurred about 1 month earlier than in Haines.

III. Garlic Production

Orsi Organic had the highest total production for all varieties grown and compared to all other growout areas. Russian Giant and Killarney Red varieties produced the largest bulbs, and had the highest total production for all areas grown followed by the other two varieties (Table 3). Using a European grading system described by Meredith (2008), Orsi Organic produced the highest number of "Premium" sized garlic bulbs. Sizes were measured at the widest point across the width of the bulb. Gustavus and Haines produced predominantly "Extra" sized garlic. These two areas also had a few more split garlic compared to the Auke Rec site (Orsi Organic) and were harvested about a week later. Ketchikan and Douglas had largest number of smaller garlic ("Class I" and "Class II") and had more split, unmarketable garlic (Table 4). These two areas were harvested only a few days later than was the Auke Rec site. Split garlic had few or no leaf coverings (i.e.- leaf wrappers) on the bulbs leaving the cloves exposed. Split garlic with exposed cloves do not store as well and are harder to get clean which effects bulb saleable and storage quality. Split garlic were not considered marketable. All sizes of marketable garlic were sold at the Juneau and Gustavus farmers markets. Where available, large split garlic were held back for seed. More splitting occurred in Ketchikan than elsewhere, followed by the Douglas garden beds. For every growout area about 8 bulbs of the largest sizes of each variety were kept for the

storage experiment and were not sold (Table 4).

IV. Soil Amendments, Soil Temperatures, and Foliar Feeding

In general, growers utilized similar methods for growing the garlic, however, there were some differences in initial soil amendment regimens, foliar spraying rates, plastic mulching and row coverings. Although culture methods were slightly different between growers, grow-out results were very encouraging. Soil test for N:P:K in the form of NO_3 plus NH_4, P_2O_5 and K_2O respectively were the most similar pre- and post-harvest for the Auke Rec and Haines Highway sites. The soil tests before and after growout for the other areas were variable (Table 5). Soil testing results (Table 5). Complete Brookside Laboratories soil testing results for soil samples taken before and after the grow-out experiment are provided in Appendix B. Soil temperature probes were all deployed January 1, 2013 in all 5 areas and all sampled through August 14, 2013. Soil temperatures were generally similar, but were slightly higher during the March-August growing season at the Auke Rec site and lowest at the Douglas site. Haines soil temperatures were the lowest in the winter prior to about early March but then increased to temperatures very similar to the Auke Rec site (Figure 1). Comparing the cumulative degree days for January-August, Auke Rec had the highest followed by Haines, Gustavus, Ketchikan and Douglas (Table 6). Average bulb weights for all varieties combined were highest at Auke Rec, and Haines, with Russian Giant and Killarney Red producing the biggest bulbs, but the biggest % difference between large and small average bulb size for Chesnok Red and Russian Giant (Table 6).

V. Soil Ammendments, Foliar Feeding, Side Dressing

All growers in the 5 areas supplemented their soils with organic fertilizers to varying edgrees. Because the garlic grant funding was not issued until after two of the growers had already fertilized their growout areas, soil ammendments were added at different rates thatn the other three areas. Although the intent was for all growers to fertilize at the same rates, Joe Orsi and Ed Buyarski added additional soil ammendments to their soils. In addition to the 2 lbs per 100 ft^2 used by all growers, Joe added additional Alfalfa meal, bone meal, fish meal and wood ash. Orsi Organic Produce also cover crops between years, leaving the beds fallow when covered with a cover crop. Ed Buyarski and George Campbel are developing garlic fields in Haines, and also added additional Alfalfa meal, bone meal, fish meal and wood ash (Table 7). All areas planted through IRT and used the dibble that Joe Orsi developed to ensure that garlic were planted at the same planting density. Planting dates varied about a month during September and October of 2012. At planting, cloves were all fertilized with 1 Tbls of a mix of equal parts alfalfa meal, Potassium phosphate and greensand (Table 8). First shoots were noted poking through the seaweed mulch between February (Ketchikan) and late April (Haines). Joe Orsi side dressed his bulbs 4 times using the same mixture of fertilizers used when the cloves were planted and also foliar sprayed a mixture of hydrolysed fish powder and seaweed extract onto the leaves and stems of the plants 8 times between early April and mid-July. The other areas either did not side dress or side dressed once and did not foliar spray as often (Table 8).

VI. Summer Growout

Thirty cloves of each of the 4 varieties grown during 2012-2013, harvested in August of 2013, and stored until July of 2014, were planted in the Gustavus greenhouse. Germination rates were

97% -100% for all 4 varieties planted, with only a few surviving plants that were small in size. Garlic cloves that were planted in the Gustavus greenhouse in early July, produced single, undivided bulbs between planting date (7/5/14) and when a sample of the largest plants were pulled in late September (Figure 2). One of the Purple Glazers did not germinate. Planting density was the same as during the growout experiment and the sandy soil in the greenhouse was amended according to the same fertilization rates as used for the growout study (2 lbs/100 ft^2). Plants were watered every morning for twenty minutes using an automatic drip irrigation system and automatic timer. After removing 4 of each variety in late September, 2014 to evaluate bulb size and development, the remainder of the garlic planted was allowed to remain in the greenhouse, mulched with 3-4" of peat moss and overwintered in place. A picture of the bulbs removed for evaluation is provided in Figure 2. Average weights for each variety planted in July of 2014 in the greenhouse ranged from 0.3-0.5, similar to clove weights during 2012/2013(Table 9).

Discussion of Garlic Growout Experiment

At more than 90% average survival, a high percentage of all of the garlic cloves of the 4 different varieties grown in this experiment, sprouted and survived well. These four varieties: Russian Giant, Killarney Red, Purple Glazer, and Chesnok Red could provide Southeast Alaska with the basic varieties that could be marketed and would hold consumer's interest. No disease, pests, or parasites were observed during the growout experiment, so that if seed sources come from the Southeast region, growers in this area should have no introduced disease problems. There have been instances of parasitic mites being brought in with purchases from out of state and also descriptions of basal root rot, but the latter can be controlled by consistent biennial crop rotation. Combined with cover cropping, this practice should maintain the soils in Southeast Alaska where garlic are grown in a disease free condition. Mite infestations can be controlled by careful regulation of garlic seed introduced into Alaska, and is likely best approached by purchasing only locally grown garlic for seed.

Yields were also generally good, with a minimum of about 2 times the weight of garlic planted to a maximum of almost 6 times the yield by weight being produced at harvest, depending on variety. Of course, about 1/4 to 1/3 of the total yield, depending on cultivar being grown, would be held back for seed each year. Varieties such as Purple Glazer, produce smaller bulbs that seem to mature earlier, thus could provide saleable product about 2 weeks or more before other varieties such as Killarney Red which could be held longer.

Soil testing results were disappointing, and were not as useful as was hoped, maybe because a more rigorous sampling design needed to be employed in order to provide more representative results. Although soil tests were generally inconclusive, Orsi Organic Produce at the Auke Recreation (Auke Rec) site north of Juneau seemed to have the most stable soil nutrition pre- and post-harvest. Orsi's garden area also is surrounded by black landscape cloth between and around the beds to discourage weed growth. This practice may also result in slightly higher soil temperatures, especially in the summer when heating by the sun (insolation) is greater. This is depicted well by the use of cumulative degree-day comparisons between the various areas where garlic was grown. Monitoring cumulative soil temperatures (degree-days) may be useful for deciding when bulbing and best bulb yields would be expected to occur. Comparing cumulative

degree days for all five growout areas until July 1, 2013, Haines and Gustavus were actually higher than the Auke Rec site, but by time of harvest Auke Rec had the highest cumulative degree days, even though the data logger was pulled earlier because the garlic harvest happened earlier there. Although not completed at this time, correlations between cumulative degree days and bulb sizes could be evaluated as a means of deciding when best to harvest for best yields. This of course, would need to be balanced with market timing and retaining the number of wrappers on each bulb for an attractive product that stores well. The interplay of heating by insolation and cooling by rainfall would also cause variability in cumulative degree days experienced by soils and be affected by any regional differences, soil surface coverings such as IRT, or mulches, or garden construction and placement. Certainly the weather for a particular year, for example, 2013 was one of the warmest and driest summers on record, influenced the growing conditions.

As evidenced by Orsi's use of higher soil fertilization rates, more frequent use of side-dressing and foliar spraying, garlic requires nutrient rich soils to produce maximum yields per pound planted. Planting into rich, well fertilized soils, covered with IRT plastic and mulched heavily in the fall helps reduce needed weeding time and increases net profit. Our experience is that preparing the beds well and planting carefully through the IRT plastic helps reduce the total time needed to maintain the growth of the plants during the following spring and summer growing season. Side dressing and foliar spraying may require a small amount of time, but the resultant larger bulb size and bulb growth are well worth this effort. This leaves more time to spend on cleaning, drying and preparing a more attractive product for the local market.

Utilization of greenhouses for garlic production is still an area needing study. Late planting of the Gustavus greenhouse in July of 2014 resulted in good sprouting and survival rates, but only produced single, undivided bulbs that will need an additional season to produce saleable good-sized garlic. It is not known if larger bulbs would have been produced if the greenhouse had been ready to plant in March of 2014 as initially anticipated when this project proposal was submitted, but most bulbs planted were left in the greenhouse to grow to maturity in 2015. Survival and bulb production in the greenhouse will again be evaluated in summer of 2015 to determine if they will produce marketable bulbs.

Table 1. Number cloves planted, survival by number and % planted for the 5 different garlic grow-out areas, and average survivals across grow-out areas for the varieties Russian Giant, Killarney Red, Purple Glazer and Chesnok Red grown in Ketchikan, Juneau, Douglas, Gustavus, and Haines.

Variety	Initial number of cloves planted in experimental plots	Survival (no. cloves planted/% bulbs harvested)					Average Survival (%)	Average Survival (%) without Moose stomping in Haines
		Auke Rec[1)]	Haines[2)]	Gustavus	Ketchikan	Douglas[3)]		
Russian Giant	25 -40	33 of 33/100%	34 of 40/85%	32 of 33/97%	33 of 33/100%	24 of 25/96%	96%	98%
Killarney Red	25 -40	33 of 33/100%	28 of 40/70%	30 of 33/91%	33 of 33/100%	23 of 25/92%	91%	96%
Purple Glazer	25 -40	n/a	26 of 40/65%	33 of 33/100%	31 of 33/94%	23 of 25/92%	88%	95%
Chesnok Red	25 -40	33 of 33/100%	24 of 40/60%	31 of 33/94%	33 of 33/100%	25 of 25/100%	91%	99%

[1)] survivals estimated from bed planted with 85-87 cloves of Killarney, Chesnok and Russian Giant. Purple Glazer was not sampled, but survivals reported as good. Planting density was the same as the other growout areas for the 4 different cultivars grown.

[2)] 40 bulbs of each variety were planted in the Haines beds. Planting density was the same as other growout areas. In Nov. 2012, Moose damaged IRT, some plants had to be helped through the plastic row covers in the spring.

[3)] 25 cloves of each variety were planted in the Douglas beds. Planting density was the same as other growout areas.

Table 2. Planting and Harvest dates, initial average bulb weights, final average bulb weights, production, and yield per ounce planted for 4 hardneck garlic varieties planted in the fall of 2012 and harvested in late summer 2013.

Variety of Garlic	Date Planted in 2012	average weight per bulb (oz) planted	total bulb weights (oz) planted	Date bulbs harvested in 2013	Date counted and weighed (after drying)	final average weight per bulb (oz)	initial total bulb weights (oz)	Yield per oz planted
Orsi Organic Produce, Auke Rec area, Juneau Alaska, Joe Orsi-owner								
Russian Giant	9/17	2.4	15.1	7/22-7/23	8/18	2.5	83.1	5.5
Killarney Red	9/17	2.5	20.1	7/22-7/23	8/18	2.1	70.4	3.5
Purple Glazer	9/17	1.6	11.6	7/22-7/23	8/18	1.6	53.3	4.6
Chesnok Red	9/17	1.7	10.8	7/22-7/23	8/18	1.9	62.7	5.8
Little Digger's Landscaping, Haines Highway, Haines Alaska, Ed Buyarski, George Campbell-owners								
Russian Giant	10/19	2.4	18.3	8/2-8/3	8/26	2.0	68.8	3.8
Killarney Red	10/19	2.5	24.3	8/2-8/3	8/26	1.8	51.6	2.1
Purple Glazer	10/19	1.6	14.1	8/2-8/3	8/26	1.3	32.7	2.3
Chesnok Red	10/19	1.7	13.1	8/2-8/3	8/26	1.6	38.4	2.9
RootSeller Farm, Gustavus Alaska, David Love & Nikki Morris-owners								
Russian Giant	10/7	2.4	15.1	8/3	8/27	1.7	53.3	3.5
Killarney Red	10/7	2.5	20.1	8/3	8/27	1.3	40.3	2.0
Purple Glazer	10/7	1.6	11.6	8/3	8/27	0.9	29.3	2.5
Chesnok Red	10/7	1.7	10.8	8/3	8/27	1.0	29.0	2.7
Ketchikan Alaska, Andy Piston								
Russian Giant	9/29	2.4	15.1	7/27	8/18	1.5	48.0	3.2
Killarney Red	9/29	2.5	20.1	7/27	8/18	1.4	45.9	2.3
Purple Glazer	9/29	1.6	11.6	7/27	8/18	0.9	26.9	2.3
Chesnok Red	9/29	1.7	10.8	7/27	8/18	0.7	24.7	2.3
RootSeller Farm, Douglas Alaska, David Love & Nikki Morris-owners								
Russian Giant	10/5	2.4	11.4	7/26	8/18	1.5	35.7	3.1
Killarney Red	10/5	2.5	15.2	7/26	8/18	1.7	38.8	2.5
Purple Glazer	10/5	1.6	8.8	7/26	8/18	1.2	26.8	3.0
Chesnok Red	10/5	1.7	8.2	7/26	8/18	1.4	31.7	3.9

Table 3. Total garlic production in number of bulbs and total weight, production of four classes of marketable garlic, split garlic that was not marketed and garlic saved for storage experiment for 4 hardneck garlic varieties planted in the fall of 2012 and harvested in late summer 2013.

Variety	Total Production		Marketable Garlic (no. & oz.)								Split Garlic (not marketable)	
			"Premium" quality (> 2")		"Extra" quality (> 1 3/4")		"Class I" quality (>1 1/4"< 1 3/4")		"Class II" quality (<1 1/4")			
	no.	oz.	no.	oz.	no.	oz.	no.	oz.	no.	oz.	no.	oz.
Orsi Organic Produce, Auke Rec area, Juneau Alaska, Joe Orsi-owner												
Russian Giant	33	83.1	29	75.3	4	7.8	--	--	--	--	--	--
Killarney Red	33	70.4	26	57.2	7	13.2	--	--	--	--	--	--
Purple Glazer	33	53.3	21	35.2	5	6.5	--	--	--	--	7	11.55 [1]
Chesnok Red	33	62.7	26	50.7	7	12.0	--	--	--	--	--	--
Little Diggers Landscaping, Haines Highway, Haines Alaska, Ed Buyarski, George Campbell-owners												
Russian Giant	34	68.8	--	--	14	34.3	15	24.2	1	1.0	4	9.4 [2]
Killarney Red	28	51.6	--	--	14	31.0	9	15.6	5	5.0	--	--
Purple Glazer	26	32.7	--	--	14	21.5	7	7.1	--	--	5	4.1
Chesnok Red	24	38.4	12	22.1	4	6.6	8	9.8	--	--	--	--
RootSeller Farm, Gustavus Alaska, David Love & Nikki Morris-owners												
Russian Giant	32	53.3	14	25.4	13	21.6	5	6.4	--	--	--	--
Killarney Red	30	40.3	11	17.0	5	8.2	11	13.7	3	1.4	--	--
Purple Glazer	33	29.3	--	--	6	6.4	17	15.7	4	1.6	6	5.6 [3]
Chesnok Red	31	29.0	--	--	16	16.1	11	10.3	4	2.7	--	--
Ketchikan Alaska, Andy Piston												
Russian Giant	33	48.0	--	--	13	21.5	6	5.2	2	0.8	12	20.6 [4]
Killarney Red	33	45.9	--	--	14	21.2	3	2.8	6	3.7	10	18.3
Purple Glazer	31	26.9	--	--	8	9.0	17	14.0	3	1.4	3	2.5
Chesnok Red	33	24.7	--	--	8	8.3	11	9.0	10	4.1	4	3.3
RootSeller Farm, Douglas Alaska, David Love & Nikki Morris-owners												
Russian Giant	24	35.7	5	13.5	8	11.4	4	4.3	4	1.3	3	5.3 [5]
Killarney Red	23	38.8	2	5.5	13	25.4	4	5.3	3	1.5	1	1.1
Purple Glazer	23	26.8	--	--	9	10.9	8	8.4	1	0.7	5	6.9
Chesnok Red	25	31.7	--	--	13	19.1	8	9.4	4	3.3	--	--

[1] Split Purple Glazer were of "Premium" quality size.

[2] Split Russian Giant and Purple Glazer were of "Premium" quality.

[3] Split Purple Glazer were of "Premium" quality.

[4] All varieties that were split were "Extra" quality

[5] All split Russian Giant, Killarney Red, and Purple Glazer were of "Premium" quality.

Table 4. Total garlic production in number of bulbs and total weight, production of marketable garlic, split garlic that was not marketed and % of total production that was split for 4 hardneck garlic varieties planted in the fall of 2012 and harvested in late summer 2013.

Variety	Date harvested 2013	Total Production		Marketable Garlic		Split Garlic (not marketable)		% split	Storage Experiment (mix of sizes)	
		no.	oz.	no.	oz.	no.	oz.		no.	oz.
Orsi Organic Produce, Auke Rec area, Juneau Alaska, Joe Orsi-owner										
Russian Giant	7/22-7/23	33	83.1	25	63.2	--	--	0%	8	19.9
Killarney Red	7/22-7/23	33	70.4	25	53.0	--	--	0%	8	17.4
Purple Glazer	7/22-7/23	33	53.3	18	28.4	7	11.6	39%	8	13.4
Chesnok Red	7/22-7/23	33	62.7	25	45.9	--	--	0%	8	16.8
Little Diggers Landscaping, Haines Highway, Haines Alaska, Ed Buyarski, George Campbell-owners										
Russian Giant	8/2-8/3	34	68.8	22	40.6	4	9.4	12%	8	18.8
Killarney Red	8/2-8/3	28	51.6	20	36.7	--	--	0%	8	14.9
Purple Glazer	8/2-8/3	26	32.7	13	17.4	5	4.1	19%	8	11.2
Chesnok Red	8/2-8/3	24	38.4	16	25.1	--	--	0%	8	13.4
RootSeller Farm, Gustavus Alaska, David Love & Nikki Morris-owners										
Russian Giant	8/3	32	53.3	24	41.6	--	--	0%	8	11.7
Killarney Red	8/3	30	40.3	22	29.0	--	--	0%	8	11.3
Purple Glazer	8/3	29	29.3	17	17.3	6	5.6	21%	6	6.4
Chesnok Red	8/3	31	29.0	23	22.1	--	--	0%	8	7.0
Ketchikan Alaska, Andy Piston										
Russian Giant	7/27	33	48.0	13	14.6	12	20.6	36%	8	12.9
Killarney Red	7/27	33	45.9	15	16.7	10	18.3	30%	8	11.0
Purple Glazer	7/27	31	26.9	20	15.4	3	2.5	10%	8	9.0
Chesnok Red	7/27	33	24.7	21	13.1	4	3.3	12%	8	8.3
RootSeller Farm, Douglas Alaska, David Love & Nikki Morris-owners										
Russian Giant	7/26	24	35.7	15	22.4	3	5.3	13%	6	8.1
Killarney Red	7/26	23	38.8	15	24.9	1	1.1	4%	8	12.8
Purple Glazer	7/26	23	26.8	10	10.7	5	6.9	22%	8	9.3
Chesnok Red	7/26	25	31.7	17	22.4	--	--	0%	8	9.4

Table 5. Soil testing results for 4 hardneck garlic varieties before planting in the fall of 2012 (but after adding soil ammendments) and after harvest in late summer 2013 and the suggested levels of fertilization as recommended by UAF Cooperative Extension Office, Juneau, Alaska (personal communication Darren Snyder).

SOIL TESTING RESULTS PRIOR TO GROWOUT OF GARLIC

		Initial soil test results prior to planting							
Grower	Area	Organic Matter	pH	total N: NO_3 plus NH_4 (ppm)	(N to apply in lb/100sqft)	Phosphorus (ppm)	(P to apply in lb P_2O_5/100sqft)	Potassium (ppm)	(K to apply in lb K_20/100sqft)
Joe Orsi	Auke Rec	2.86%	6.6	59.0	Medium (.5)	419	Very High (0)	108	Medium (1.0)
Ed Buyarski	Haines Hwy	8.07%	7.1	15.0	Low (.6)	15	Very Low (1.5)	168	Medium (1.0)
David Love	Gustavus	4.03%	7.0	110.2	High (.4)	72	Very Low (1.5)	153	Medium (1.0)
Andy Piston	Ketchikan	14.07%	7.0	12.7	Low (.6)	40	Very Low (1.5)	211	High (.5)
David Love	N. Douglas	17.63%	7.2	5.9	Low (.6)	232	Very High (0)	273	High (.5)

SOIL TESTING RESULTS AFTER HARVEST OF GARLIC

		Initial soil test results after harvest							
Grower	Area	Organic Matter	pH	total N: NO_3 plus NH_4 (ppm)	(N to apply in lb/100sqft)	Phosphorus (ppm)	(P to apply in lb P_2O_5/100sqft)	Potassium (ppm)	(K to apply in lb K_20/100sqft)
Joe Orsi	Auke Rec	2.31%	7.1	20.8	Low (.6)	429	Very High (0)	110	Medium (1.0)
Ed Buyarski	Haines Hwy	6.99%	6.8	23.1	Low (.6)	15	Very Low (1.5)	164	Medium (1.0)
David Love	Gustavus	18.73%	6.5	24.6	Low (.6)	165	Very High (0)	225	High (.5)
Andy Piston	Ketchikan	29.94%	6.5	90.7	High (.4)	226	Very High (0)	312	Very High (0)
David Love	N. Douglas	3.19%	7.5	22.6	Low (.6)	86	Low (1.2)	258	High (.5)

Figure 1. Average daily soil temperatures taken from 1/1/13 to 8/13/13 for the five areas where garlic varieties were grown from fall 2012-summer 2013.

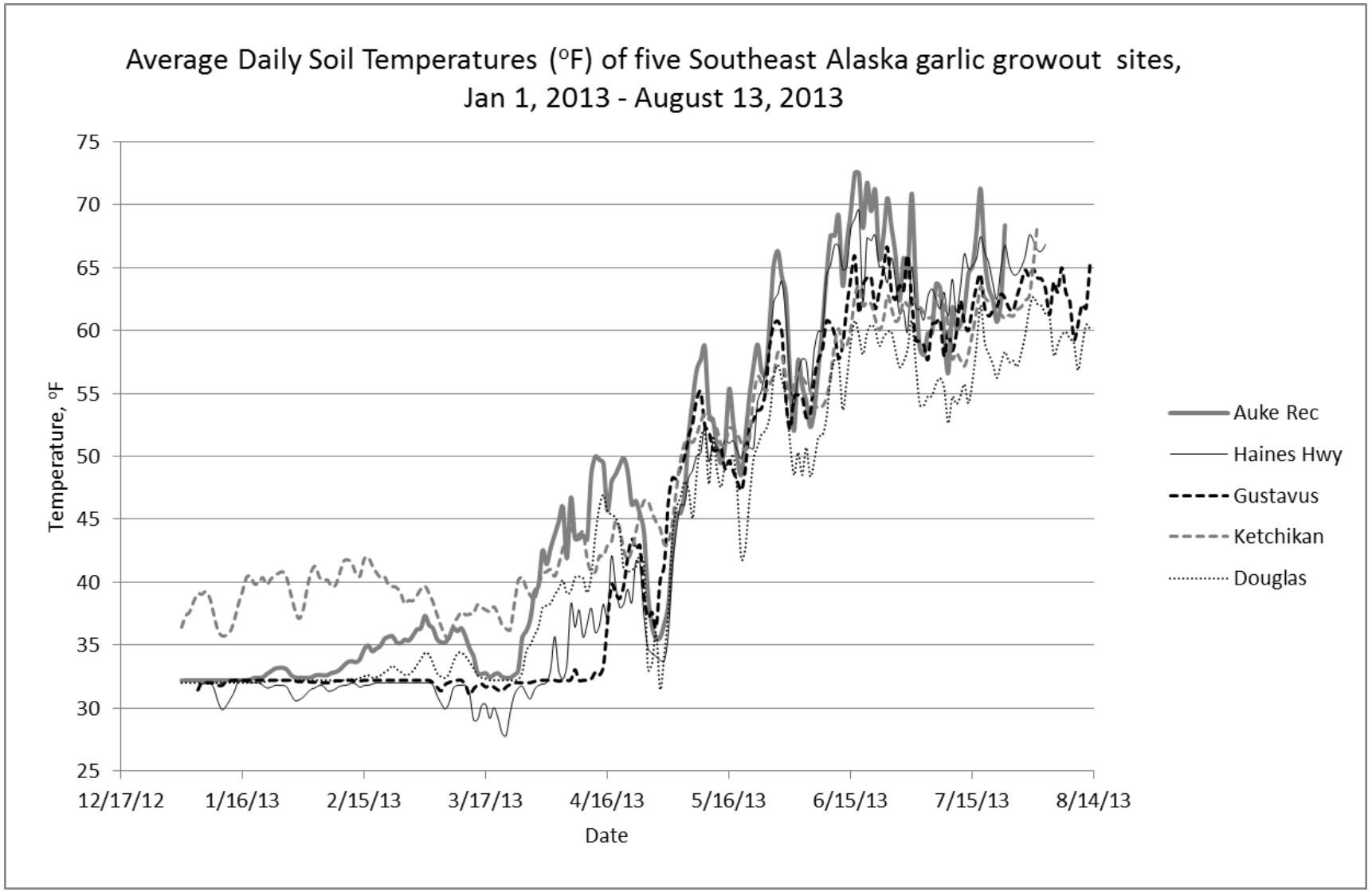


Table 6. Cumulative degree days in the five growing areas and average bulb weights in ounces for the 4 varieties of garlic grown, and the average bulb size of all varieties combined. Percent difference between average sizes of garlic grown in the most productive areas compared to the least productive for all areas for garlic harvested in 2013.

Garlic Growout Site	cumulative degree days (^{o}F)	Average bulb weights (oz)				Average bulb size (oz) (all varieties combined)
		Russian Giant	Killarney Red	Purple Glazer	Chesnok Red	
Auke Rec	36.163	2.5	2.1	1.6	1.9	2.0
Haines Hwy	34.808	2.0	1.8	1.3	1.6	1.7
Gustavus	33.937	1.7	1.3	0.9	1.0	1.2
Ketchikan	32.088	1.5	1.4	0.9	0.7	1.1
Douglas	28.101	1.5	1.7	1.2	1.4	1.4
% difference largest to smallest:		170%	159%	186%	254%	183%

Table 7. Fertilization rates in pounds of fertilizer per 100 square foot of alfalfa meal, calcium phosphate, greensand, bone meal, fish meal, and wood ash. Fertilizers used at planting were comprised of an equivalent mix of alfalfa meal, calcium phosphate and greensand applied at a rate of 1 Tablespoon (Tbls) underneath each clove planted. Garden beds also mulched after planting with IRT plastic and 6-8" of seaweed mulch.

Grower	Area	Date planted 2012	Standard fertilizer ammendment rates (lbs/100ft^2)			Additional soil ammendments (lbs/100ft^2)				Cover crop year previous?	Clove fertilizer at planting?*
			Alfalfa Meal	Calcium Phosphate	Grensand	Alfalfa Meal	bone meal	fish meal	wood ash		
Joe Orsi	Auke Rec	9/17	2.0	2.0	2.0	8.0	5.0	1.0	1.0	Y	Y
Ed Buyarski	Haines Hwy	10/19	2.0	2.0	2.0	0.5	0.5	0.5	7.4	N	Y
David Love	Gustavus	10/7	2.0	2.0	2.0	n/a	n/a	n/a	n/a	N	Y
Andy Piston	Ketchikan	9/29	2.0	2.0	2.0	n/a	n/a	n/a	n/a	N	Y
David Love	N. Douglas	10/5	2.0	2.0	2.0	n/a	n/a	n/a	n/a	N	Y

* Planted garlic cloves were fertilized with a 1 Tablespoon of a mix of equal parts alfalfa meal, potassium phosphate and greensand

Table 8. Planting and initial fertilization dates, dates of first emergence of garlic shoots in spring of 2013, and the dates beds were side dressed and foliar sprayed in 2013.

Grower	Area	Dates cloves planted & initially fertilized in 2012	Dates 1st shoots emerged in spring 2013	Dates plants side dressed[1] 2013	Dates plants foliar sprayed 2013
Joe Orsi	Auke Rec	9/17	4/4	4/7, 4/25, 5/9, 5/21	4/4, 4/18, 5/2, 5/16, 5/30, 6/14, 6/28, 7/12 [2]
Ed Buyarski	Haines Hwy	10/19	4/21	n/a	5/25, 6/30 [3]
David Love	Gustavus	10/7	4/16	7/4	4/28, 5/11, 6/14, 7/4 [4]
Andy Piston	Ketchikan	9/29	2/16	n/a	4/4, 5/5, 6/7 [5]
David Love	N. Douglas	10/5	4/15	7/5	4/23, 5/13, 6/17, 7/8 [4]

[1] Side dressing fertilizer was 1 Tablespoon of a mix of equal parts alfalfa meal, potassium phosphate and greensand

[2] Foliar spray comprised of 3 Tbls each of Peaceful Valley Farm Supply (PVFS) hydrolysed fish powder and "Maxicrop" seaweed extract per gallon using backpack SOLO foliar sprayer, used about 2 gallons per application to cover about 1000 square feet

[3] Foliar spray comprised of 3 Tbls each of PVFS hydolysed fish powder and "Maxicrop" seaweed extract per gallon sprayed onto leaves and stems

[4] Foliar spray comprised of 2 Tbls each of PVFS hydolysed fish powder and "Maxicrop" seaweed extract per gallon of water spryed onto leaves and stems

[5] Foliar spray comprised of 2 Tbls each of Alaska fish fertilizer and "Maxicrop" seaweed extract in 2 gallon watering can, soaked leaves and ground around each plant

Figure 2. Summer growout examples for garlic cloves planted in Gustavus greenhouse on 7/5/14. Plants were pulled 9/28/14 and had been cured for about 2 months when this picture was taken. All varieties pictured produced single, undivided bulbs between July and September. Only the largest 4 plants of each cultivar were pulled. The remainder of the cloves planted (~26 remaining per variety) were left in the greenhouse to determine growth characteristics and harvest timing during the spring/summer of 2015.

Table 9. Greenhouse garlic growout, survival July-September 2014 and average weight of garlic plants sampled when they were pulled 9/28/14. Planting density was the same as 2012-2013 growout experiment.

Variety	Initial number of cloves planted in greenhouse	Survival July-September 2014 [1)]	Average weight (oz) for sample of 4 plants pulled 9/28/14
Russian Giant	30	30 of 30/100%	0.5
Killarney Red	30	30 of 30/100%	0.6
Purple Glazer	30	29 of 30/97%	0.3
Chesnok Red	30	30 of 30/100%	0.4

[1)] Planting density was the same as 2012-2013 garlic growout experiment

Goal 2: Preliminary Storage Trials for Hardneck Garlic, 2013-2014:

Objectives for Goal 2:

1) Perform storage trials for 3 to 6 varieties held for 3 months and 6 months (2013) either in the refrigerator, in an outbuilding at ambient temperatures, or in a simple root cellar.
2) Prepare written summary including recommendations by variety and storage method

Goal 2 Preliminary Storage Trial Results:

I. Storage Methods, Bulb weights and Germination

To evaluate Goal 2, after harvest, completion of sales, and drying in late August, samples of garlic from each growout area were stored from September 1 until January 15. Through additional research, refrigeration was not tested as a method of storage due to reports of poor storage results (Engelund 1998). Use of a root-cellar was also not tested since construction of the root cellar in Gustavus is still underway and was not ready at the beginning of the storage trial. In past seasons, the garage used at the author's residence had proved adequate for multi-month storage of garlic and was thought to be a stable storage environment. For each growout area, 8 bulbs were saved for storage. Of these 8 bulbs, 2 were not cut from their stalks and were hung intact. Bulb weights of the samples of each garlic variety from each of the grow-out areas were measured at the beginning of the storage trial and were to be measured at several monthly intervals to evaluate weight loss through loss of bulb moisture. Any rotting or dehydrated bulbs were to be removed at the end of the trial and bulb quality was to be evaluated. Stored bulb weights were measured at the time the trial was terminated in mid-January. Average bulb weights for all varieties combined and all different grow-out areas were about 82% of initial average bulb weights measured August 18 (Table 10). Initial weights were measured after about 2-3 weeks of drying at the author's residence, depending on harvest date by the different growers. No rotting or dehydrated bulbs were observed by mid-January. Those garlic not cut from their stalks lost more weight primarily due to loss of leaves each time they were weighed. Although the full 6 months were not reached, all garlic was successfully stored in excellent condition for 3 months and some saleable bulbs in good condition were still available after 4-5 months. The 6 month mark was not reached due to germination in all of the varieties grown, mostly as root growth at the basal plate, but also sprouting of shoots. Sprouting rates were similar for all bulbs grown in Auke Rec, Haines, Gustavus and Douglas, but were higher for Ketchikan which probably could have been harvested earlier than in the other areas. Of the 4 varieties, Purple Glazer germinated at the highest rates probably because it matured earlier in the late summer in all areas grown. Russian Giant stored well, as did Chesnok Red, with Killarney Red intermediate in % germination and basal root growth (Table 11, pictures Appendix C).

II. Temperature and Relative Humidity

Stored garlic bulbs were hung in a dark, well-ventilated garage that was thought to maintain temperatures of about 60-70 ^{o}F, and relative humidity of 50-70%. These conditions are reported

to be optimal for storage (Engelund 1998) and represent what was thought to be an achievable, inexpensive method for most small growers. An ONSET Corporation temperature and percent humidity recorder was placed in the storage area in October, 2014 which sampled air temperature and relative humidity 4 times hourly until the storage trial was terminated in mid-January, 2014. The storage trial was terminated earlier than anticipated in mid-January due to low temperatures experienced in the storage garage in late December and early January followed by abnormally high temperatures through late January (Figure 3). These temperature changes seem to have stimulated germination. Relative humidity ranged from 35-72%, averaging about 50% which within the preferred range for storage (Meredith 2008). ONSET loggers worked well and appear to be a dependable device for monitoring storage conditions in storage spaces.

Discussion of Storage Trials

Although refrigeration and root cellar storage were not tested, storage in the garage proved to be a successful method. Humidity seemed to vary within the range recommended for successful storage. The problem seemed to be controlling temperature in the storage garage. If low temperatures during the colder periods of the year could be minimally increased then this method using this particular garage could be successful and the garlic stored would likely remain in top condition for longer than 4 months. Porcelain varieties such as Russian Giant have been stored in storage areas with more stable humidity and temperature for longer periods, 9 months up to a year (Engelund 1998). Joe Orsi recommends storage in a perforated container (ceramic works well) at room temperatures and has had excellent results storing Porcelains, Purple Stripes and Glazed Purple Stripes for many months. Rocambole varieties store just as long as our storage experiment but not as long as the other varieties when stored at room temperature. Although bulbs began growing roots from the basal plate and also began to sprout shoots after 4 months in the garage, thus making them un-saleable, most were still able to be kept from September 2013 until July 5 2014 for planting into the Gustavus greenhouse. Although some of the cloves and some bulbs had shriveled and rotted by this time, viability was good enough for many of the other bulbs to be planted. Those that were planted seemed to have survived well until late September. At the very least, unheated garage storage provided seed for additional experimentation in the greenhouse and could be used for providing seed in case of crop failure.

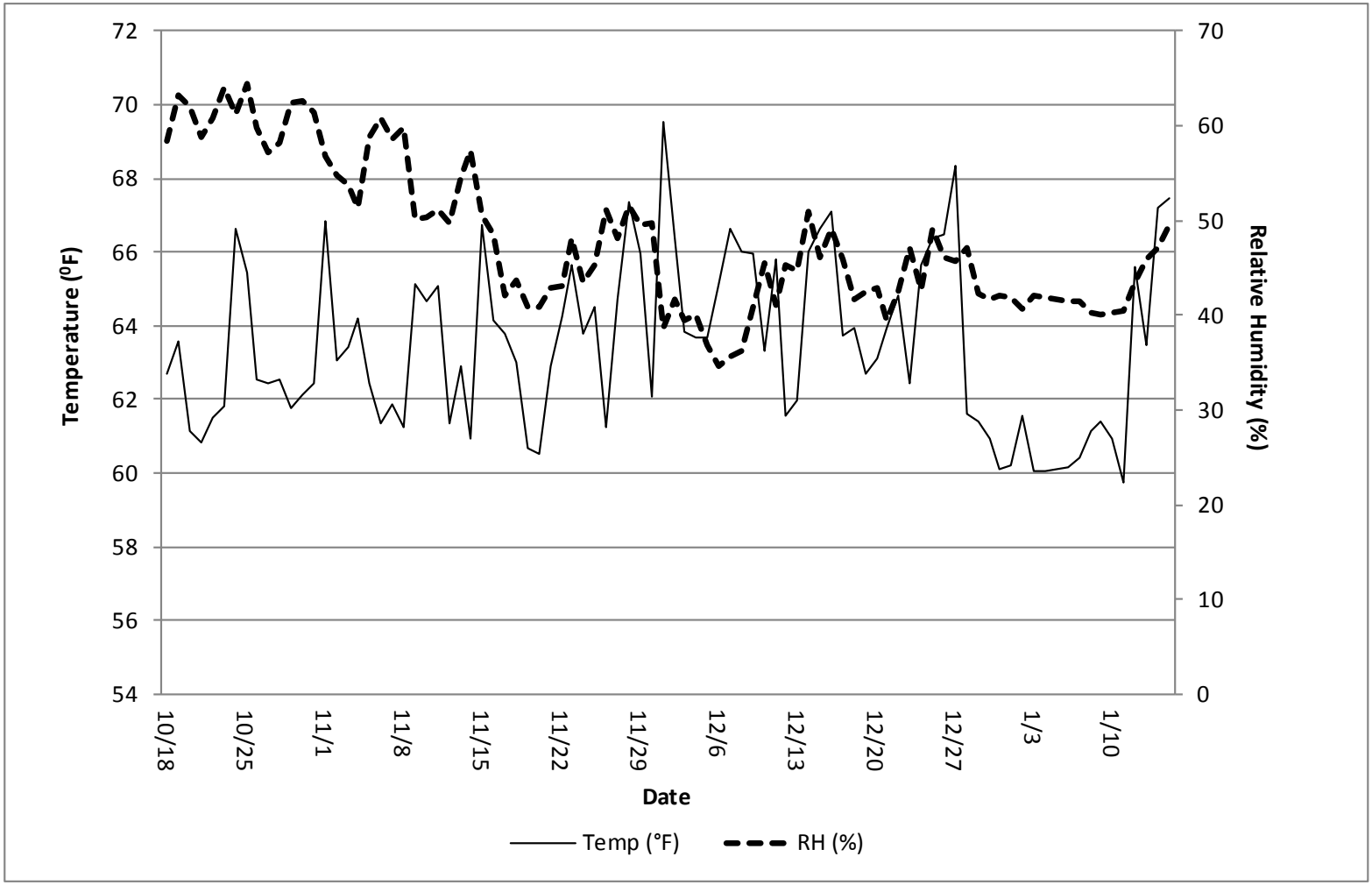
Table 10. Bulb weights prior to and after 4 months storage for four varieties and five growout areas. For each growout area, 2 of the 8 bulbs saved for storage were not cut from their stalks and were hung intact. Asterisk indicate those bulbs from which pictures were taken (Appendix C).

		Russian Giant			Killarney Red			Purple Glazer			Chesnok Red		
	Bulb #	8/18	1/15	% of initial wt	8/18	1/15	% of initial wt	8/18	1/15	% of initial wt	8/18	1/15	% of initial wt
Auke Red	1	2.3	1.8*	78	1.9	1.6	84	1.6	1.4*	88	2.1	1.7*	79
	2	2.5	2.0	78	2.2	1.8	84	1.5	1.3	90	1.8	1.5	81
	3	2.2	1.9	86	2.3	2.0*	87	1.6	1.4	88	2.2	1.9	86
	4	2.3	1.8	78	1.9	1.6	84	1.7	1.5	88	2.1	1.7	79
	5	2.2	1.7	77	2.0	1.7	85	1.6	1.4	88	1.8	1.5	83
	6	2.2	1.7	75	2.4	2.0	83	1.9	1.6	84	2.0	1.6	80
	2 uncut	6.3	4.7	75	4.8	4.1	85	3.5	3.1	89	4.8	3.9	80
average for bulbs:		2.3	1.8	79	2.1	1.7	82	1.6	1.4	88	2.0	1.6	81
average for plants:		3.2	2.4	75	2.4	2.1	85	1.8	1.6	89	2.4	1.9	80
Haines	25	2.1	1.6	76	1.5	1.3	83	1.4	1.2*	89	1.6	1.3	81
	26	2.2	1.7	79	1.9	1.6	84	1.3	1.1	88	1.7	1.4	85
	27	2.0	1.6	80	1.7	1.5	88	1.6	1.4	87	1.9	1.5	79
	28	2.2	1.7	77	1.9	1.6	84	1.4	1.2	89	1.3	1.1	85
	29	2.3	1.8	78	2.1	1.8	85	1.6	1.4	90	1.4	1.1	79
	30	1.8	1.3	74	2.1	1.7	81	1.2	1.0	87	1.2	1.0	83
	2 uncut	6.3	4.6	73	3.8	2.9	75	3.0	2.7	90	4.3	3.5	81
average for bulbs:		2.1	1.6	78	1.9	1.6	84	1.4	1.2	89	1.5	1.2	82
average for plants:		3.2	2.3	73	1.9	1.4	75	1.5	1.4	90	2.2	1.8	81
Gustavus	19	1.4	1.1*	81	1.2	1.0*	83	1.1	1.0*	90	0.9	0.8*	83
	20	1.5	1.2	77	1.0	0.8	84	1.1	1.0	91	0.5	0.5	90
	21	1.6	1.3	81	1.5	1.3	87	1.0	0.9	90	0.9	0.7	78
	22	1.7	1.3	76	1.5	1.3	87	1.3	1.1	85	1.2	1.0	83
	23	1.3	1.1	85	1.4	1.2	85	1.1	1.0	86	1.0	0.8	80
	24	1.6	1.4	84	1.5	1.3	86	0.8	0.7	88	0.7	0.6	79
	2 uncut	2.7	2.3	83	3.4	2.5	75	NT	NT		1.8	1.6	91
average for bulbs:		1.5	1.2	82	1.3	1.2	88	1.1	0.9	88	0.9	0.7	81
average for plants:		1.4	1.1	83	1.7	1.3	75	--	--	--	0.9	0.8	91
Ketchikan	7	1.9	1.6*	84	1.3	1.0	80	1.1	0.9*	86	1.1	0.9*	82
	8	1.2	1.0	83	1.3	1.1	85	1.5	1.3	86	1.0	0.8	75
	9	1.2	1.0	83	1.4	1.2*	82	1.1	1.0	86	1.1	0.9	82
	10	1.6	1.3	81	1.1	0.9	86	1.0	0.8	84	1.0	0.8	84
	11	1.7	1.4	82	1.0	0.9	90	0.9	0.8	89	0.6	0.5	91
	12	1.4	1.1	78	1.2	1.0	87	0.9	0.8	89	1.0	0.8	80
	2 uncut	3.9	3.2	81	3.9	3.0	78	2.7	2.1	79	2.6	2.0	75
average for bulbs:		1.5	1.2	77	1.2	1.0	82	1.1	0.9	87	1.0	0.8	79
average for plants:		2.0	1.6	81	1.9	1.5	78	1.3	1.1	79	1.3	1.0	75
Douglas	13	1.8	1.5*	83	1.5	0.9*	62	1.1	0.9*	86	1.2	1.0*	79
	14	1.2	1.0	87	1.8	1.3	72	0.9	0.7	82	1.1	0.8	73
	15	1.3	1.1	85	1.3	1.0	77	1.1	1.0	86	1.1	0.9	82
	16	1.5	1.3	87	1.1	0.8	71	1.0	0.9	90	1.0	0.8	79
	17	1.3	1.1	81	1.1	0.8	76	1.4	1.1	81	1.3	1.1	81
	18	1.1	1.1	100	1.8	1.2	69	1.0	0.8	84	0.8	0.6	75
	2 uncut	NT	NT		4.4	2.4	54	3.0	2.5	85	2.9	2.2	76
average for bulbs:		1.4	1.1	82	1.4	1.0	72	1.1	0.9	85	1.1	0.8	76
average for plants:		--	--	--	2.2	1.2	54	1.5	1.3	85	1.5	1.1	76

Table 11. Bulb sprouting rates in number and percentage after 5 months of storage, as well as number of bulbs that sprouted by variety and growout area.

Variety	Initial number of bulbs stored	no. and % germinated after 5 months in garage	Auke Rec	Haines	Gustavus	Ketchikan	Douglas
Russian Giant	38	10 of 38/26%	2	1	2	3	2
Killarney Red	40	16 of 40/40%	3	3	3	4	3
Purple Glazer	38	26 of 38/68%	5	5	5	6	5
Chesnok Red	40	12 of 40/30%	2	2	3	3	2

Figure 3. Air temperature (^{o}F) depicted by solid line and relative humidity (%) depicted by stippled line for garage storage area for the period 10/18/13 -1/15/14.



Goal 3: Simple Market Research, 2013:

Objectives for Goal 3:

1) Provided that sufficient quantity of garlic survive to be marketed, preliminary market research will evaluate local sales in the Gustavus area farmers market, and possibly at the Gustavus area health-food store.
2) Provided sufficient quantity of garlic are produced, sales and product acceptance will be evaluated during at least one Juneau produce market.
3) Standardized questionnaires will be completed for customers evaluating pricing, product desirability, and customer demand.
4) Prepare written report, including summaries of results from Goals 1 & 2 as well as compilation of simple regional (Southeast Alaska) shipping methods and costs in order to evaluate potential for expanded sales regionwide.

Goal 3 Simple Market Research Results:

I. Garlic Market questionaire

To evaluate Goal 3, garlic were sold at the Food Festival in Juneau on August 31, 2013 and at the Gustavus Saturday market September 7, 2013. All garlic available for sale was sold out at both markets with several potential buyers turned away. The overall response was very positive, with buyers looking forward to the following year's sales. Marketing questionaires were also developed in conjunction with a Division of Agriculture marketing grant received in 2013 that evaluated use of various advertising methods for garlic purchased by buyers at the 2013 Juneau Food Festival. Two interviewers were hired to ask attendees of the 2013 Juneau Food Festival 9 questions about the varieties of garlic purchased, attendance at farmer's markets, average amount of money spent, pricing, interest in scheduled sales, product image for local garlic, and advertising of the Food Festival event. Interviewers wandered the crowd asking questions and tried to spend equal time in front of the booths of the three local garlic producers at the Festival: Orsi Organic Produce, Ed's Edible Landscaping, and RootSeller Farm. Questionaires were also given to buyers at the RootSeller Farm booth. Approximately 10% of the total attendance of the Festival (89 of about 900 total) were asked all 9 questions on the questionnaire, for about 800 responses. Appendix D provides an example image of the questionnaire.

II. Garlic Varieties purchased, and Intended use

Questions 1 and 2 of the questionnaire asked buyers about the variety of garlic purchased, other preferred varieties and intended use of purchase. At the beginning of the sales day, many people were looking for the largest bulbs of specific garlic varieties for planting that fall. Large bulbs of any of the varieties sold quickly. Experienced Festival attendees that were also gardeners looking for planting stock, knew to arrive early at the event in order to get the best quality bulbs for planting. As fewer bulbs of large size were available, more people purchased garlic for eating, or purchased smaller bulbs of different varieties to experiment with in their gardens. By the end of the sales day, all varieties available had sold (Figure 4), and most purchased were for eating purposes (Table 12).

III. Farmer's markets, Pricing and Amount spent

Questions 3, 4, 5, 6 and 7 of the questionnaire asked buyers about attendance at farmer's markets, amount of money spent, fairness of pricing, and CSA-type marketing. More than 50% of interviewed buyers also shopped at other farmers markets in the Juneau area and elsewhere including the monthly Second Saturday markets, Community Garden events, and while traveling (Figure 5). When asked about the frequency of attendance, most interviewees responded that they attended annually, monthly and when available (Figure 6). Most people interviewed also responded that they spent between $11 and $20 per shopping event (Figure 7), and 93% felt the pricing was fair for locally produced garlic (Figure 8). When asked if they would pay more to have garlic delivered on a semi-regular basis (such as a garlic-of-the-month club, or CSA) an equal percentage (44%) said they would as wouldn't with about 8% indicating that they would consider it (Table 13).

IV. Market Acceptance, and Advertising

Questions 8 and 9 of the questionnaire asked buyers what they liked best about garlic at the market and how they heard about the Juneau Food Festival. Most buyers responded that they mostly wanted a locally grown product that is produced using organic methods. Of approximately equal but lesser importance were variety, quality and 'Alaska Grown" (Figure 9). Even in Juneau, a community of about 30,000 people, word-of-mouth apparently is still one of the best ways to advertise this event, especially if the responses "knew about market" and "friend/neighbor" are included with "word-of-mouth" for a total of 43% of total responses (Figure 10). Buyers also reported learning of the Food Festival from the Juneau Empire/local newspaper advertisement the week previous and from radio announcements. Posted flyers (about 30) all around town only attracted the attention of about 4% of the attendees. Internet accounted for about 11% of knowledge of the event.

Discussion of Simple Market Research

Proportionately, equal numbers of each variety were purchased by buyers in Juneau and Gustavus. More Killarney Red were available, thus more were sold. Killarney Red produces larger bulbs with more cloves than other larger varieties such as the Procelains, thus fewer bulbs need to be held back from market for seed. Other varieties shoppers purchased, expressed interest in, or had experience with, included Nootka Rose, Xian, Silverskin, Romanian Red, German Red, Purple Italian Easy Peel, White, and Music. The Food Festival provides local gardeners a source for locally produced seed just prior to fall planting, thus buyers early in the day purchased all of the larger garlic for planting. By the end of the sales day, more people total had purchased garlic to eat. To a point (1 ¼" bulb size in this study), no matter what size of garlic bulb is produced, it appears that it is popular at the local markets, and can be sold. As Orsi Organic has proven, production of garlic powder or salts can add value to sales of smaller bulbs. Only 1 person of 89 surveyed indicated they were giving garlic as a gift, certainly a present that this author would truly enjoy!

Many buyers indicated that they only shopped at this one annual event, however, there is a growing number of people buying at other venues including the monthly Second Saturday markets, Friday Food truck, Community Garden events, and the Saturday market in the summer months in Gustavus. Farmers markets were also popular events for tourists/visitors from out-of-state and should be advertised widely. A local chef was at the Food Festival as well as the monthly Second Saturday markets in 2013. He was a welcome means of advertising the creative culinary use of local produce. Unfortunately, the chef was not present at the 2014 Juneau Food Festival. We would like to see more grants awarded to chefs to attend these types of market venues.

Based on the question about advertising, preliminary results indicate that even in a community of almost 30,000 people, word-of-mouth (43% of responses) is still the most effective means of advertising. An expensive, week-long advertisement in the local newspaper generated just over ½ of the knowledge of the event compared to word-of-mouth, with print and electronic media (Facebook and JAHC website) combined equaling word-of mouth. Maybe this indicates that multiple advertising methods are necessary to successfully reach attendees of these events. Combining word-of-mouth, newspaper, radio announcements, and electronic media, about 83% of the attendees were informed about the event. Designing, printing, and posting the flyers around town may not have been worth the effort.

Most attendees (93%) felt that the price was fair for organic, locally grown, flavorful, hardneck Alaskan garlic. This indicates that the current (higher) price for locally grown garlic is acceptable to the buyer. An equal number felt that they would pay 10% more to have garlic delivered on a scheduled basis, than those that would not. This may indicate that producers could maybe sell half again as much over an extended schedule to buyers and may allow producers to time sales more closely to the harvest timing of garlic varieties grown. Purple Glazer could be harvested earlier and sold earlier followed by other cultivars such as Russian Giant, Chesnok Red, and Killarney Red.

At the single Food Festival event in 2013, according to interviews from about 9.9% (89 interviews) of the total attendance, 89% of those interviewed said they spent money on garlic. These 79 interviewees spent on average about $4 each, with the median money spent equaling between $11-$20. This equates to about 800 buyers of garlic that spent a total of about $3000 among 3 vendors. This was a bit more than the RootSeller Farm booth actually sold at about $700, indicating that more sales may have been possible. Regardless, if one additional event (entire weekend instead of just 1 day) were to be hosted each year, additional sales would likely be generated given the growing interest and fair pricing. This simple marketing analysis seems to indicate acceptable pricing, and a solid market demand for hardneck garlic because of the following desirable attributes: local availability, organically grown, good quality, and Alaskan adapted varieties.

Figure 4. Results from survey questionnaire question 1 about garlic varieties purchased by 89 attendees(~10% of total attendance) at the August 31, 2013 Juneau Food Festival. Approximately equal numbers of each variety were purchased.

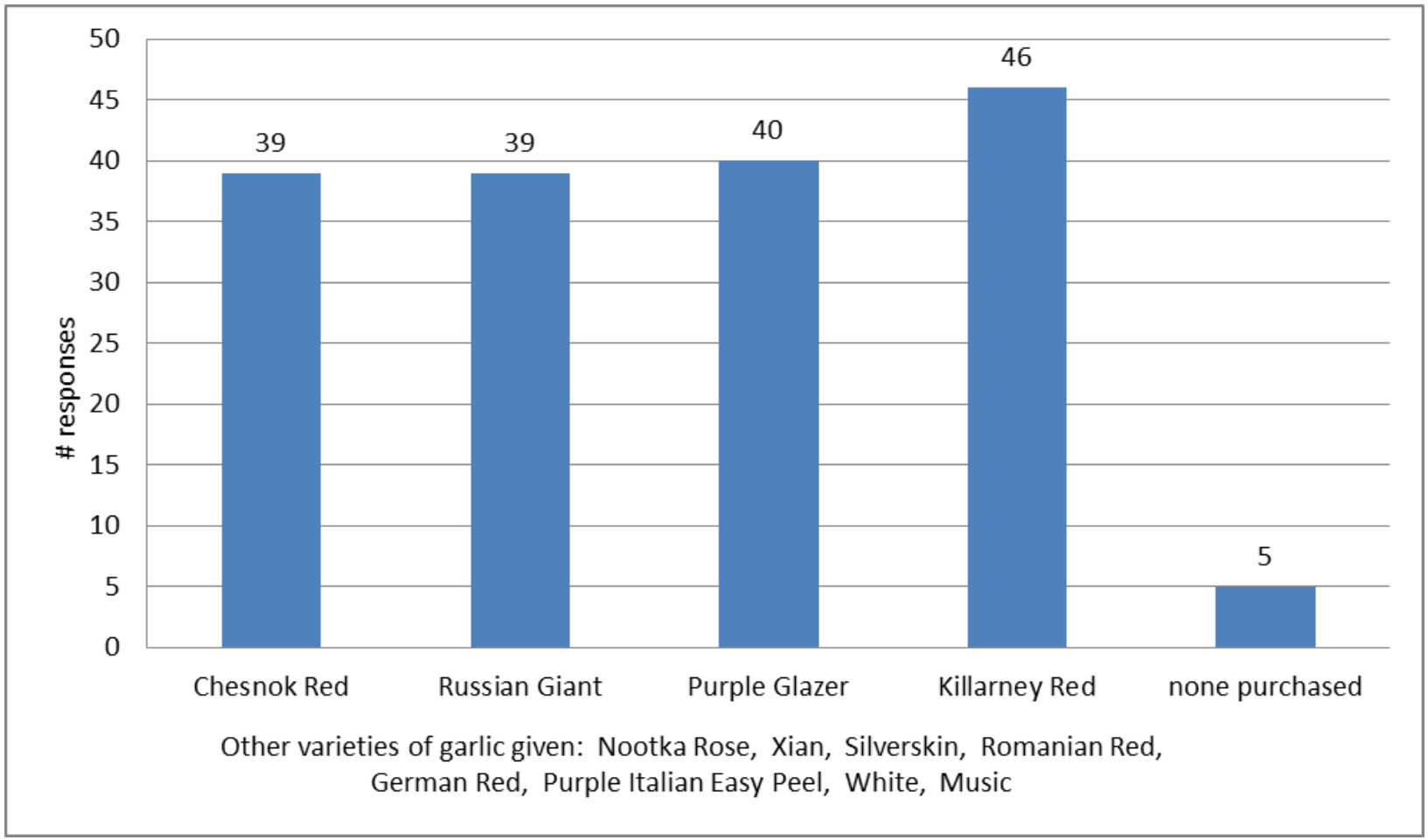


Table 12. Results from survey questionnaire question 2 asked of 2013 Juneau Food Festival attendees about intended use of purchased garlic.

Eating	Seed/planting	Gift	Other use:	Blank
68	38	1	1	2

Other uses: Pesto, Sales, Grows own does not buy, Vampires

Figure 5. Results from survey questionnaire question 3 asking whether people at the 2013 Juneau Food Festival attended other farmer's markets and which ones.

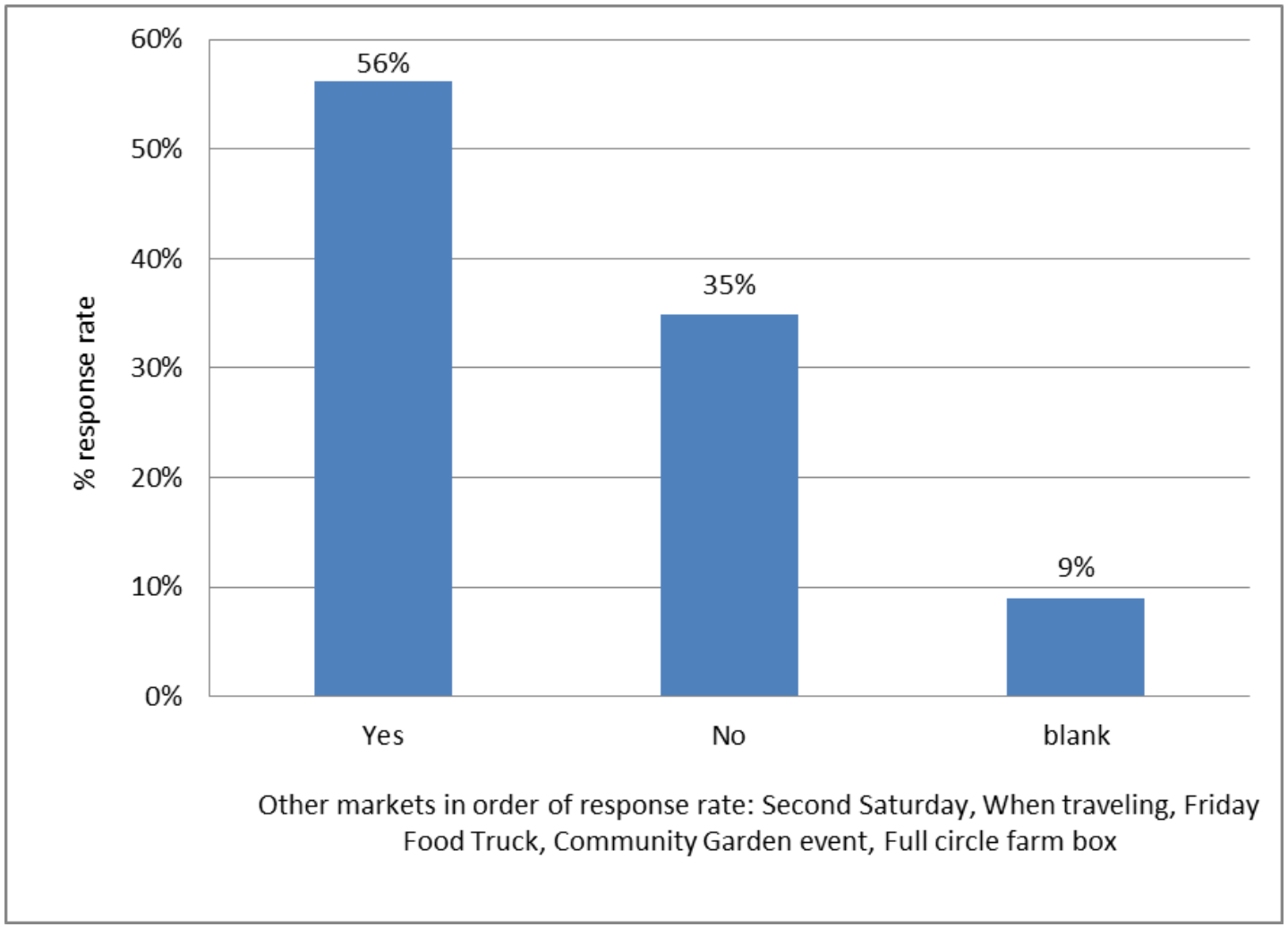


Figure 6. Results from survey questionnaire question 4 about the frequency of attendance to local fresh produce venues in the Juneau area.

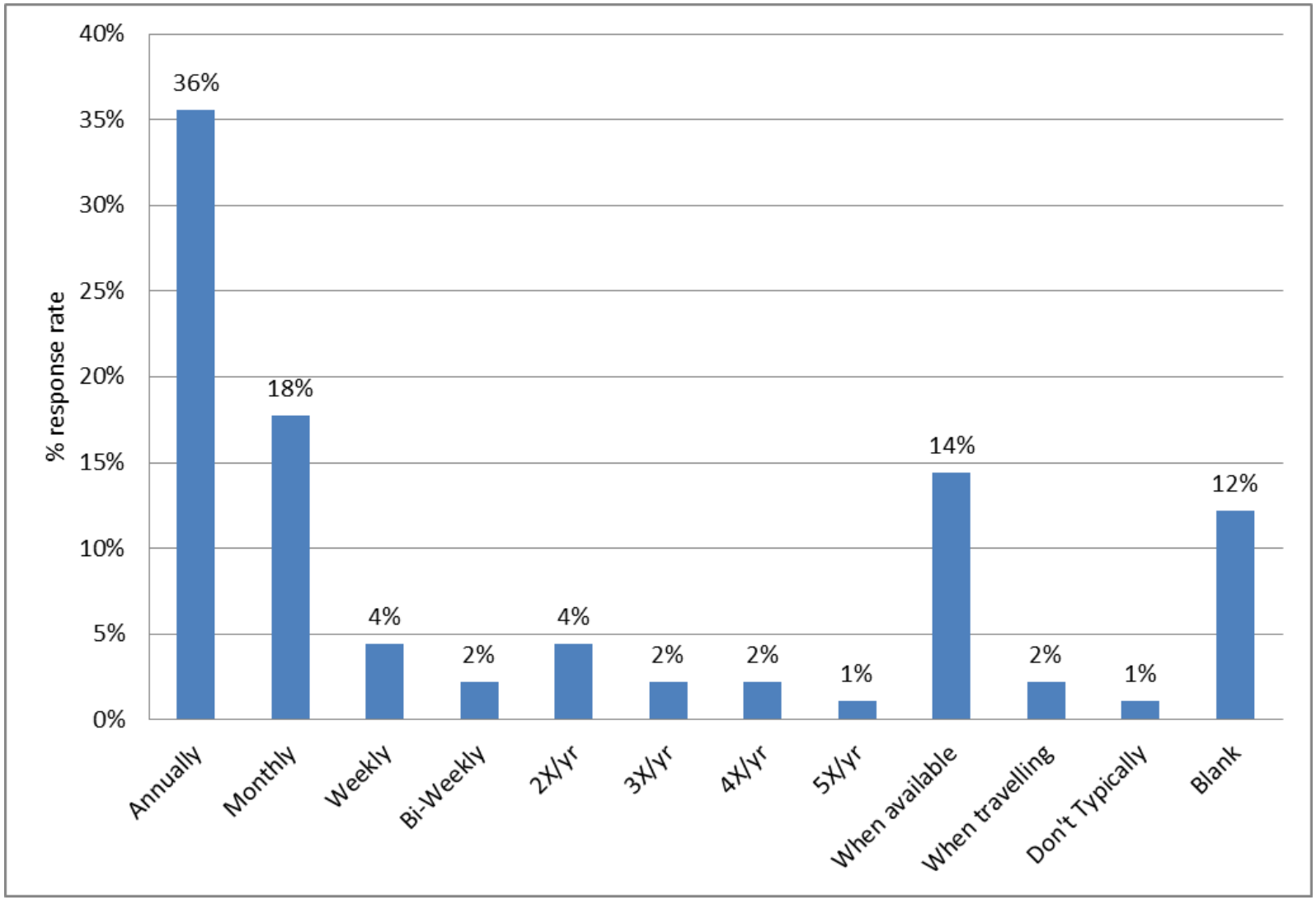


Figure 7. Results from survey questionnaire question 5 regarding amount of money buyers at the 2013 Juneau Food Festival spent. Most people spent about $10.00 - $20.00 on garlic at the event.

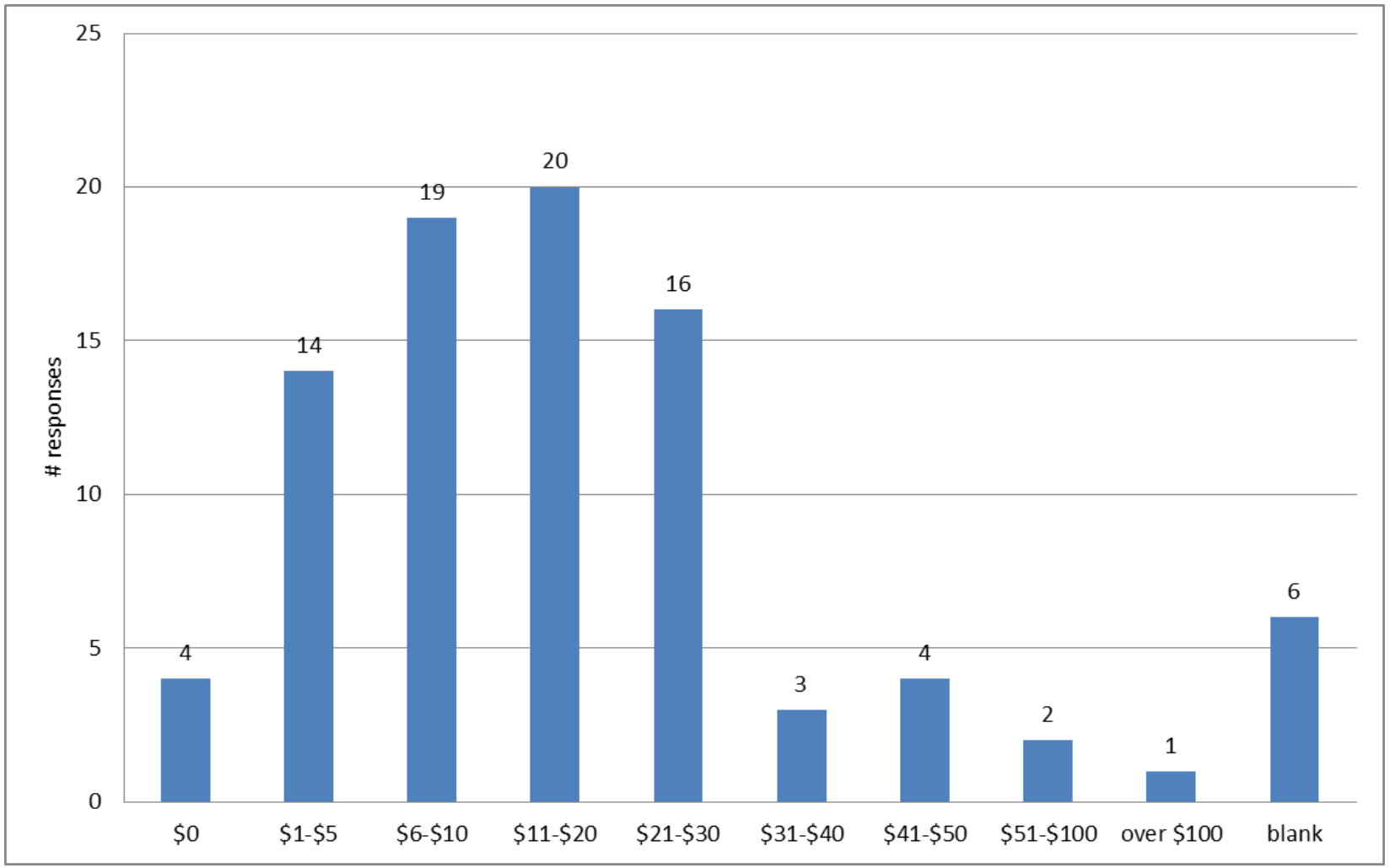


Figure 8. Results from survey questionnaire question 6 about current price for local garlic asked of 89 attendees at the August 31, 2013 Juneau Food Festival.

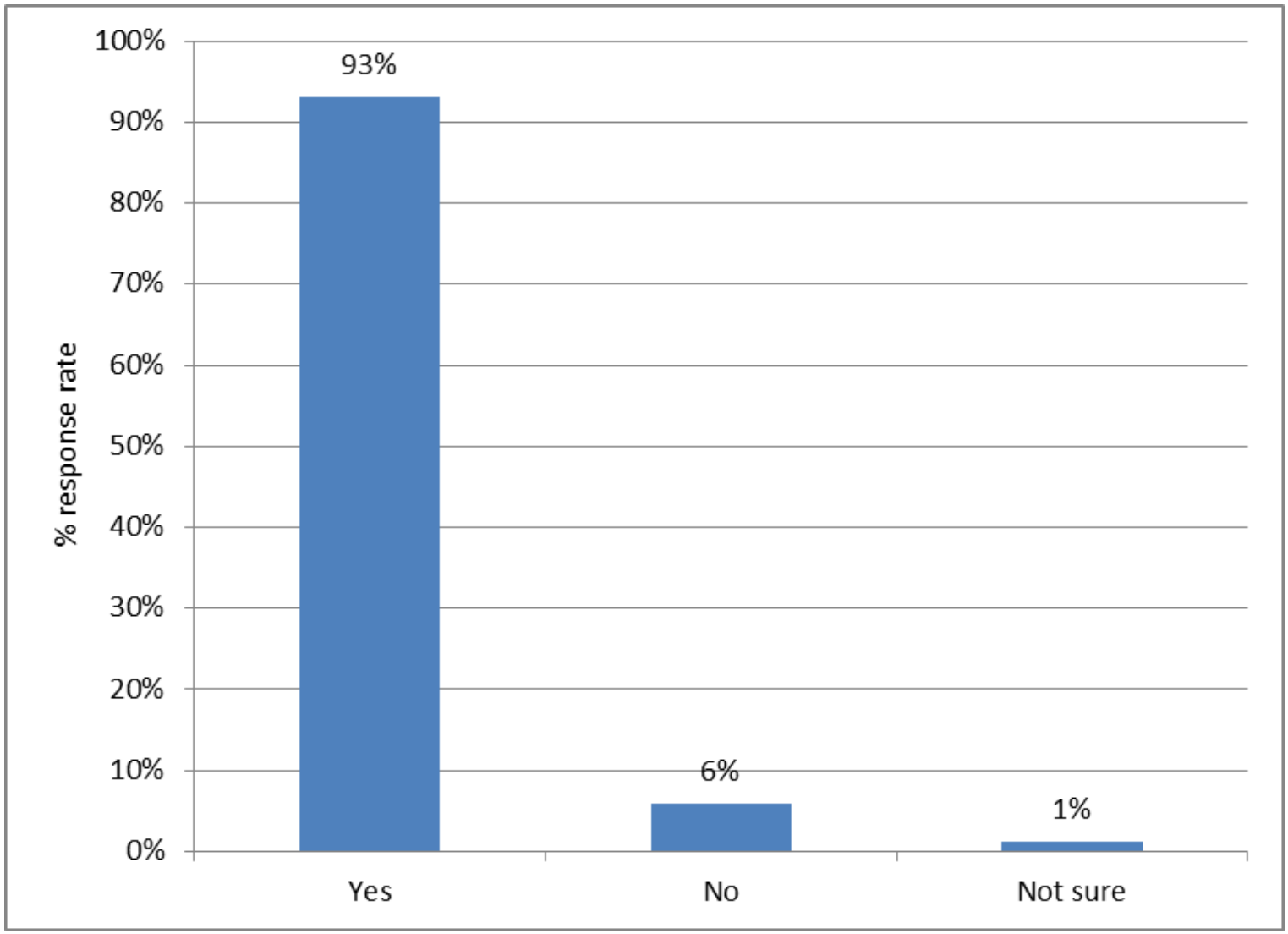


Table 13. Responses from survey questionnaire question 7 that asked whether buyers at the August 31, 2013 Juneau Food Festival would pay 10% more to receive garlic on a scheduled (monthly or semi-monthly) basis.

	Yes	No	Maybe	Not sure	Blank
#	39	39	7	1	3
%	44%	44%	8%	1%	3%

Figure 9. Results from survey questionnaire question 8 regarding desirable attributes of Alaskan garlic asked of 89 attendees at the August 31, 2013 Juneau Food Festival.

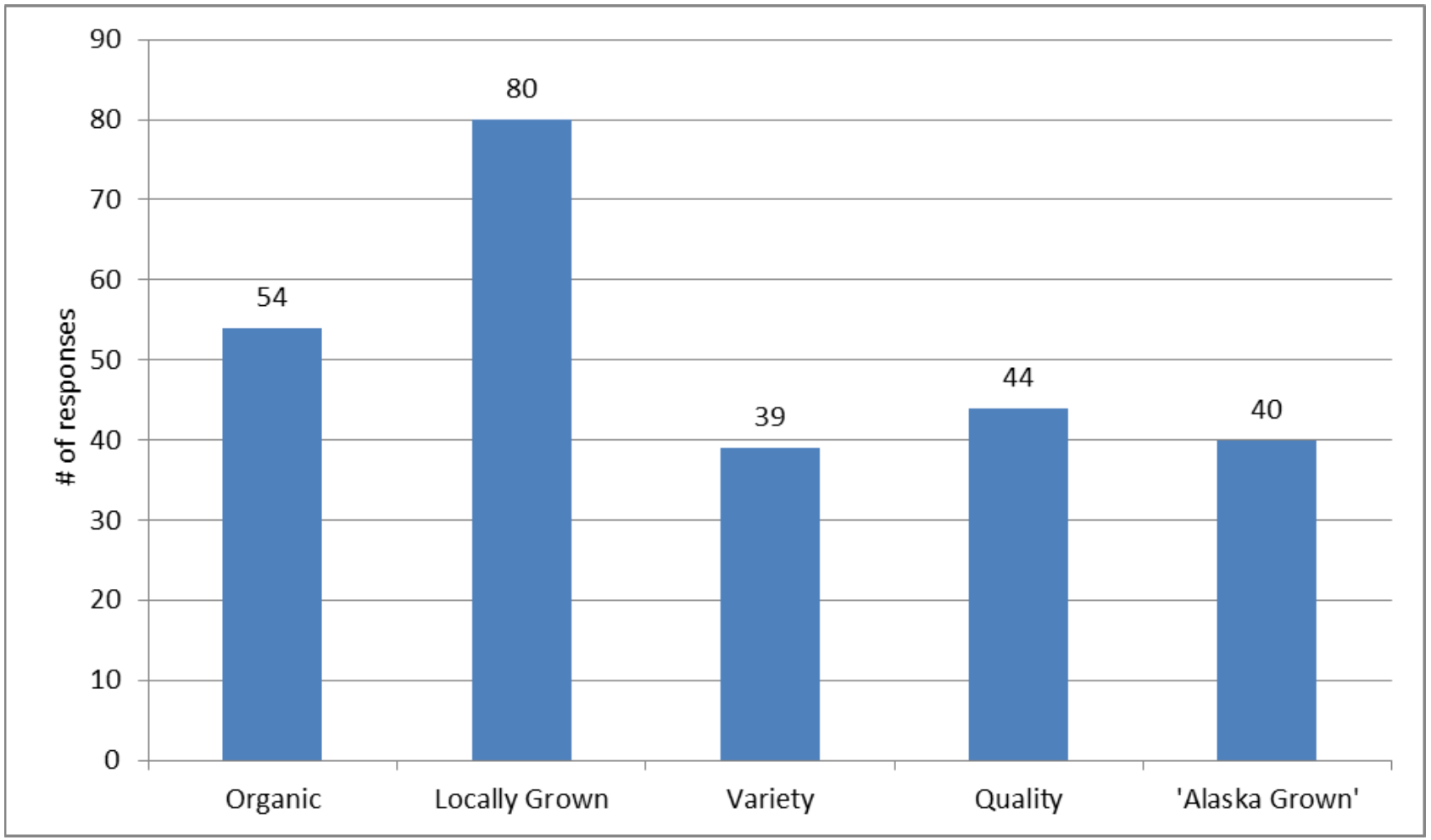
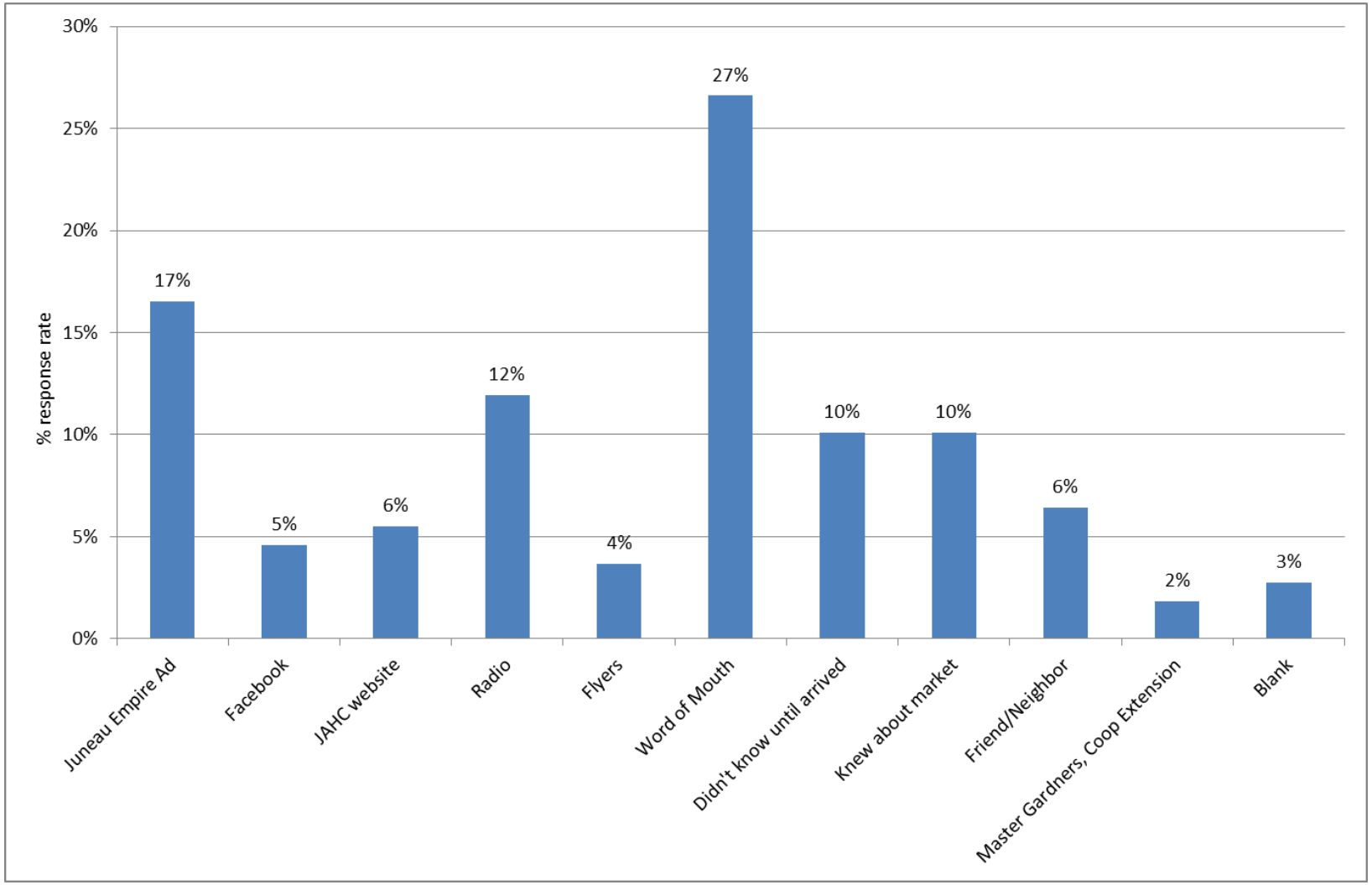


Figure 10. Results from survey questionnaire question 9 regarding advertising of Alaskan garlic sold during the August 31, 2013 Juneau Food Festival.



Acknowledgements
A very large ***Thank You!*** goes out to the participating growers who provided their time, energy and gardening space in order to complete the grow-out part of this project: Joe and Julie Orsi of Orsi Organic Produce graciously shared invaluable insights into successful garlic cultivation methods and suggestions for garlic cultivars that have consistently good growth characteristics for the Southeast region. Without the Orsi's participation this project would not have been nearly as successful. Ed Buyarski provided a wealth of gardening information and advice on garlic production as well as valuable space in the small farm that he and George Campbell are developing in Haines. Andy Piston's enthousiasm and use of the limited garden space were essential in providing information for southern Southeast Alaska growing conditions.

Literature Cited:

Engelund, R.L. 1998 Growing Great Garlic. Pubished by Filaree Production, Okanagon, Washington. ISBN 0-9630850-1-8

Meredith, T.J. 2008 The Complete Book of Garlic, A Guide for Gardeners, Growers, and Serious Cooks.Timber Press, Inc. ISBN-13:978-0-88192-883-9

Appendix A. page 1 of 3.- Pictoral guide to Garlic cultivation methods used in this study by growers in Southeast Alaska

Figure 1. In the fall, prior to planting, soils were amended with organic fertilizers of N, P and K

Figure 2. Garlic bulbs were split and cloves planted through IRT plastic

Figure 3. Planted beds were then mulched with seaweed and covered with plastic and left through the winter

Figure 4. In the spring, garlic shoots sprouted through the holes in the IRT and overlying seaweed

Figure 5. Newly emerged and young plants were side dressed with organic fertilizers and foliar sprayed with a combination of seaweed and fish fertilizer mixed in water

Figure 6. Once garlic scapes began to form on garlic plants they were cut to force larger bulb growth

Figure 7. If scapes were not removed, bulb size was smaller

Figure 8. These methods produced impressive results

Appendix B1, page 1 of 5. - Pre-planting soil test results from Brookside Labs for all areas garlic was grown.

#/1000

BROOKSIDE LABORATORIES, INC.

59581-1

SOIL AUDIT AND INVENTORY REPORT

Name David Love City Douglas State AK

Independent Consultant Home Office Date 01/24/2013

Sample Location	AUKA REC		JUNEAU					
Sample Identification			J.ORSI					
Lab Number			0257-1					
Total Exchange Capacity (ME/100 g)			16.37					
pH	Buffer (SMP/Sikora)		7.1					
	H_2O (1:1)		6.6					
Organic Matter (humus) %			2.86					
Estimated Nitrogen Release		#/1000	2					
ANIONS	SOLUBLE SULFUR*	ppm	53					
ANIONS / PHOSPHORUS	MEHLICH III	#/1000	44					
		P as P_2O_5	419					
		ppm of P						
	BRAY II	#/1000						
		P as P_2O_5						
		ppm of P						
	OLSEN	#/1000						
		P as P_2O_5						
		ppm of P						
EXCHANGEABLE CATIONS	CALCIUM*	#/1000	113					
		ppm	2459					
	MAGNESIUM*	#/1000	10					
		ppm	217					
	POTASSIUM*	#/1000	5					
		ppm	108					
	SODIUM*	#/1000	2					
		ppm	51					
BASE SATURATION PERCENT								
Calcium	%		75.11					
Magnesium	%		11.05					
Potassium	%		1.69					
Sodium	%		1.35					
Other Bases	%		4.80					
Hydrogen	%		6.00					
EXTRACTABLE MINORS								
Boron* (ppm)			0.81					
Iron* (ppm)			362					
Manganese* (ppm)			36					
Copper* (ppm)			2.50					
Zinc* (ppm)			8.10					
Aluminum* (ppm)			553					
OTHER TESTS	Soluble Salts (mmhos/cm)							
	Chlorides (ppm)							
	NO_3-N (ppm)		58.0					
	NH_4-N (ppm)		1.0					

* Mehlich III Extractable

#/1000

BROOKSIDE LABORATORIES, INC.

59581-1

SOIL AUDIT AND INVENTORY REPORT

Name David Love City Douglas State AK

Independent Consultant Home Office Date 01/24/2013

Sample Location			HAINES	E.			
Sample Identification				BUY.			
Lab Number				0259-1			
Total Exchange Capacity (ME/100 g)				21.79			
pH	Buffer (SMP/Sikora)			NA			
	H_2O (1:1)			7.1			
Organic Matter (humus) %				8.07			
Estimated Nitrogen Release		#/1000		3			
ANIONS	SOLUBLE SULFUR*	ppm		31			
ANIONS / PHOSPHORUS	MEHLICH III	#/1000	P as P_2O_5	2			
			ppm of P	15			
	BRAY II	#/1000	P as P_2O_5				
			ppm of P				
	OLSEN	#/1000	P as P_2O_5				
			ppm of P				
EXCHANGEABLE CATIONS	CALCIUM*	#/1000		173			
		ppm		3766			
	MAGNESIUM*	#/1000		7			
		ppm		159			
	POTASSIUM*	#/1000		8			
		ppm		168			
	SODIUM*	#/1000		3			
		ppm		62			

BASE SATURATION PERCENT						
Calcium %	86.42					
Magnesium %	6.08					
Potassium %	1.98					
Sodium %	1.24					
Other Bases %	4.30					
Hydrogen %	0.00					

EXTRACTABLE MINORS						
Boron* (ppm)	1.16					
Iron* (ppm)	376					
Manganese* (ppm)	42					
Copper* (ppm)	17.11					
Zinc* (ppm)	7.76					
Aluminum* (ppm)	631					
OTHER TESTS: Soluble Salts (mmhos/cm)						
Chlorides (ppm)						
NO_3-N (ppm)	13.2					
NH_4-N (ppm)	1.8					

* Mehlich III Extractable

#/1000

BROOKSIDE LABORATORIES, INC.

59581-1

SOIL AUDIT AND INVENTORY REPORT

Name David Love City Douglas State AK

Independent Consultant Home Office Date 01/24/2013

Sample Location	GUSTAVUS		D.LOVE				
Sample Identification							
Lab Number			0258-1				
Total Exchange Capacity (ME/100 g)			13.65				
pH (H_2O 1:1)			7.0				
Organic Matter (humus) %			4.03				
Estimated Nitrogen Release		#/1000	2				
ANIONS	SOLUBLE SULFUR*	ppm	30				
ANIONS / PHOSPHORUS	MEHLICH III	#/1000 P as P_2O_5	8				
		ppm of P	72				
	BRAY II	#/1000 P as P_2O_5					
		ppm of P					
	OLSEN	#/1000 P as P_2O_5					
		ppm of P					
EXCHANGEABLE CATIONS	CALCIUM*	#/1000	106				
		ppm	2305				
	MAGNESIUM*	#/1000	5				
		ppm	116				
	POTASSIUM*	#/1000	7				
		ppm	153				
	SODIUM*	#/1000	2				
		ppm	37				
BASE SATURATION PERCENT							
Calcium		%	84.43				
Magnesium		%	7.08				
Potassium		%	2.87				
Sodium		%	1.18				
Other Bases		%	4.40				
Hydrogen		%	0.00				
EXTRACTABLE MINORS							
Boron* (ppm)			0.48				
Iron* (ppm)			419				
Manganese* (ppm)			27				
Copper* (ppm)			2.73				
Zinc* (ppm)			2.62				
Aluminum* (ppm)			544				
OTHER TESTS	Soluble Salts (mmhos/cm)						
	Chlorides (ppm)						
	NO_3-N (ppm)		106.7				
	NH_4-N (ppm)		3.5				

* Mehlich III Extractable

#/1000

BROOKSIDE LABORATORIES, INC.

59581-1

SOIL AUDIT AND INVENTORY REPORT

Name David Love City Douglas State AK

Independent Consultant Home Office Date 01/24/2013

Sample Location	KETCHIKAN		A.PISTON				
Sample Identification							
Lab Number			0255-1				
Total Exchange Capacity (ME/100 g)			21.69				
pH	Buffer (SMP/Sikora)		6.9				
	H_2O (1:1)		7.0				
Organic Matter (humus) %			14.07				
Estimated Nitrogen Release		#/1000	3				
ANIONS	SOLUBLE SULFUR*	ppm	44				
PHOSPHORUS	MEHLICH III	#/1000 P as P_2O_5	4				
		ppm of P	40				
	BRAY II	#/1000 P as P_2O_5					
		ppm of P					
	OLSEN	#/1000 P as P_2O_5					
		ppm of P					
EXCHANGEABLE CATIONS	CALCIUM*	#/1000	151				
		ppm	3281				
	MAGNESIUM*	#/1000	15				
		ppm	336				
	POTASSIUM*	#/1000	10				
		ppm	211				
	SODIUM*	#/1000	10				
		ppm	228				
BASE SATURATION PERCENT							
Calcium	%		75.63				
Magnesium	%		12.91				
Potassium	%		2.49				
Sodium	%		4.57				
Other Bases	%		4.40				
Hydrogen	%		0.00				
EXTRACTABLE MINORS							
Boron* (ppm)			0.91				
Iron* (ppm)			129				
Manganese* (ppm)			11				
Copper* (ppm)			1.84				
Zinc* (ppm)			20.64				
Aluminum* (ppm)			1761				
OTHER TESTS	Soluble Salts (mmhos/cm)						
	Chlorides (ppm)						
	NO_3-N (ppm)		7.4				
	NH_4-N (ppm)		5.3				

* Mehlich III Extractable

#/1000

BROOKSIDE LABORATORIES, INC.

59581-1

SOIL AUDIT AND INVENTORY REPORT

Name David Love City Douglas State AK

Independent Consultant Home Office Date 01/24/2013

Sample Location			DOUGLAS	D.LOVE				
Sample Identification								
Lab Number				0256-1				
Total Exchange Capacity (ME/100 g)				19.33				
pH	Buffer (SMP/Sikora)			NA				
	H_2O (1:1)			7.2				
Organic Matter (humus) %				17.63				
Estimated Nitrogen Release		#/1000		3				
ANIONS	SOLUBLE SULFUR*	ppm		42				
ANIONS / PHOSPHORUS	MEHLICH III	#/1000	P as P_2O_5	24				
			ppm of P	232				
	BRAY II	#/1000	P as P_2O_5					
			ppm of P					
	OLSEN	#/1000	P as P_2O_5					
			ppm of P					
EXCHANGEABLE CATIONS	CALCIUM*	#/1000		132				
		ppm		2870				
	MAGNESIUM*	#/1000		17				
		ppm		359				
	POTASSIUM*	#/1000		13				
		ppm		273				
	SODIUM*	#/1000		5				
		ppm		109				
BASE SATURATION PERCENT								
Calcium	%			74.24				
Magnesium	%			15.48				
Potassium	%			3.62				
Sodium	%			2.45				
Other Bases	%			4.20				
Hydrogen	%			0.00				
EXTRACTABLE MINORS								
Boron* (ppm)				0.78				
Iron* (ppm)				288				
Manganese* (ppm)				55				
Copper* (ppm)				5.24				
Zinc* (ppm)				14.62				
Aluminum* (ppm)				1184				
OTHER TESTS	Soluble Salts (mmhos/cm)							
	Chlorides (ppm)							
	NO_3-N (ppm)			1.5				
	NH_4-N (ppm)			4.4				

* Mehlich III Extractable

Appendix B2. page 1 of 5. – Post harvest soil test results from Brookside Labs for all areas garlic was grown.

lb/A

BROOKSIDE LABORATORIES, INC.

59581-2

SOIL AUDIT AND INVENTORY REPORT

Name David Love City Douglas State AK

Independent Consultant Home Office Date 08/21/2013

Sample Location	AUKE REC/JUNEAU-	2ND					
Sample Identification		SAMPLE					
Lab Number		1147-1					
Total Exchange Capacity (ME/100 g)		12.49					
pH	Buffer (SMP/Sikora)	NA					
	H_2O (1:1)	7.1					
Organic Matter (humus) %		2.31					
Estimated Nitrogen Release	lb/A	66					
ANIONS — SOLUBLE SULFUR*	ppm	16					
ANIONS — PHOSPHORUS — MEHLICH III	lb/A P as P_2O_5	1965					
	ppm of P	429					
ANIONS — PHOSPHORUS — BRAY II	lb/A P as P_2O_5						
	ppm of P						
ANIONS — PHOSPHORUS — OLSEN	lb/A P as P_2O_5						
	ppm of P						
EXCHANGEABLE CATIONS — CALCIUM*	lb/A	3978					
	ppm	1989					
EXCHANGEABLE CATIONS — MAGNESIUM*	lb/A	362					
	ppm	181					
EXCHANGEABLE CATIONS — POTASSIUM*	lb/A	220					
	ppm	110					
EXCHANGEABLE CATIONS — SODIUM*	lb/A	102					
	ppm	51					
BASE SATURATION PERCENT							
Calcium %		79.62					
Magnesium %		12.08					
Potassium %		2.26					
Sodium %		1.78					
Other Bases %		4.30					
Hydrogen %		0.00					
EXTRACTABLE MINORS							
Boron* (ppm)		0.76					
Iron* (ppm)		333					
Manganese* (ppm)		35					
Copper* (ppm)		2.81					
Zinc* (ppm)		5.46					
Aluminum* (ppm)		533					
OTHER TESTS — Soluble Salts (mmhos/cm)							
Chlorides (ppm)							
NO_3-N (ppm)		17.2					
NH_4-N (ppm)		3.6					

* Mehlich III Extractable

lb/A

BROOKSIDE LABORATORIES, INC.

59581-2

SOIL AUDIT AND INVENTORY REPORT

Name David Love City Douglas State AK

Independent Consultant Home Office Date 08/21/2013

Sample Location	HAINES HWY-E.	2ND					
Sample Identification		SAMPLE					
Lab Number		1149-1					
Total Exchange Capacity (ME/100 g)		17.80					
pH	Buffer (SMP/Sikora)	7.3					
	H_2O (1:1)	6.8					
Organic Matter (humus) %		6.99					
Estimated Nitrogen Release	lb/A	110					
ANIONS — SOLUBLE SULFUR*	ppm	32					
ANIONS — PHOSPHORUS — MEHLICH III	lb/A P as P_2O_5	69					
	ppm of P	15					
ANIONS — PHOSPHORUS — BRAY II	lb/A P as P_2O_5						
	ppm of P						
ANIONS — PHOSPHORUS — OLSEN	lb/A P as P_2O_5						
	ppm of P						
EXCHANGEABLE CATIONS — CALCIUM*	lb/A	5758					
	ppm	2879					
EXCHANGEABLE CATIONS — MAGNESIUM*	lb/A	252					
	ppm	126					
EXCHANGEABLE CATIONS — POTASSIUM*	lb/A	328					
	ppm	164					
EXCHANGEABLE CATIONS — SODIUM*	lb/A	268					
	ppm	134					
BASE SATURATION PERCENT							
Calcium %		80.87					
Magnesium %		5.90					
Potassium %		2.36					
Sodium %		3.27					
Other Bases %		4.60					
Hydrogen %		3.00					
EXTRACTABLE MINORS							
Boron* (ppm)		1.20					
Iron* (ppm)		364					
Manganese* (ppm)		70					
Copper* (ppm)		12.41					
Zinc* (ppm)		7.66					
Aluminum* (ppm)		495					
OTHER TESTS — Soluble Salts (mmhos/cm)							
Chlorides (ppm)							
NO_3-N (ppm)		19.9					
NH_4-N (ppm)		3.2					

* Mehlich III Extractable

lb/A

BROOKSIDE LABORATORIES, INC.

59581-2

SOIL AUDIT AND INVENTORY REPORT

Name David Love City Douglas State AK

Independent Consultant Home Office Date 08/21/2013

Sample Location		GUSTAVUS-D. LOVE	2ND				
Sample Identification			SAMPLE				
Lab Number			1148-1				
Total Exchange Capacity (ME/100 g)			20.40				
pH	Buffer (SMP/Sikora)		6.9				
	H_2O (1:1)		6.5				
Organic Matter (humus) %			18.73				
Estimated Nitrogen Release		lb/A	129				
ANIONS	SOLUBLE SULFUR*	ppm	42				
PHOSPHORUS	MEHLICH III	lb/A P as P_2O_5	756				
		ppm of P	165				
	BRAY II	lb/A P as P_2O_5					
		ppm of P					
	OLSEN	lb/A P as P_2O_5					
		ppm of P					
EXCHANGEABLE CATIONS	CALCIUM*	lb/A	5654				
		ppm	2827				
	MAGNESIUM*	lb/A	694				
		ppm	347				
	POTASSIUM*	lb/A	450				
		ppm	225				
	SODIUM*	lb/A	124				
		ppm	62				
BASE SATURATION PERCENT							
Calcium	%		69.29				
Magnesium	%		14.17				
Potassium	%		2.83				
Sodium	%		1.32				
Other Bases	%		4.90				
Hydrogen	%		7.50				
EXTRACTABLE MINORS							
Boron* (ppm)			1.05				
Iron* (ppm)			261				
Manganese* (ppm)			30				
Copper* (ppm)			4.45				
Zinc* (ppm)			17.44				
Aluminum* (ppm)			801				
OTHER TESTS	Soluble Salts (mmhos/cm)						
	Chlorides (ppm)						
	NO_3-N (ppm)		15.4				
	NH_4-N (ppm)		9.2				

* Mehlich III Extractable

lb/A

BROOKSIDE LABORATORIES, INC.

59581-2

SOIL AUDIT AND INVENTORY REPORT

Name David Love City Douglas State AK

Independent Consultant Home Office Date 08/21/2013

Sample Location	KETCHIKAN-A.	2ND					
Sample Identification		SAMPLE					
Lab Number		1145-1					
Total Exchange Capacity (ME/100 g)		26.48					
pH	Buffer (SMP/Sikora)	7.2					
	H_2O (1:1)	6.5					
Organic Matter (humus) %		29.94					
Estimated Nitrogen Release	lb/A	> 130					
ANIONS — SOLUBLE SULFUR*	ppm	48					
ANIONS — PHOSPHORUS — MEHLICH III	lb/A P as P_2O_5	1035					
	ppm of P	226					
ANIONS — PHOSPHORUS — BRAY II	lb/A P as P_2O_5						
	ppm of P						
ANIONS — PHOSPHORUS — OLSEN	lb/A P as P_2O_5						
	ppm of P						
EXCHANGEABLE CATIONS — CALCIUM*	lb/A	7334					
	ppm	3667					
MAGNESIUM*	lb/A	832					
	ppm	416					
POTASSIUM*	lb/A	624					
	ppm	312					
SODIUM*	lb/A	274					
	ppm	137					
BASE SATURATION PERCENT							
Calcium %		69.24					
Magnesium %		13.09					
Potassium %		3.02					
Sodium %		2.25					
Other Bases %		4.90					
Hydrogen %		7.50					
EXTRACTABLE MINORS							
Boron* (ppm)		1.14					
Iron* (ppm)		161					
Manganese* (ppm)		10					
Copper* (ppm)		2.40					
Zinc* (ppm)		30.19					
Aluminum* (ppm)		899					
OTHER TESTS — Soluble Salts (mmhos/cm)							
Chlorides (ppm)							
NO_3-N (ppm)		82.0					
NH_4-N (ppm)		8.7					

* Mehlich III Extractable

lb/A

BROOKSIDE LABORATORIES, INC.

59581-2

SOIL AUDIT AND INVENTORY REPORT

Name David Love City Douglas State AK

Independent Consultant Home Office Date 08/21/2013

Sample Location		DOUGLAS-D. LOVE	2ND				
Sample Identification			SAMPLE				
Lab Number			1146-1				
Total Exchange Capacity (ME/100 g)			10.06				
pH	Buffer (SMP/Sikora)		a NA				
	H_2O (1:1)		7.5				
Organic Matter (humus) %			3.19				
Estimated Nitrogen Release		lb/A	82				
ANIONS	SOLUBLE SULFUR*	ppm	18				
ANIONS / PHOSPHORUS	MEHLICH III	lb/A P as P_2O_5	394				
		ppm of P	86				
	BRAY II	lb/A P as P_2O_5					
		ppm of P					
	OLSEN	lb/A P as P_2O_5					
		ppm of P					
EXCHANGEABLE CATIONS	CALCIUM*	lb/A	3114				
		ppm	1557				
	MAGNESIUM*	lb/A	234				
		ppm	117				
	POTASSIUM*	lb/A	516				
		ppm	258				
	SODIUM*	lb/A	112				
		ppm	56				
BASE SATURATION PERCENT							
Calcium		%	77.39				
Magnesium		%	9.69				
Potassium		%	6.58				
Sodium		%	2.42				
Other Bases		%	3.90				
Hydrogen		%	0.00				
EXTRACTABLE MINORS							
Boron* (ppm)			0.80				
Iron* (ppm)			411				
Manganese* (ppm)			26				
Copper* (ppm)			2.69				
Zinc* (ppm)			3.06				
Aluminum* (ppm)			514				
OTHER TESTS	Soluble Salts (mmhos/cm)						
	Chlorides (ppm)						
	NO_3-N (ppm)		19.2				
	NH_4-N (ppm)		3.4				

a - alkaline soil

* Mehlich III Extractable

Appendix C. page 1 of 3. Example images of sprouting garlic cloves from bulbs that had been held for storage trials for 5 months from 8/18/2013 to 8/15/2013. Naming convention indicates sample number, garlic variety and source growout area. Note that Purple Glazer sprouted at rates almost twice that of the other varieties and exhibited both root sprouting from the basal plate of the clove as well as shoot growth.

Russian Giant Auke Rec

Killarney Red Auke Rec

Purple Glazer Auke Rec

Chesnok Red Auke Rec

Purple Glazer Haines

Russian Giant Gustavus

Killarney Red Gustavus

Purple Glazer Gustavus

Chesnok Red Gustavus

Russian Giant Ketchikan

Killarney Red Ketchikan

Purple Glazer showing basal root growth Ketchikan

Purple Glazer showing shoot growth Ketchikan

Chesnok Red Ketchikan

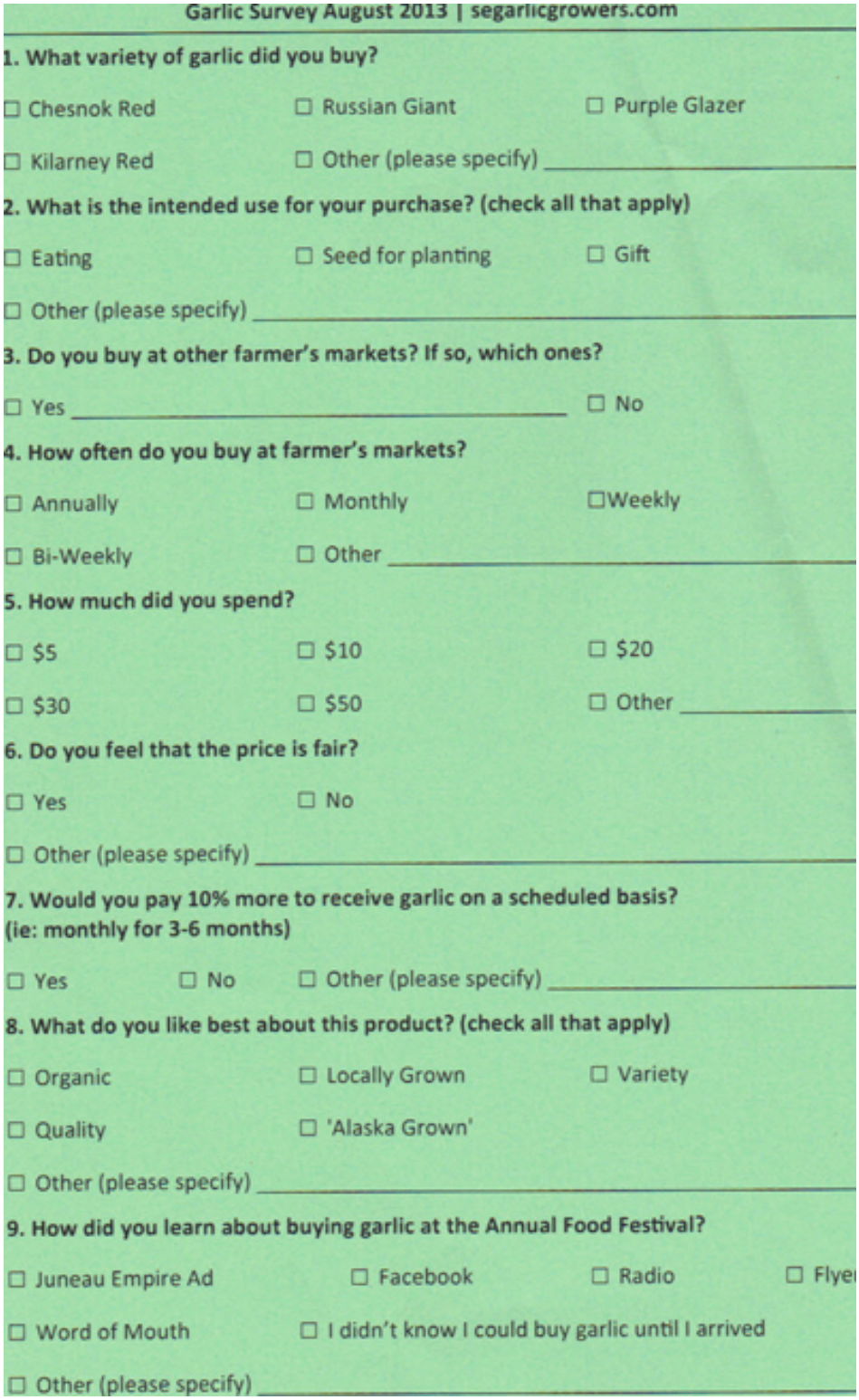
Russian Giant Douglas

Killarney Red Douglas

Purple Glazer Douglas

Chesnok Red Douglas

Appendix D. page 1 of 2. Marketing questionaire used to survey customers at the Juneau Food Fair August 31, 2013



Garlic Survey August 2013 | segarlicgrowers.com

1. What variety of garlic did you buy?

☐ Chesnok Red ☐ Russian Giant ☐ Purple Glazer

☐ Kilarney Red ☐ Other (please specify) _____

2. What is the intended use for your purchase? (check all that apply)

☐ Eating ☐ Seed for planting ☐ Gift

☐ Other (please specify) _____

3. Do you buy at other farmer's markets? If so, which ones?

☐ Yes _____ ☐ No

4. How often do you buy at farmer's markets?

☐ Annually ☐ Monthly ☐Weekly

☐ Bi-Weekly ☐ Other _____

5. How much did you spend?

☐ $5 ☐ $10 ☐ $20

☐ $30 ☐ $50 ☐ Other _____

6. Do you feel that the price is fair?

☐ Yes ☐ No

☐ Other (please specify) _____

7. Would you pay 10% more to receive garlic on a scheduled basis? (ie: monthly for 3-6 months)

☐ Yes ☐ No ☐ Other (please specify) _____

8. What do you like best about this product? (check all that apply)

☐ Organic ☐ Locally Grown ☐ Variety

☐ Quality ☐ 'Alaska Grown'

☐ Other (please specify) _____

9. How did you learn about buying garlic at the Annual Food Festival?

☐ Juneau Empire Ad ☐ Facebook ☐ Radio ☐ Flye

☐ Word of Mouth ☐ I didn't know I could buy garlic until I arrived

☐ Other (please specify) _____

Appendix D. page 2 of 2. Example of flyers posted around Juneau used for advertizing the Juneau Food Fair in 2013. Other advertising methods included Public Radio, Juneau Empire advertisement, Facebook posts, launching of a website specific to Southeast garlic growers, and limited word of mouth.