

# Garlic



**Extension**  
UNIVERSITY OF WISCONSIN-MADISON  
DANE COUNTY



**FAIRSHARE**  
CSA COALITION

**Collin Thompson**  
Willowsford Farm

**Jason Thimmesch**  
The Thimmesch Farm

**Cindy Hollenbeck**  
Keene Garlic, LLC

Location	Ashburn, VA	LaFarge, WI	Sun Prairie, WI
Acres in Vegetables	15	9	1
Acres in Garlic	0.5	2	10

How these tasks are done for Garlic:

field prep/tillage	with a tractor	with a tractor	with a tractor
seeding	with a tractor	by hand	with a tractor
cultivating	with a tractor	do not do this task for garlic	by hand
spreading amendments	with a tractor	with a tractor	by hand
mulch laying	with a tractor	by hand	by hand
laying irrigation lines	with a tractor	do not do this task for garlic	do not do this task for garlic
laying row cover	do not do this task for garlic	do not do this task for garlic	do not do this task for garlic
spraying for pests or diseases	do not do this task for garlic	do not do this task for garlic	do not do this task for garlic
harvesting	by hand	by hand	by hand
hauling crops from the field	with a tractor	with a tractor	by hand
mowing residues	with a tractor	with a tractor	with a tractor
incorporating residues	with a tractor	with a tractor	with a tractor
farming style	organic practices, not certified	certified organic	certified organic, sustainable

## Propagation

Varieties HARDNECK	Uncle Hank's, Italian Red, German Red, German White, Music,	Armenian, Asian Tempest, Bogatyr, Chamisal Wild, Chesnok Red, Georgian Crystal, German Red, Jovak, Korean Red, Leningrad, Majestic, Metake, Persian Star, Siberian	Amish Rocambole, Armenian, Asian Tempest, Blossom, Chamisal Wild, California Wild, Chesnok red, Elephant Garlic, Estonian Red, Georgian Crystal, Georgian Fire, German Extra Hardy, German Red, Italian Red, Killarney Red, , Majestic, Metechi, Montana Giant, Music, Northern White, Pehoski Purple, Persian Star, Purple Glazier, Romanian Red, Rose de Lautrec, Russian Giant, Russian Inferno, Siberian, Spanish Roja, Vietnamese red. Garlic Families: Porcelain, Standard Purple Stripe, Marbled Purple Stripe, Rocambole, Asiatic, Turban, Creole, Softneck (artichoke and silverskin).
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Varieties SOFTNECK	Inchelium Red	Transylvanian	Silverwhite, Red Toch, Inchelium red, Kettle River Giant, Lorz Italian, CA White.
Saved Seed Pros and Cons	Additional labor required to grade/select	<p>The challenges of saving our own seed as well as selling seed stock is of course making sure we have an extremely high quality product, as well as growing our garlic to size up.</p> <p>The benefits are a higher market value as well as more security in future year success. If we plant high quality garlic, we are more likely to harvest high quality garlic.</p>	<p>Overall, saving your own seed year after year will allow your garlic seed to develop into great seed stock as it acclimates into your climate and soil. Saving the largest seed stock can reduce income, so professional growers can easily plant 1.75-2" bulbs and size them up. If you are growing for culinary, you can plant your 1.75-2" bulbs and will have more plantable cloves per pound. But if you are planting to sell as seed stock, size is important and you may only want to plant the largest bulbs. Keep an eye on seed stock as it can deteriorate before planting due to mold or mites. Saving your own seed reduces chances of incorporating disease into your seed and field (closed system). Sometimes stunted seed never recovers back into good seed stock so you may need to replace it. WI garlic acclimates well into most regions in the US, but not all garlic from other regions acclimates well into WI - like Pacific North West garlic</p>
Saved Seed Selection	I grade bulbs based on size and quality (disease-free). Some varieties are sorted by clove size, as well, with large cloves being planted for bulbs and small for green garlic.	I choose large, healthy seed stock. The garlic we save and sell as seed garlic ranges from 2-3 inches in diameter. This garlic is also reasonably uniform in shape, and free of molds and diseases. This garlic looks healthy.	I look for the largest healthiest stock in each variety, but I will also plant imperfect bulbs that are not sellable. I also look at the health and size of the clove. Even the small cloves in a large bulb will yield a small bulb. If I am trying to grow out a variety, I will plant everything and work on sizing it up.

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Seed Suppliers	<p>Filaree Garlic Farm - great selection and exceptional quality, more expensive. Vermont Valley Community Farm - limited variety offerings, and sells out fast. Fraser Garlic Farm - decent selection and quality.</p>	<p>Keene Organics, friends and neighbors. I have a personal relationship and trust with Keene Organics that goes both ways. We are familiar with each other's growing techniques via multiple phone conversations, emails, and visits. I have a similar relationship with other select/very local friends and neighbors.</p>	<p>We purchase from a very select group of growers who have years of experience growing quality seed stock for our web sales. I have purchased seed from all over the US and from many multiple different growers. We found there is no consistency in quality. With everyone jumping into growing garlic for the "high profits" many growers are passing off substandard seed stock, and you never know until you receive the garlic. So make sure the company stands behind their product.</p>
Seed Prep	<p>All hand work. Crack heads and grade/sort cloves based on size and quality. Heads with disease, rot, soft cloves, etc. are not used. For most hardneck varieties, all cloves are planted for head garlic except those that are very small, which may be used for green garlic, if growing any.</p>	<p>We break apart the individual cloves by hand, then soak them in a fertilizer solution composed of 1T fish emulsion and 1T baking soda per gallon for 3 to 12 hours. Then we strain the garlic and submerge in isopropyl alcohol for 5 minutes just before planting.</p>	<p>I soak my garlic with a sterilizer and then soak it in a fertilizer and baking soda overnight before planting.</p>
Planting Schedule	<p>Typically I try to have everything in by October 31, though weather can drive this decision. I try to shoot for four weeks before a hard freeze.</p>	<p>We plant our garlic anytime after October 10th, depending on the weather.</p>	<p>More garlic growers are planting garlic earlier (even late September) and yielding better results. We did not want our garlic to sprout in the fall, because we thought that the energy spent in the fall would mean smaller bulbs the next season. More growers are finding that an earlier planting develops stronger roots, and that plant/bulb size does not appear to be affected by fall growth. Regardless, the garlic will re-sprout in the spring and grow into a strong healthy plant. We don't have the ability to plant until after "shipping season", so we have planted as late as November 10th, but due to these new studies, we are trying to move planting up as early as we can, which is about October 20.</p>

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**Bed Prep**

Preceding Cash Crop	Strawberries	Here's the procession: cover crop followed by brussel sprouts followed by cover crop/cilantro followed by garlic	
Preceding Cover Crop	I usually precede fall planted annual strawberries with a spring/summer cover crop that includes oats and peas, then maybe buckwheat. Depending on the strawberry crop, I will do a summer fallow or another round of buckwheat before garlic.	cover crop succession: spring: oats and peas, summer: buckwheat and/or sorghum sudan, fall: hairy vetch and/or winter wheat	Mighty mustard or buckwheat
Soil Amendments	Manure based composts are typically applied to fields to boost organic matter and a little fertility at a rate of 10T/acre. I try to apply 120-150# of N before planting. This is applied using the fertilizer hopper on my Rainflow 2600 plastic mulch layer. This is typically part of a poultry based blend - sometimes custom blended by Midwestern BioAg. P and K are amended based on soil tests.	Composted Poultry Manure: 1000#/s/acre(nitrogen/phosphorus/calcium) Soft Rock Phosphate: 1000#/s/acre(phosphorus/calcium)	We soil test using Midwestern Bio Ag and apply according to their recommended rates. We use Veggie Plus and Veggie NKO in the fall and in the spring we will apply feather meal and/or pelleted chicken manure. Don't apply any fertilizer after the garlic scapes! The soil MUST be adequately fertilized in the fall as a spring application won't give the garlic all the food it needs for the year. Since we are currently renting land, we don't use compost, but we do highly recommend it as some of the best garlic comes from highly composted field, but make sure the compost does not add to your weed seed bank.
Bed Prep	If buckwheat has been planted, it is incorporated with a disc 3 weeks before planting. One week prior to planting, I will keyline plow, then disc or Perfecta, depending on residue levels. Beds are shaped when time allows in the week leading up to planting.	Mid-September: mow/disc cover crops Early October: rototill soil w/6' tiller Mid October: till again if necessary/create 4' beds(one bed per till pass)	After garlic harvest, we will till in the mulch and wait a week or so and then plant a cover crop like buckwheat (if there is time) and then in mid August we plant Might Mustard and till it in a little over 3 weeks before planting. Before we till in the cover crop we will broadcast the fertilizer and till it into the soil.
Pre-Planting Mulch	4' wide black plastic mulch is used for weed control and moisture management. I have found that it results in a larger average head size when compared to bare ground or straw mulch. I prefer growing on black plastic mulch without additional straw mulch.		

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Other Notes on Bed Prep		Field preparations and most of my strategies for garlic production are based on weather patterns over dates and calendar timelines. For example, if it rains October 7th and is forecast to be dry for the next several days, I might till on the 9th or 10th, when tilling conditions are optimal.	
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**Planting**

Bed Width	72" wheel centers with 30" bed tops.	4' bed, 15' walking row	3 feet 6 inches, 9 inches between beds
Plant Spacing	3 rows at 12", 6" between plants	4 rows per bed, 8" between plants	3 rows per bed, 6" between plants
Planting Process	Cloves are planted with a Rainflo 1600 waterwheel planter. We do not typically water in cloves with the transplanter.	We mark the rows with a pull along row marker and plant our garlic by hand, planting 1" deep (measuring from the top of the clove), and making sure cloves are planted upright.	We make sure the garlic varieties are properly marked, because we are in the seed business. So we mark the rows with flags where we start each variety and then we label each variety with a metal tag. We also have a written map that gets put into the computer. We start on the tractor and waterwheel with two people planting the same garlic variety. When we stop the variety, we will flag where we stop. Then we use flags to start the new variety with a tag.
Mulch at Planting	Black plastic is laid before planting. See above.	We have mulched with a variety of materials including oat straw, wheat straw, rye straw, and corn fodder. We usually mulch about a week or two after planting. This allows the soils to stay warm and encourages root set before winter sets in. This year we used oat straw at a rate of 3 tons per acre. We used large square bales, placing them throughout the field with a tractor and bale fork. We then peeled off flakes from the bales, and covered the fields with a light and fluffy 8" layer. The mulch suppresses weeds, insulates the garlic through the winter, and ultimately increases organic matter in the soil.	We use straw thrower to apply 3-6" of straw mulch a week or two after planting. This retains moisture and protects the garlic over the winter, which is now necessary in WI without the consistent snow cover. It also reduces weed pressure. We leave it there until harvest. There are circumstances that growers do decide to remove the mulch, but we don't. It does keep the soil a little cooler which does result in us harvesting a few days later than most. After the harvest we will till in the mulch which adds organic matter.

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Other Notes on Planting		Planting depth is debatable. We plant shallow for several reasons: ease of planting (stick in by hand/no dibble), garlic protected by thick mulch, garlic less likely to get "wet feet" in our moisture retaining clay/loam, ease of harvest (less digging/can pull most by hand if timed right).	
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**Crop Maintenance**

Post-Emergence Mulch	I have a Teagle bale chopper that I plan to put to use in 2019 for wheel tracks after spring cultivation.		
Irrigation	Approximately 1-1.5" of irrigation is applied once temperatures warm in the spring (no irrigation typically needed in fall). This typically equals about 3 hours, twice a week, depending on drip tape specs.	No irrigation. Thanks mulch!	In 12 years of growing, we have never had to irrigate. Occasionally, WI will see a drought in certain areas, so we always say "be prepared to irrigate", but it should not usually be necessary. Hopefully, the rains will stop and taper off before harvest. A drenching rain right before harvest can be detrimental to the garlic crop.
Irrigation Modifications	I'll typically stop irrigating in the last two weeks leading up to planting. If I am paying close enough attention, I'll increase irrigation to 1.5"-2" when the heads are starting to divide and size up.		
Supplemental Fertility	Not typically used. If the crop needs it, I'll fertigate through the drip system.	This year I did not fertilize before planting (other than the fish dip), so am considering side dressing cpm after emergence, depending on spring soil test results and general health appearance of emerging plants.	Right after the snow melts, we will fertilize the garlic with feather meal and pelleted chicken manure based on our soil test. If we felt the garlic needed a boost, we may foliar spray the garlic with compost tea or another fertilizer.
Weeding	The plastic beds take care of most of the bed top weed pressure, but I'll do one hand weeding of holes when the garlic is about 6" tall. Wheel tracks are managed using an I&J wheel track cultivator, which consists of rolling spiders along the edge of the plastic and S-tines for wheel tracks. Ideally, mulch is either applied in the fall or in the spring after cultivating.	Pull weeds as needed/likely minimal	We use thick mulch to reduce weed pressure. Then we hand weed the garlic while the weeds are small and before they get out of control. We keep up with the weeding, because garlic does not compete well with weeds which can result in a significant bulb size reduction.

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<p>HARDNECK Scape Removal</p>	<p>Scapes are removed shortly after emergence (end of May). We don't have a huge market for scapes, but some are distributed through the CSA and the rest are left in the field. This seems to lead to larger heads, so is worth the effort.</p>	<p>We pull our scapes as they start to curl, usually beginning in the middle/end of June, and continuing into July. We usually simply snap the scapes at their base. Some varieties/plants are late scape, so we continue surveying and snapping a few times/week until complete.</p>	<p>We remove all garlic scapes as soon as they emerge with the hope of getting them before the curl. The longer the scape is on the plant the larger the reduction in bulb size. If you pick the scape before curl, you will see scape still grow out a little bit. If you wait too long to snap the scape, it will turn woody and become difficult to remove. We do try to leave at least 1 scape per variety, because when the scapes points to the sky, it is usually ready to harvest. You can also collect the bulbis (seeds) to grow the varieties from seed (which is a 3 year process).</p>
<p>Insects and Pests</p>	<p>I have not had many pest issues with garlic. Mid-Atlantic growers are seeing more issues with leek moths, but I haven't faced it yet.</p>	<p>We have had no problems with insects or pests.</p>	<p>We don't have insect or pest problems with garlic.</p>
<p>Diseases</p>	<p>I have seen some white rot in previous years, which can usually be avoided through crop rotation and careful seed selection. I have also had some blue mold issues in storage, but it has not been a large issue. Using clean seed and careful grading out of the field can help.</p>	<p>We send samples every year to be tested. Tests have resulted disease free. If a plant looks questionable/unhealthy, we will remove it from the field. The soaking in vodka/alcohol before planting is apparently quite effective in eliminating fungal issues. Another preventative is avoiding "wet feet", by harvesting in a timely fashion and planting shallow.</p>	

**Harvest and Yields**

<p>SCAPES Harvest Window</p>	<p>If scapes are being harvested for sale, we will wait for the stems to elongate enough for bunching. This is usually in late May through early June. If not being used for sale, they are harvested immediately after emergence.</p>	<p>Question answered previous page</p>	<p>It seems that we are picking our scapes around Father's day annually. Our goal is to snap them ASAP and we don't sell them, so we are not trying to get to a certain size.</p>
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<p>SCAPES Harvest Procedure</p>	<p>Workers snap scapes off with their hands. Two rows are harvested from one side of the bed and the third row is harvested from the other side. If bunching, workers bunch 12 scapes using rubber bands and place in a harvest crate. To keep hands clean and avoid skin irritation, some workers wear disposable gloves. If not selling, scapes are snapped and left in the field.</p>	<p>Our market for scapes is minimal. When we sell, we typically bunch one pounds worth, and secure with a twist tie.</p>	<p>We snap the scapes right as the scape emerges out of the center of the plant. We don't pull the scapes (which is more delicious) as we don't want water to enter the bulb and potentially rot bulb. It also takes out the "hardneck stem" and our bulbs need to look perfect and blemish free before selling.</p>
<p>SCAPES Cleaning</p>	<p>If harvested carefully and clean, no processing is needed. If dirty, bunches are dunked in cold water and allowed to dry in bulb crates.</p>		
<p>SCAPES Packing</p>	<p>Scapes are distributed through a market style CSA. Delivery is in vented bulb crates.</p>	<p>We pack a twelve count of one pound bunches in a 3/4 bu box.</p>	
<p>SCAPES Storage</p>	<p>Scapes are stored in a walk in cooler at 34 degrees in harvest crates covered in vented box liners. I can keep scapes for about 3-4 weeks using this method.</p>	<p>Cold storage, good for two weeks</p>	
<p>HEADS Harvest Window</p>	<p>I harvest when about half of the leaves (4-6 leaves) have yellowed. Each leaf corresponds with a wrapper, so late harvest can reduce storage potential. To test, I'll pull a few heads, cut them open to make sure the cloves have filled the skins and there are 4-6 papers intact. In Virginia, this is late June or early July. In Michigan, this was mid to late July.</p>	<p>We usually harvest mid-July, when around 7 green leaves remain (about 2/3 green leaves remaining, 1/3 brown/wilted)</p>	<p>We usually harvest at the end of July, dependent on the variety. We harvest each variety when 5 green leaves remain. These green leaves are the bulb wrappers needed for curing. Approaching harvest, we pull a bulb every few days, because we want to know what they are doing under ground. Some varieties are more prone to rot, like rocamboles. If we see any problems, we may harvest and sacrifice bulb size for the health of the bulb. You can also cut the bulb in half and if the cloves are starting to pull away from the stem slightly that is another indication that it is time to harvest. Some growers will leave their own seed stock in the ground longer for bulb size increase. Some wrappers may be lost this way, which reduces salability and may make it easier to crack the bulbs for planting.</p>



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<p>HEADS Harvest Procedure</p>	<p>I use an undercutter to loosen beds and pull plants by hand. I have used two methods for curing, which impacts the harvest procedure. For hanging, plants are stacked onto a harvest wagon and transported to the barn for bunching and tying. Bunches of ten are tied on each end of a piece of twine and hung over nails in the barn. For bin curing, plants are topped to about 1" and roots are trimmed in the field with knives or pruning shears. Damaged or diseased heads are discarded and good heads are packed into harvest crates for transport to the greenhouse.</p>	<p>We simply pull the garlic by hand. If the plant feels "tight" we'll carefully loosen the soil with a potato fork. We then clean the garlic in the field by brushing off the dirt, and sometimes peeling a layer or two of leaf/wrapper off of the head. We load the harvested garlic neatly on a wagon, and haul into the packing shed to hang/cure.</p>	<p>We hand harvest with forks and brush off the roots (if the roots are mud balls, we will cut off the roots). Within 30 minutes of harvest, we pull the lowest green leaf down around the bulb to clean it. Then we cut the leaves leaving a 6-8" stem and put the garlic into a crate for curing. It takes a little longer at harvest, but we harvest and clean this way with a large crew as we don't want to come back and clean the bulbs later. We need to ship perfectly clean bulbs to our customers, but we have to be as efficient as possible for profitability. So after curing, we cut the neck and roots and we are done with the bulb.</p>
<p>HEADS Curing</p>	<p>I prefer bin curing over hanging because of reduced labor. A waxed box is built and placed in the center of a macro bin. Trimmed garlic is loaded into the macro bin to about 2/3 full. Two bins are stacked and topped with a plywood cap that has a hole cut to accommodate a box fan. The stack of bins is wrapped using plastic pallet wrap and placed in the greenhouse. The constantly running fans push air down through the two bins and out the bottom. Curing can be as quick as a week with dry conditions, but takes longer if the weather is humid.</p>	<p>We cure in an open air shed, shaded and with good ventilation. We hang the garlic on suspended 2 by 4 constructed garlic hangers, by bunching and tying together two seven head bunches of garlic and slinging them over the hangers, heads down. If there is not a strong breeze we'll plug in some big barn fans. The curing process takes about three weeks.</p>	<p>We put the garlic in bulb crates about 1/3 full and stack the crates in an air conditioned room at 70 degrees with many fans blowing on them. A 1/2 acre of garlic can be cured in a 2 car garage. Air conditioning is not necessary, but good airflow is! The garlic will cure down quickly and we can even start shipping within a week without the bulbs molding, but it usually takes 2-3 weeks for a proper cure and this depends on the humidity and the curing environment.</p>
<p>HEADS Cleaning</p>	<p>Most of the initial cleaning is done in the field, so all that remains is hand removal of the outer papers. Gardening gloves with rubber palms make pretty easy work of this.</p>	<p>We mostly pre-clean in the field by peeling layers. Otherwise, we'll peel a few layers post-cure. We'll then snip the stem down to 1" and grade to size.</p>	<p>Rose Cutter and pruners.</p>

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<p>HEADS Packing</p>	<p>Grading boards are used to sort garlic. They consist of a piece of plywood cut to a wedge shape with two 2x4 pieces between which garlic is slid. The grade is determined by how far down the slot the garlic slides. Grading is done as time allows and packed into mesh bags or boxes until sold. Jumbo is usually reserved for seed. Heads are quickly hand cleaned as orders are being packed. Full wholesale cases are 40# packed into 1-1/9 bushel boxes. Smaller orders are packed into smaller boxes or mesh bags, depending on size of order.</p>	<p>We grade our garlic for three sizes, 2" (eating), 2 1/4(seed), 2 1/2+(large seed)</p>	<p>We store our garlic in bulb crates with plenty of air flow.</p>
<p>HEADS Storage</p>	<p>For short term storage, garlic is kept in mesh bags or boxes in our dry storage room at 55 degrees and 65% relative humidity. For longer storage, garlic is kept in a walk in cooler at 34 degrees and approximately 75% relative humidity.</p>	<p>We store our garlic in the same shed in ventilated crates, off the ground, with fans continuously blowing on them. In extra humid conditions, I've placed crates in our box truck with a dehumidifier.</p>	<p>We sell 80-90% of our garlic by early November, so our goal is to get the garlic to store until planting in early November. Much of our garlic will store until April, but it depends on many factors. If garlic breaks down before early November (excluding rocamboles which are naturally short storing bulbs), then it was not cured properly, had a high water content, an issue with mites or disease, or not stored with good airflow.</p>
<p>HEADS Yield</p>	<p>We get about 0.3-0.6# per row foot on average, depending on variety. For our half acre, we are usually looking at about 5,500# of garlic.</p>	<p>Marketable average per 10 bed feet: 8 pounds (5.5#'s seed sell, 1.5 pounds eating sell, 1 pound replant).</p>	<p>We calculate yields by variety, so each pound planted will multiply by: Porcelain - 5, Standard Purple stripe 10, Marbled purple stripe 6, Rocambole 8, Softneck 10, turban 7. Pounds per foot depends on how you plant the field.</p>
<p>Other Notes on Harvest &amp; Yield</p>			<p>Control what you can, because we can't control mother nature. 2018 harvest decreased yield across the board for almost all WI garlic growers, with many growers only yielding 60% of anticipated harvest due to mother nature. This occurred across the midwest to east coast and caused a garlic shortage across the nation for the year.</p>

**Equipment**

General	New Holland T5050 (\$40,000); Case 265 (\$10,000); I&J Cultivator (\$1500); Rainflo 2600 (\$5000); Rainflo 1600 (\$2500); Undercutter (\$800)	used MF 165, 50 hp tractor with three point and pto - \$3500 6' tiller - \$1500 used 9' disc - \$800	Most larger growers have a planting machine like a water wheel using a tractor that can creep, and this can significantly reduce planting time. Many growers also use an under cutter to harvest garlic.
Biggest Impact	An undercutter is an essential piece of equipment. The labor savings over digging forks or hand harvest are substantial and the cost of the tool is relatively low.	Human labor. A hard-working, swift, and versatile crew has been vital for the livelihood of our farm. The tractor and tiller help a bunch, but the humans help more. The packing shed with hanging infrastructure and fans is also vital.	Every farm is different and use the equipment that you have as investing in equipment just for garlic can make your profit go entirely to purchasing equipment.

**Marketing**

Markets	CSA, on-site farm stand, direct to grocery, direct to restaurant	direct to grocery, wholesale through a distributor, Direct to farms	Website
CSA	1-2 heads per week June through February.		
Farmers Market Prices	Large heads - \$12.00/lb Medium heads - \$10.00/lb Small heads - \$8.00/lb		
Direct to Grocery Prices	Large heads - \$10.00/lb Medium heads - \$8.00/lb Small heads - \$6.00/lb	\$5 per pound, culinary use	
Direct to Restaurant Prices	Large heads - \$10.00/lb Medium heads - \$8.00/lb Small heads - \$6.00/lb		
Wholesale Prices		\$8-\$12 pound seed grade	
Other Markets		Direct to farms for culinary use: \$5-\$8/pound (depending on size and quantity) Direct to farms for seed: \$9-\$15/pound (depending on size and quantity)	Website from bulk price to 1/2lb price is \$17 - \$29/lb.