Growing, Harvesting, Storing & Marketing Garlic in the Northeast

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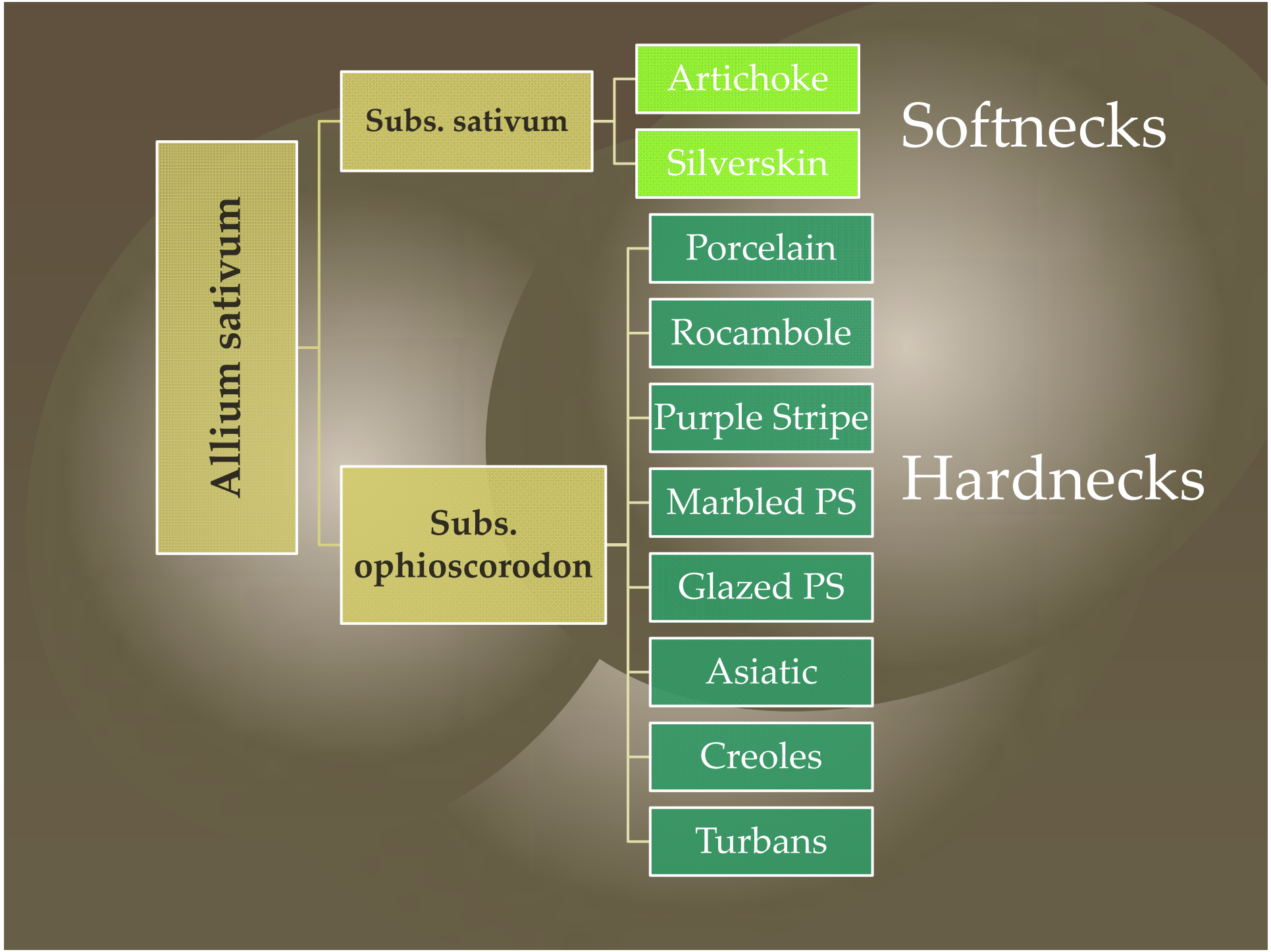
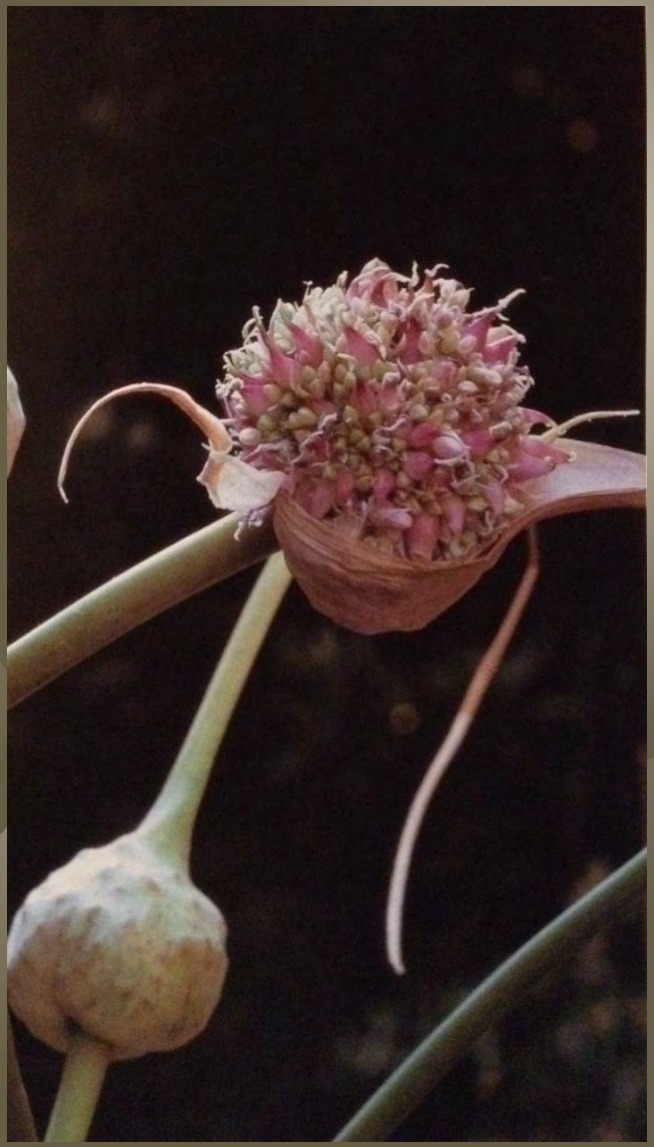
Topics for today:

- A little about *Allium Sativum:*
- Soil preparation: Fertility, cover crops
- Weed control: Research results and experience
- Disease control: Research results and experience
- Harvesting, post-harvest handling
- Choosing seed stock


Allium sativum
Subs. sativum
Artichoke
Silverskin
Softnecks
Subs. ophioscorodon
Porcelain
Rocambole
Purple Stripe
Marbled PS
Glazed PS
Asiatic
Creoles
Turbans
Hardnecks

Porcelain bulbs & bulbils



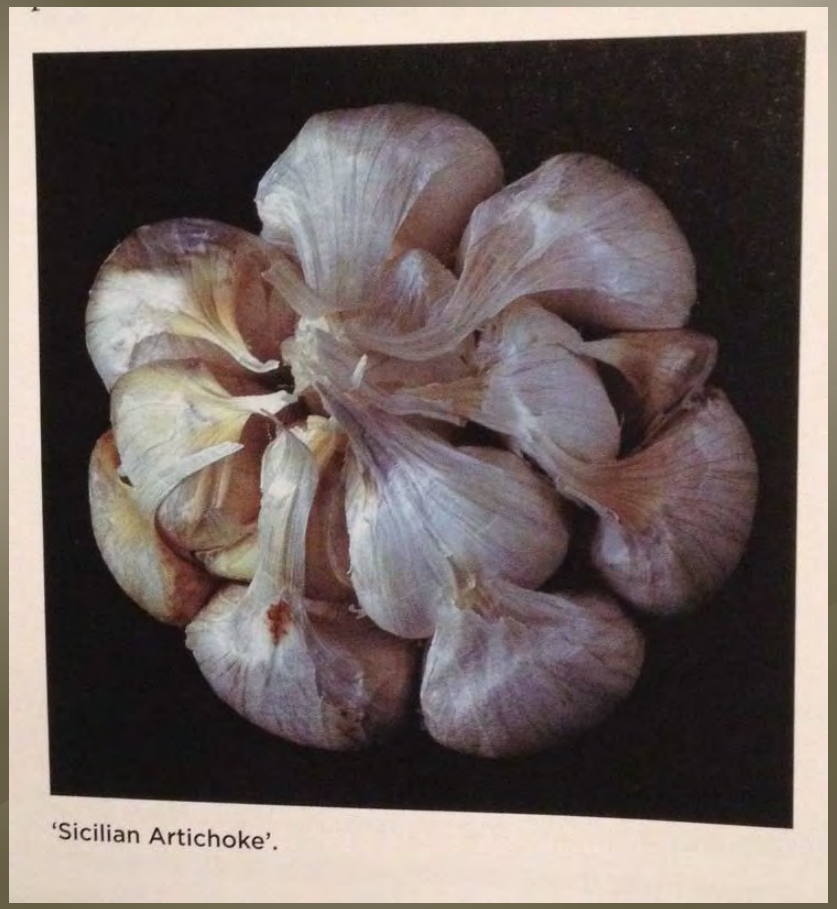
German White, Georgian Crystal, Music

Rocambole bulbs & bulbils

German Red, Killarney Red, Spanish Roja

Artichoke bulb

California early,
California late,
Inchelium



'Sicilian Artichoke'.

Purple Stripe, Marbled Purple Stripe

- Chesnok Red, Persian Star

Elephant garlic is a leek!

- *Allium ampyloprasum*
- Bulb contains compounds found in both garlic and leek, but is more closely related to leek
- Mild garlic flavor

Soil Preparation

- Optimum cover crop rotation for garlic
- Maximize Nitrogen, minimize wireworms

Biofumigant cover crops

Garlic Fertility

Garlic	Nitrogen (N) Lbs/A	Phosphorus (P2O5) Lbs/A					Potassium (K2O) Lbs/A				
Soil Test Results		**Very low <3lbs/A**	**Low 3-6**	**Medium 7-13**	**High 14-40**	**Very High >40**	**Very low <50**	**Low 51-100**	**Medium 101-200**	**High 201-300**	**Very High >300**
Incorporate at planting	0	200	150	100	50	0	200	150	100	50	0
Sidedress before emergence	25-50	0	0	0	0	0	0	0	0	0	0
Sidedress 2-3 times, 3-4 weeks apart	25-50 divided among sidedressings	0	0	0	0	0	0	0	0	0	0
TOTAL	50-100	150	100	75	50	0	150	100	75	50	0

Source: Cornell Recommendations for garlic, used by Agro-One Soil Lab. Based on use of a Morgan extract.

How to figure fertilizer…

Element	Morgan lbs/acre	Very Low	Low	Medium	High	Very High
Phosphorus (P)	2					
Potassium (K)	176					
Calcium (Ca)	2,717					
Magnesium (Mg)	509					

Element	Value	Element	Value	Element	Value
Soil pH	6.8	Manganese (Mn), lbs/acre	10.1	Organic Matter, %	2.9
Buffer pH	6.3	Zinc (Zn), lbs/acre	0.6		
Iron (Fe) , lbs/acre	1.5	Aluminum (Al), lbs/acre	10.8		

Crop History (1 = last year, etc.)

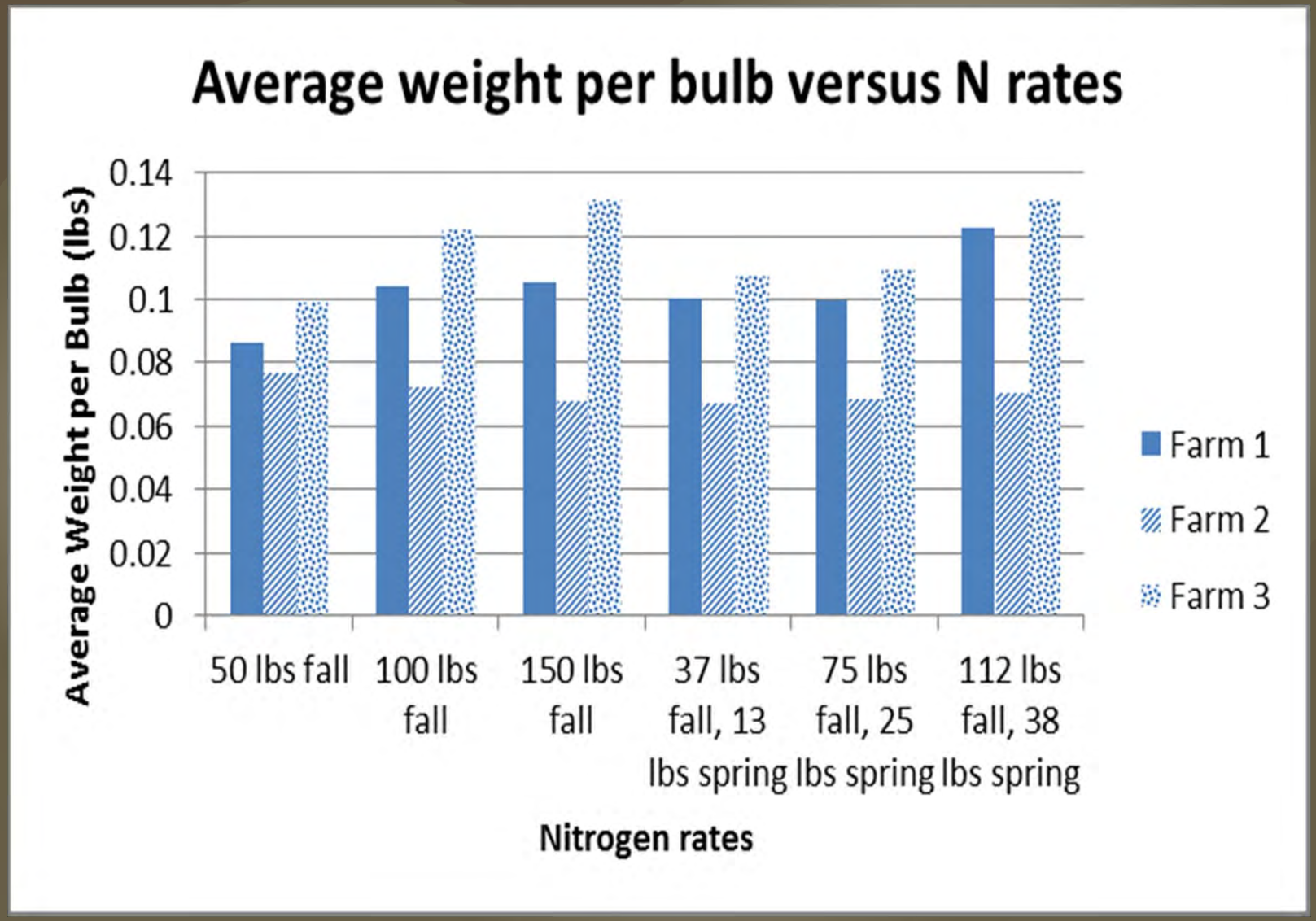
Year	Crop
3	Idle Land
2	Idle Land
1	Idle Land

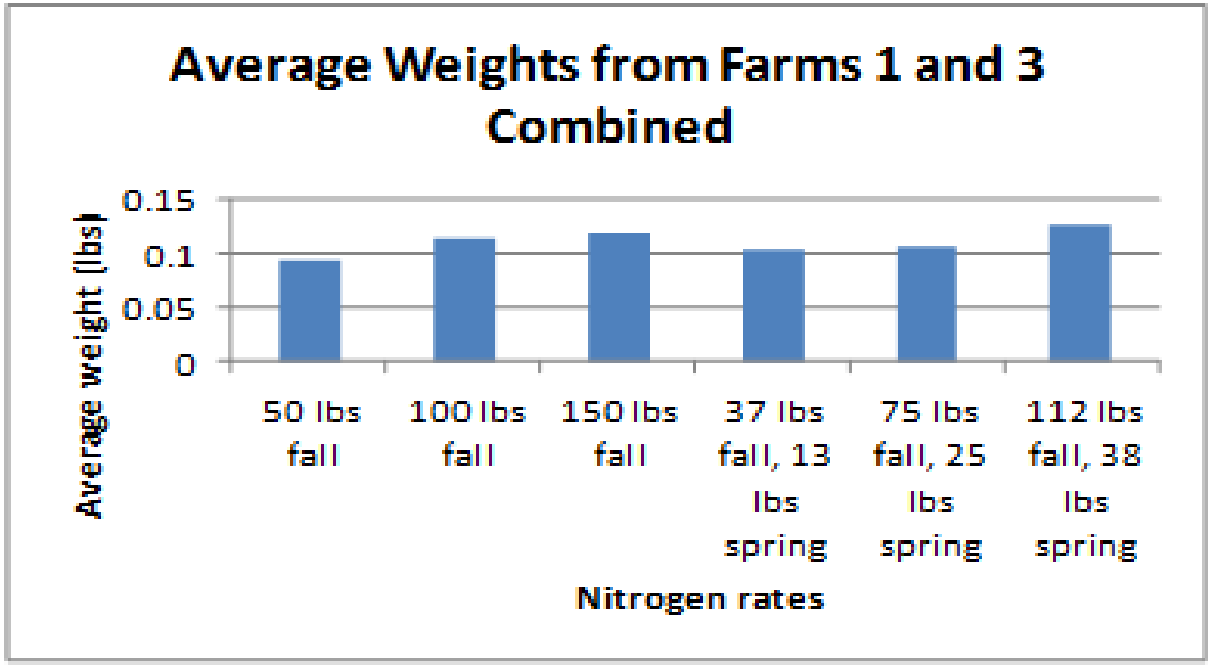
Soil Fertilizer Recommendations		tons / acre	lbs / acre		
Year	Crop	Lime	N Range	P2O5 Range	K2O
1	Garlic	0.00	50 - 100	200	100.00

Fertility Trials Results

50 lbs total Nitrogen	100 lbs total Nitrogen	150 lbs total Nitrogen
All fall	All fall	All fall
75% fall, 25% quick split spring*	75% fall, 25% quick split spring	75% fall, 25% quick split spring

*All fertility treatments were organic


Average weight per bulb versus N rates
Average Weight per Bulb (lbs)
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
50 lbs fall
100 lbs fall
150 lbs fall
37 lbs fall, 13 lbs spring
75 lbs fall, 25 lbs spring
112 lbs fall, 38 lbs spring
Nitrogen rates
Farm 1
Farm 2
Farm 3



Treatment	Average Weight
50 lbs fall	0.093
100 lbs fall	0.113
150 lbs fall	0.119
37 lbs fall, 13 lbs spring	0.104
75 lbs fall, 25 lbs spring	0.105
112 lbs fall, 38 lbs spring	0.127

Images: Ed Fraser

Closing up

Image: Ed Fraser

Fred Forsburg's platform planter. SARE grant FNE11-717

Left: Double offset rows at 6 inches

Right: Triple row on standard bed, 6 by 10 inch grid

Image: Ed Fraser

Image: Crystal Stewart

To mulch, or not to mulch?

Image: Brian Fox

Image: Brian Fox

Weed control in garlic

Garlic is an extremely poor competitor with weeds

Weed pressure can easily reduce yields by 30%

Weed control starts before planting and continues until shortly before harvest

Weed Control Step 1: Control Perennials

- Perennial weed control should happen before planting.
  - Tilllage
  - Cover Crops

Step Two: Winter annuals

- Look for winter annuals such as chickweed emerging before the garlic emerges. These weeds can be controlled through flaming or very shallow cultivation.

Step Three: Season-Long Control

- Don't stop! Don't ever stop!!

Images: University of Maine

So many options to choose from!

- Mechanical cultivation (especially between rows)
- Hand weeding (especially in row)
- Mulch (plastic/Biotello, hay, leaves)
- Vinegar

Image: Ed Fraser

Image: Rich Guardi

Image: Ed Fraser

Mulch

Image: Crystal Stewart

Vinegar for weed control

- 10% is the recommended rate
- Applications made on sunny days with temperatures greater than 70 degrees F are most effective
- Small (cotyledon stage) plants are most easily controlled
- Cosmetic damage to garlic may result

Scaping

Removal sends more energy back into the bulb. Scapes add value to the crop, with prices ranging from $2 to $8 per pound.

Diseases of the field

Images: Crystal Stewart

Fusarium bulb rot (left) and Fusarium basal rot (right).

Severity varies

Control factors

1. Start with clean seed
2. Create a great growing environment for garlic
3. Cull suspicious plants during the season and destroy them
4. Surface sterilization will not control *Fusaria.*

Garlic Bloat Nematode

Image: George Abawi

Images: George Abawi

Control measures:

1. Start with clean seed—have it tested!
2. Create a great growing environment for garlic
3. Cull suspicious plants during the season and destroy them
4. Surface sterilization will not control Garlic Bloat Nematode

Insect Pest: Leek Moth

Images courtesy of Masa Seto and Amy Ivy

Organic controls

Well-timed DiPel or Entrust application (7-10 days after flight)

Row covers applied prior to first flight

Harvest!

Image: Skymeadow Garlic Farm

Timing the harvest

- Softneck: ½ tops have laid down
- Hardneck: cut bulb in half and look at clove fill

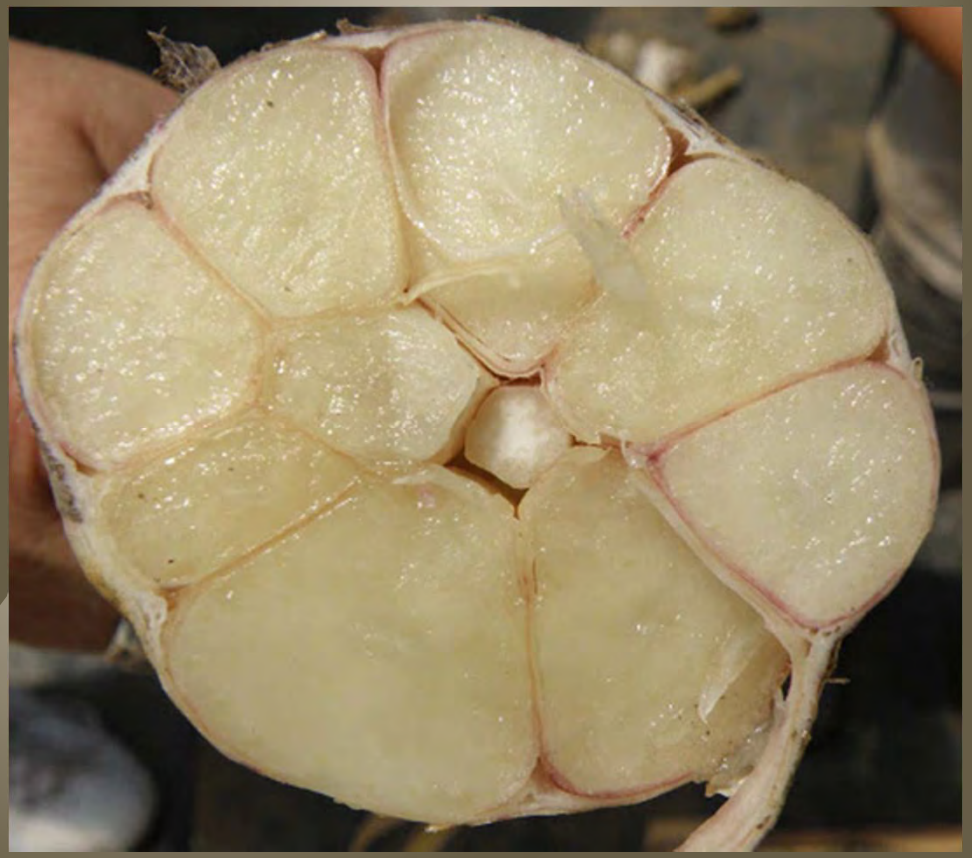


Image: Crystal Stewart

How much do you like your back?

- Digging fork
- Undercutter
- Potato digger
- Root digger
- Middle buster
- Moldboard plow
- ETC

Harvesting garlic, Zanjan, Iran

Image: Crystal Stewart

Image: Crystal Stewart

Image: Ed Fraser

Image: Ed Fraser

Image: Ed Fraser

Image: Ed Fraser


Anyone
modified a
potato
harvester?

Image: Brian Fox

Post-Harvest Handling

Image: Ed Fraser

Post-Harvest Diseases of Garlic

Embellisia (left) and Aspergillus (right). These two diseases are largely cosmetic, but can negatively affect the marketability of garlic. Closely tied to postharvest handling.

Images: Crystal Stewart

Disease continued

Penicillium blue mold (left) and Botrytis neck rot (right). Both diseases are airborne and widely present, but post-harvest conditions play a role in disease severity.

Images: Oregon State University

Treatment combinations

A=Trim roots flush with basal plate
B= Trim tops to 6" long
C= Wash D=cure in high tunnel
E=Cure in open-air structure
F= leave roots and tops un-cut

F+E	F+D	A+E	A+D
A+E+C	A+D+C	A+E+B	A+D+B
A+E+C+B	A+D+C+B	B+E	B+D
B+C+D	C+E	C+D	B+C+E

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

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

All images from trial results: Crystal Stewart

Top cutting


Tops cut 6" tall with sickle-bar mower. Greens left in field. Garlic was undercut to harvest.
06/29/2012 12:31

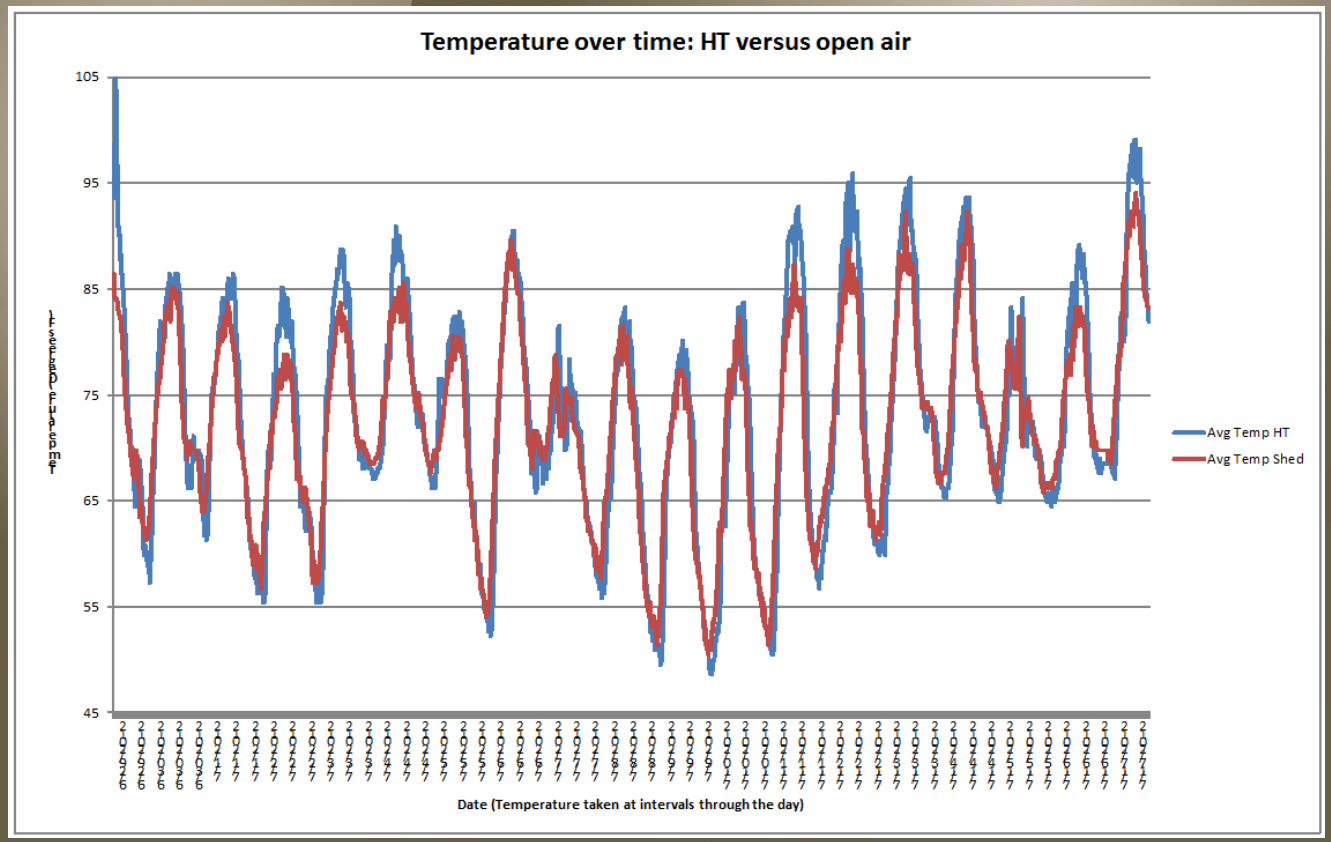
C. Washing was completed using a garden hose and a nozzle. Power washers were not used. After washing, garlic was air dried before being placed in the curing area. Garlic was washed until dirt was removed from the bulb.

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

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

About High Tunnel Drying

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



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

Results: HT vs Open Air

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

Results: Root Trimming

- **Trimmed vs. untrimmed:** No statistically significant differences were observed between these treatments in regards to bulb quality, weight, or disease incidence.

Treatment: Roots trimmed, tops trimmed, washed, open-air dried

Results: Washing bulbs

Washed garlic looked very good initially, but became more discolored than the unwashed garlic during the drying and curing process. Disease incidence, particularly *Aspergillus* and *Embellisia,* was slightly higher in washed garlic.

Additional question: In a wet year, would washing mud from bulbs be better than leaving large amounts of dirt on them?



R to L: Immediately after washing, after curing, 1 leaf removed, two leaves removed

Year one conclusions

- Drying garlic in HT did not cause post-harvest breakdown or increase disease incidence
- Cutting the tops at approximately 6 inches did not increase post-harvest breakdown or increase disease incidence
- Washing garlic immediately improved appearance but had minor effect on long-term appearance and disease incidence

For more information…

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NORTHEAST SARE
Sustainable Agriculture Research & Education

Storage

Marketing!

- Green and fresh garlic
- Garlic Festivals
- Restaurants/Stores
- CSA's
- Farmer's Market
- Seed, table, processed, garlic powder,
- decorative braids, wholesale etc.

New? Garlic Scape Powder

Chef Organics Organic Scape Powder

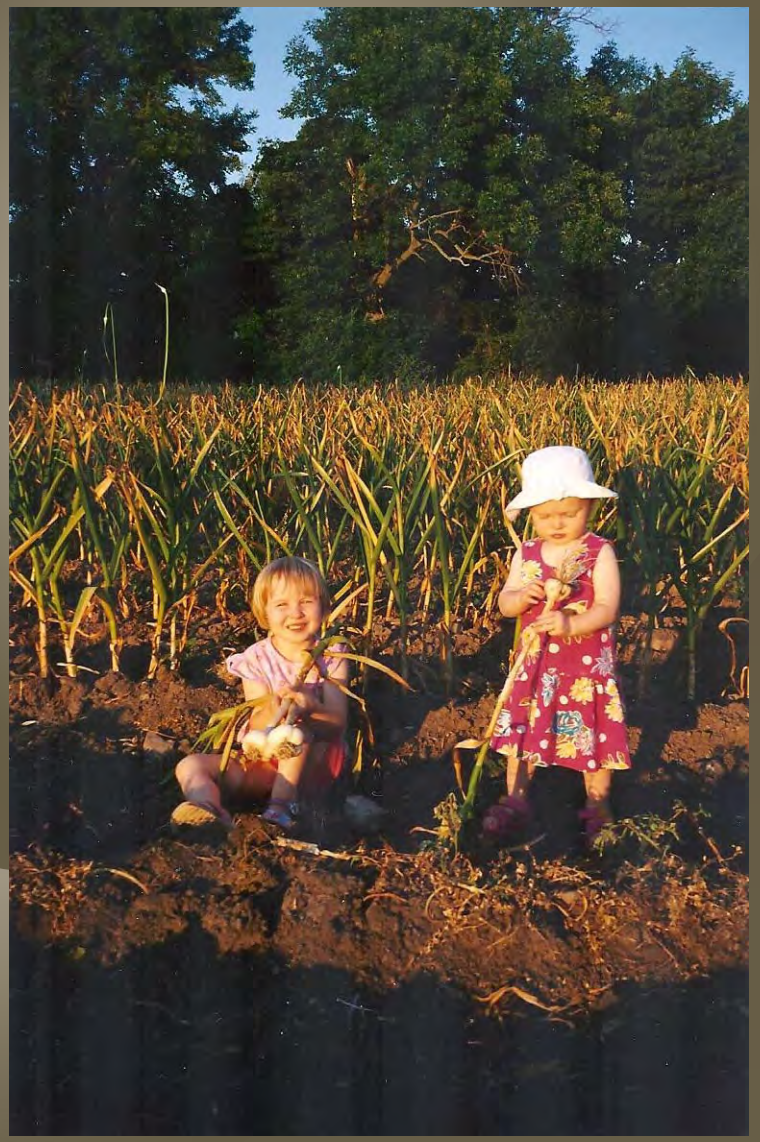
cheforganics.com

$16 per 56g package (that's about 2 oz)

Investment in drying facility: $1M +

Thanks to the many growers who graciously shared their pictures with us for this presentation.

Garlic is good for you….



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