

Frosty Garden



Cold Climate Gardening



A Deep Dive Into Thoughts, Practices & Techniques
In Family Scale Cold Climate Food Production

- ▶ Authors: Jeff & Kayde Whiteside
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- ▶ Socials:
 - ▶ Facebook: @frostygardens
 - ▶ Instagram: [subarctic.garden](https://www.instagram.com/subarctic.garden)
 - ▶ Pinterest: [frosty-garden](https://www.pinterest.com/frosty-garden)
- ▶ An experiential source of cold climate gardening information
- ▶ Practitioners of family scale, subarctic food production
 - ▶ Urban & semi-urban northern agriculture
 - ▶ On & Off-grid gardening practices
 - ▶ Utilize most known preservation techniques



► Website Topics:

- Cold Climate Gardening Basics
- Growing A Garden From Seed Indoors
- Advanced Cold Climate Gardening Techniques
- Plant Specific Cold Climate Growing Guides
- Zone 2/3 Perennials & Food Forests
- Indoor Lighting & Grow Rooms
- Greenhouses & Temperature Control
- Harvesting & Food Preservation
- Solving Cold Climate Gardening Problems
- Northern Focused Seed Planting Schedules Zones 1A to 8B



- ▶ Thank you:
 - ▶ Central Peninsula Gardening Club for having us as a guest speaker.
 - ▶ We are grateful for the opportunity to contribute to our shared northern growing experience!



Plant Temperature Tolerance



- ▶ Different plants feature certain tolerance towards colder temperatures & frost tolerance
- ▶ Four types of frost tolerance:
 - ▶ Cold hardy
 - ▶ Frost tolerant
 - ▶ Frost sensitive
 - ▶ Warm loving
- ▶ Generally accepted reason is that more frost tolerant plants have higher sugar content
- ▶ Sugar water freezes at temperatures <32F!



- ▶ Strong correlation between frost tolerance & ideal growing conditions
- ▶ Informs the gardener of what gardening techniques might be best (containers, in-ground, raised beds, etc.)
- ▶ Guides hardening off processes & timing
- ▶ Tells you what plants can be outside at what temperatures
- ▶ Offers larger scale gardeners a strategy to prioritize planting from cold hardy to warm loving in spring
- ▶ Provides prioritization for harvest from warm loving to cold hardy in the fall
- ▶ Helps cramped indoor grow rooms by letting you put some plants outside earlier in the season



▶ Cold Hardy Notes:

- ▶ Majority of commonly garden grown plants are cold hardy!
- ▶ Spring minimum temperature: ~36F (preferably higher)
- ▶ Fall minimum temperature: Sub freezing, ~25F (hard frost)
- ▶ Can often transplant ~2 weeks prior to last frost
- ▶ Can often harvest ~2-4 weeks after first frost
- ▶ Will typically germinate in cooler soils (e.g. garage, window)
- ▶ Good candidates for winter sowing techniques
- ▶ Some are good candidates for late season planting & fall harvest (<60 day to finish)
 - ▶ Leaf lettuce, spinach, mustards, etc.
- ▶ We often harden off 4-6 weeks prior to last frost



- ▶ Arugula
- ▶ Asparagus (perennial)
- ▶ Beets
- ▶ Broccoli
- ▶ Brussels sprouts
- ▶ Cabbage
- ▶ Carrots
- ▶ Collards
- ▶ Endive
- ▶ Garlic
- ▶ Kale
- ▶ Kohlrabi
- ▶ Leeks
- ▶ Lettuce (most)
- ▶ Mustard greens
- ▶ Onions
- ▶ Parsnip
- ▶ Potatoes
- ▶ Rhubarb (perennial)
- ▶ Rutabaga
- ▶ Spinach
- ▶ Turnips



▶ Frost Tolerant Notes:

- ▶ Spring minimum temperature: ~36F (preferably higher)
- ▶ Fall minimum temperature: ~32F (light frost)
- ▶ Can often transplant ~2 weeks prior to last frost
- ▶ Can often harvest ~2 weeks after first frost
- ▶ Will typically germinate in cooler soils (e.g. garage, window)
- ▶ Good candidates for winter sowing techniques (sometimes)
- ▶ Some are good candidates for late season planting & fall harvest
 - ▶ Bok Choy, Radish, Chinese cabbage
- ▶ We often harden off ~4 weeks prior to last frost



- ▶ Artichoke
- ▶ Bok choy
- ▶ Cauliflower
- ▶ Celeriac
- ▶ Celery
- ▶ Chard
- ▶ Chinese Cabbage
- ▶ Parsley
- ▶ Peas
- ▶ Radish
- ▶ Radicchio



▶ Frost Sensitive Notes:

- ▶ Spring minimum temperature: ~40F (preferably higher)
- ▶ Fall minimum temperature: ~36F (zero frost tolerance)
- ▶ Suggest transplanting no earlier than last frost
- ▶ Should harvest prior to first frost
- ▶ Typically germinates in warmer soils (heat mat, indoors)
- ▶ Typically not good candidates for winter sowing techniques
- ▶ We often harden off ~2-3 weeks prior to last frost, ~4 weeks when placing into temperature controlled greenhouse
- ▶ Suggest frequent weather (temperature) checks when these plants are outside in the shoulder season
- ▶ Often good candidates for greenhouse & soil warming techniques



- ▶ Snap pea
- ▶ Corn
- ▶ Tomatoes
- ▶ Beans
- ▶ Most herbs
- ▶ Most flowers



▶ Warm Loving Notes:

- ▶ Spring minimum temperature: ~50F
- ▶ Fall minimum temperature: ~40F (zero frost tolerance)
- ▶ Suggest transplanting 1-2 weeks after last frost
- ▶ Should harvest prior to first frost
- ▶ Typically germinates in warmer soils (heat mat, indoors)
- ▶ Typically not good candidates for winter sowing techniques
- ▶ We often harden off ~2-3 weeks prior to last frost, ~4 weeks when placing into temperature controlled greenhouse
- ▶ Suggest frequent weather (temperature) checks when these plants are outside in the shoulder season
- ▶ Often good candidates for greenhouse & soil warming techniques



- ▶ Cucumber
- ▶ Eggplant
- ▶ Peppers
- ▶ Okra
- ▶ Pumpkins
- ▶ Summer squash
- ▶ Winter squash
- ▶ Melon



Climate, Weather & Growing Zones



- ▶ Climate & weather are not the same thing!
 - ▶ Climate = Long Term Trends
 - ▶ Weather = Short Term Experience
- ▶ Significant seasonal differences in weather patterns from year to year.
- ▶ The Northern experience?
 - ▶ First frost = Early, normal or late
 - ▶ Last frost = Early, normal or late
- ▶ First and last frost dates are highly variable, but also generally consistent



- ▶ Growing zones are solely determined by the expected minimum temperatures in an area
- ▶ Strong correlation between growing zone and general first and last frost dates
- ▶ Much gardening information is indirectly tied to growing zones, despite being information for perennials
- ▶ This is not absolute, example:
 - ▶ Soldotna = Zone 4b, estimated last frost ~June 1
 - ▶ Homer = Zone 5a, estimated last frost ~May 1
 - ▶ All that different? Hmm...
 - ▶ Truth = Your experience PLUS your annual weather conditions

**Average Annual Extreme
Minimum Temperature
1976-2005**

Temp (F)	Zone	Temp (C)
-60 to -50	1	-51.1 to -45.6
-50 to -40	2	-45.6 to -40
-40 to -30	3	-40 to -34.4
-30 to -20	4	-34.4 to -28.9
-20 to -10	5	-28.9 to -23.3
-10 to 0	6	-23.3 to -17.8
0 to 10	7	-17.8 to -12.2
10 to 20	8	-12.2 to -6.7
20 to 30	9	-6.7 to -1.1
30 to 40	10	-1.1 to 4.4
40 to 50	11	4.4 to 10
50 to 60	12	10 to 15.6
60 to 70	13	15.6 to 21.1



► Why this matters?

- Even if you follow so-called “experts” the weather conditions ultimately determine what the gardener SHOULD do!
- Northern gardeners near major zone shifts (e.g. Kenai Peninsula area) might be wise to follow more conservative seed planting schedules to avoid losing crops & consequence
- Your specific microclimate & experience means a lot!
- Seed planting schedules might need to be adjusted 1 to 2 weeks as opposed to common one month zone based shifts for your personal situation
- Your personal preparations for adverse scenarios can also determine outcomes! (e.g. Do you have frost cloth?)



- ▶ The northern gardener should:
 - ▶ PLAN for their climate
 - ▶ ACT on the weather
- ▶ Plants can be outside, based on their tolerance to warmer or colder temperatures (i.e. The Weather)
- ▶ Use well understood northern guidelines:
 - ▶ Never transplant outdoors >2 weeks before last frost
 - ▶ If weather outlook looks good > 1-2 weeks before last frost, cold hardy & frost tolerant plants can often be transplanted
 - ▶ Always take care for frost sensitive & warm loving plants, rarely plant prior to last frost
- ▶ Develop a “feel” for first and last frost experiences, even journal them!



- ▶ What SHOULD the northern “from seed” gardener do?
 - ▶ Always pay attention to short & long term forecasts when hardening off plants! LOW TEMPS!
 - ▶ Take advantage of warmer days (>40F) before last frost, especially with cold hardy & frost tolerant plants! Sun is good!
 - ▶ At 2 weeks to last frost, review 10 day forecasts for planting conditions only for cold hardy & frost tolerant crops. Sow & transplant based on expected conditions.
 - ▶ Never plant into expected 10 day adverse conditions.
 - ▶ Transplant frost sensitive & warm loving crops after last frost, no matter what. (Except climate controlled greenhouses!)
 - ▶ Be prepared to ride out late season frosts!



Cold Climate Gardening Techniques



Cold Climate
Growing Is A
Strength!



...Not A Weakness!



- ▶ Northern soils are commonly cooler due to lower average temperatures and sometimes permafrost
- ▶ Low soil temperatures can negatively influence some plants, more so frost sensitive and warm loving fruits & vegetables
- ▶ Low soil temperatures often benefit cold hardy and frost tolerant plants (although many don't mind warmer soils)
- ▶ Unlike lower-48 growers, in-ground gardening is not always the best solution for northern gardens



- ▶ Warmer ambient air temperatures can highly benefit some types of plants
- ▶ Typically frost sensitive and warm loving plants benefit the most from warmer air temperatures
- ▶ Air temperatures >100F are not desirable for growing anything. Ideal is typically <90F.
- ▶ Some plants stop or slow growing in temperatures below 40F to 45F (peppers, tomatoes, squash, etc.)



▶ Commonly used techniques to raise soil temperatures:

- ▶ Raised row gardening (wide & narrow)
- ▶ Soil mounding
- ▶ Raised beds
- ▶ Container gardening
- ▶ Thermal mass (such as a home)



- ▶ Commonly used techniques to raise ambient air temperatures:
 - ▶ Greenhouses
 - ▶ Hoop houses
 - ▶ Cold frames (small raised beds with cover, typically windows)
 - ▶ Indoor growing
 - ▶ Thermal mass (water barrels, etc)
 - ▶ Garbage bags
 - ▶ Huh, whut? Common?
- ▶ Multiple layers of protection can be used. Each layer = approximately one jump in growing zone. (Approximately 2-4 weeks of total season extension)



- ▶ Soil temperature is more important than ambient air temperature!
 - ▶ Soil temperatures changes more slowly!
 - ▶ Especially important with warm climate crops!
 - ▶ Also important with frost sensitive crops!
 - ▶ Less-so with frost tolerant & cold hardy crops, but can still benefit



- ▶ Ambient air temperature are also important, but primarily for these garden crops:
 - ▶ Tomatoes
 - ▶ Cucumber
 - ▶ Most peppers (typically, to achieve fully mature color change)
- ▶ Most other crops will fully mature and do great, even with cooler (<80F) air temperatures
- ▶ Again, soil temp more important!



- ▶ For season extension (before last frost and after first frost), ambient air temperatures are most important! (Avoiding plant killing temperatures)
- ▶ With commonly used techniques (greenhouse, hoophouse, etc):
 - ▶ Cold hardy & frost tolerant crops often see 2 to 4 weeks of season extension (spring & fall)
 - ▶ Frost sensitive & warm weather, typically 1 to 2 weeks of season extension (spring & fall)
 - ▶ Can also use heat to battle ambient air temperatures, as much as you're willing to pay for



Our Northern Gardening Techniques



- ▶ We utilize three primary growing techniques, our “core gardening techniques.”
 - ▶ In-ground gardening using wide-raised rows (\$)
 - ▶ Raised bed gardening (\$\$)
 - ▶ Container gardening (typically sub irrigated containers, sometimes fabric grow bags)
 - ▶ Outdoor grown containers (\$\$)
 - ▶ Greenhouse grown containers (\$\$\$)
- ▶ We typically select the best growing technique based on the temperature tolerance of the given plants
- ▶ We also heavily use “crop value” (to us) as a metric for using more expensive gardening methods



Raised Row Gardening



Raised Bed Gardening



Container Gardening



- ▶ It makes sense to tailor the growing technique to the growing preferences of a given plant!
 - ▶ In-ground gardens are good for cold hardy & frost tolerant plants. Not as good for frost sensitive & warm loving.
 - ▶ Raised beds are good for plants with a wide range of temperature tolerance.
 - ▶ Container gardening is great for frost sensitive & warm loving plants, but also works with cold hardy & frost tolerant plants.



- ▶ Raised beds are a moderately expensive growing technique, we plant wisely!
 - ▶ Largely used for intensive planting
 - ▶ We don't grow "large plants" in them as it's a waste of valuable growing space. These are more cost effectively grown in-ground or in containers.
 - ▶ Good choice for crops that wouldn't do as well in-ground due to native grasses & weeds, difficult to mulch around



- ▶ We are highly selective of our greenhouse grown plants!
 - ▶ Must provide high crop value to us
 - ▶ Must contribute well, financially, to our well being (e.g. we use a lot of it, we'd buy it if we didn't have it)
 - ▶ Must significantly excel in greenhouse conditions over outdoor grown equivalent
- ▶ If it doesn't make "the cut" it is grown outdoors!



- ▶ The primary container growing method we use is sub irrigation
 - ▶ Specifically, GroBuckets
 - ▶ Check out Alaska Grow Buckets for DIY equivalent
- ▶ Excellent at reducing drought conditions
- ▶ Reduces general garden labor requirements
- ▶ Handles all sizes of garden grown plants
- ▶ Approaches hydroponic level growing capabilities, exceptional growth!
- ▶ Easily integrated into off-grid irrigation systems



- ▶ Sometimes we do “crazy stuff” to test out ideas & advance northern growing knowledge.
- ▶ Garbage bag greenhouses are an inexpensive & effective mechanism to increase ambient air temperatures
- ▶ Combine with containers = higher air and soil temperatures
- ▶ Gaudy, but still rooted in cold climate growing SCIENCE!



Beginner Gardener Tips & Tricks



- ▶ Newer gardeners should start with smaller gardens. Grow as your capabilities & efficiency grows!
- ▶ Understand your growing season & how many frost-free growing days you have.
- ▶ Know what “fool’s spring” is and don’t fall for it!
- ▶ Read your seed packets. They come with their very own growing manuals!



- ▶ Grow what you like to eat! No sense growing stuff you won't use.
- ▶ Grow with a mind for your climate. Cold hardy & frost tolerant crops are excellent & numerous, great for northern gardeners without more advanced gardening tools.
- ▶ Know your invasive perennial species & plant accordingly. (e.g. containers)
 - ▶ Mint
 - ▶ Lemon Balm
 - ▶ Raspberries
 - ▶ Amaranth
 - ▶ Etc.



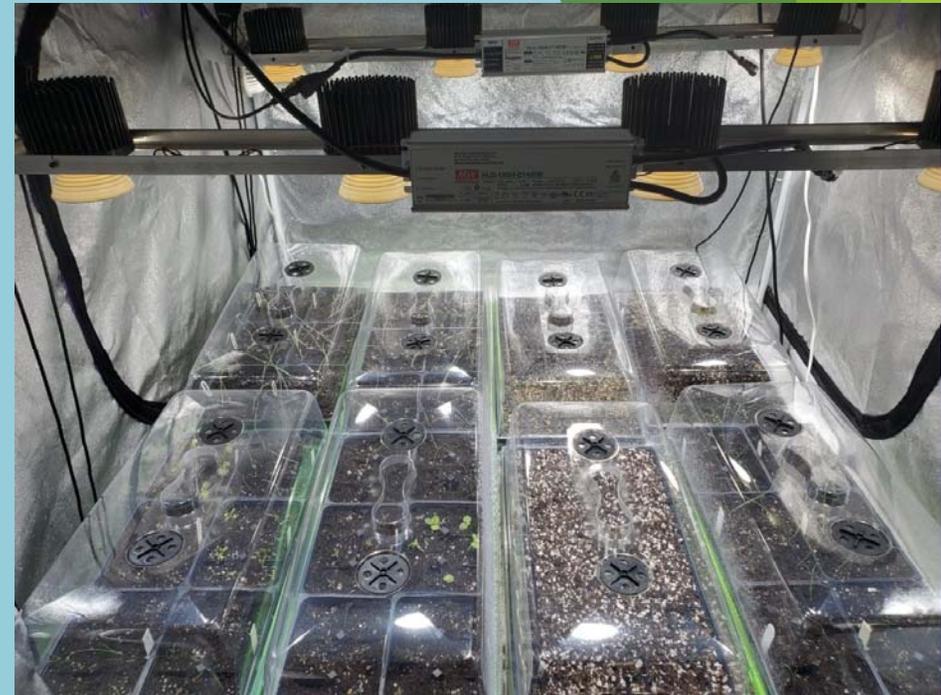
- ▶ If growing from seed, resist growing too much. It's really easy to get carried away & get into a predicament.
- ▶ Always, always, always harden off your seed grown plants!
 - ▶ 1st day = 45 to 60 minutes
 - ▶ 2nd day = 1 hour
 - ▶ 3rd day = 2 hours
 - ▶ 4th day = 2 hours
 - ▶ 5th day = 4 hours
 - ▶ 6th day = 8 hours
 - ▶ Now hardened off!



Advanced Gardener Tips & Tricks



- ▶ Integrate plant temperature tolerance deeply into your spring planting & fall harvesting strategy
- ▶ If you grow from seed, invest into high quality equipment
 - ▶ Reduce “consumables” to be more frugal!
 - ▶ Heavy duty 1020 trays, seedling trays, pots, humidity domes
 - ▶ Indoor grow space & lighting
- ▶ Minimize complexity as much as possible. Try to come up with “one way” of doing things.



- ▶ Learn how to force plant maturity by physically manipulating plants.
 - ▶ Brussels sprouts (topping)
 - ▶ Tomatoes (topping, aggressive pruning)
- ▶ Learn about parthenocarpic seed varieties to solve monoecious pollination problems!
 - ▶ Cucumbers
 - ▶ Summer squash
 - ▶ Melon



- ▶ Question your assumptions & don't promote gardening myths. There are countless myths in gardening!
- ▶ Understand photoperiodism & why it affects certain plants
 - ▶ Cat nip
 - ▶ Oregano
 - ▶ Marjoram
 - ▶ Arugula
 - ▶ Mustards
 - ▶ Cilantro/coriander
 - ▶ Bok choy



Starting Gardens From Seed Indoors



- ▶ Not the easiest approach to gardening, many people fail by taking short cuts.
- ▶ Provides significant cost savings in the long term, but costs money to “do it right”
- ▶ Takes more room than you might think, but can be heavily optimized using the 1020 tray system
- ▶ We use about 28 square feet and can grow 600-800 garden starts in that space



- ▶ Vertical vs Single Plane seed starting
 - ▶ i.e. Shelving vs. Tables
- ▶ We've done it both ways & prefer single plane. Why?
 - ▶ Allows easy, fast identification of problems
 - ▶ Similarly dense (e.g. 2x4 shelf [8 trays] = 2x6 table [8 trays]) when optimized
 - ▶ Easier to care for & manipulate plants (watering, hardening off)
 - ▶ Allows for high power, quality LED lighting which makes compact, high quality garden starts
 - ▶ Don't have to worry if your plants get big (tomatoes, peppers, etc.)



- ▶ Our current indoor lighting recommendation is LED. Worth it for the utility cost savings!
- ▶ Our favorite type of lighting right now is called “quantum board” LED
 - ▶ HLG-100 from Horticultural Lighting Group. US made!
- ▶ Covers 3 feet by 3 feet per light, very evenly!
- ▶ Aim for about 20,000 to 25,000 lux at the top of new seedlings. (~2 feet)
Very powerful, can burn plants!
- ▶ As plants mature, they grow into light & get much higher levels!



- ▶ Our germination & from seed kit:
 - ▶ 1020 trays (heavy duty)
 - ▶ 200 cell seedling trays (heavy duty)
 - ▶ 1020 inserts, 606 jumbo (36 plants per tray)
 - ▶ 3.5" pots (18 plants per tray)
 - ▶ 5.5" pots (8 plants per tray)
 - ▶ Humidity domes
 - ▶ Seeder
 - ▶ Pressure sprayer for watering
 - ▶ High quality LED lighting



▶ Our general germination strategies:

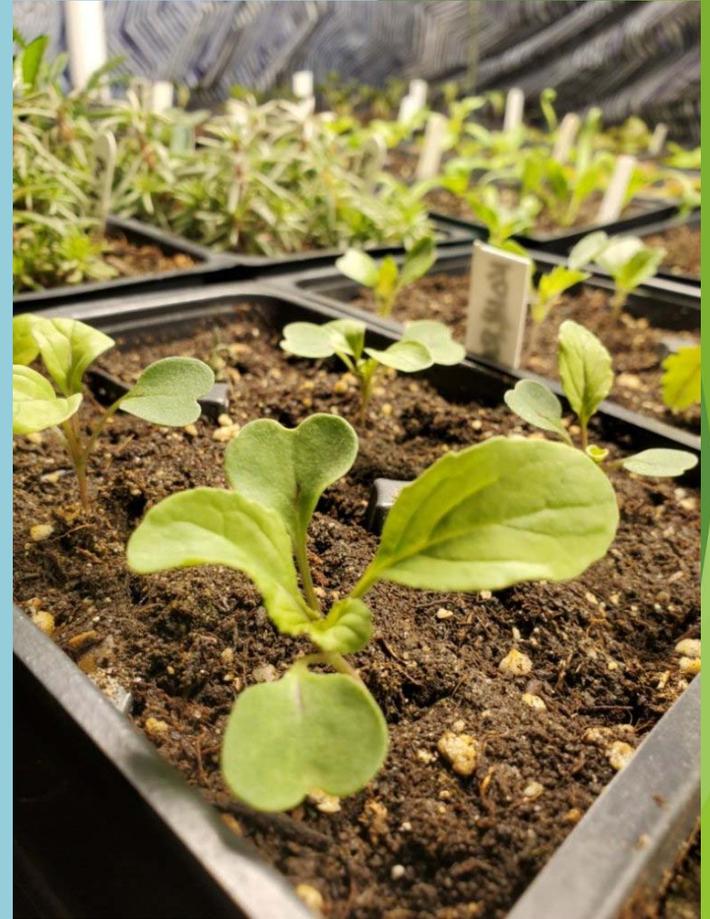
- ▶ One plant per cell to get “nice plug” with one plant. Cull other germinations if cell was multi-seeded. (Most seeds)
- ▶ Sow 9 seeds/cells per six pack that we want. Half rows if 1-3 plants are needed.
- ▶ Almost all our plants germinate in seedling tray (except cucurbits, germinate these in 3.5” pots)
- ▶ All seeds germinate under light
- ▶ Transplant to larger pot once first true leaves develop
- ▶ Water with pressure sprayer for gentle, effective watering.
- ▶ Always keep humidity dome on seedling tray



- ▶ Our general transplant strategies:
 - ▶ We aim for one, single transplant step in almost all cases
 - ▶ We only transplant the best seedlings for further growth
 - ▶ Most plants are transplanted into 606 jumbo inserts. Exceptions:
 - ▶ Peppers, tomatoes, artichoke, perennials. These are transplanted into 3.5" pots.
 - ▶ Use an eye glass screwdriver to remove the plug from seedling tray
 - ▶ Insert plug into finger sized hole in final transplant pot
 - ▶ Keep humidity dome on for ~2-3 days after transplant



- ▶ Continued growth strategies:
 - ▶ Use bottom watering techniques to water seedlings. Fill the tray about halfway with water, with the plants in the tray, when needed. Dump extra after 1 hour.
 - ▶ Start to fertilize 1-2 weeks after transplant. We like water soluble fertilizers, use about $\frac{1}{4}$ of normal dose for seedlings.
 - ▶ Organize plants by general water consumption. High consumers should not be in the same tray as low consumers.
 - ▶ We shift organization by cold tolerance similarity when hardening off.



- ▶ Many years, we will again transplant “large plants” from 3.5” pots to 5.5” pots. Typically ~1 month to last frost.
 - ▶ Examples: Tomatoes, peppers, artichoke
- ▶ We do it if the plant draws down water very quickly to reduce watering labor needs
- ▶ If plants in 606 jumbo trays need a lot of water, we fix it the next year by planting into 3.5” pots instead



- ▶ We start hardening off cold hardy & frost tolerant plants 4 to 6 weeks before last frost
- ▶ We harden off frost sensitive & warm loving plants 2-3 weeks before last frost.
- ▶ If you have a climate-controlled greenhouse, you can start moving plants out ~4-6 weeks to last frost & after hardening off. Depends on heating capabilities & outdoor temperatures.





Thank
You!