

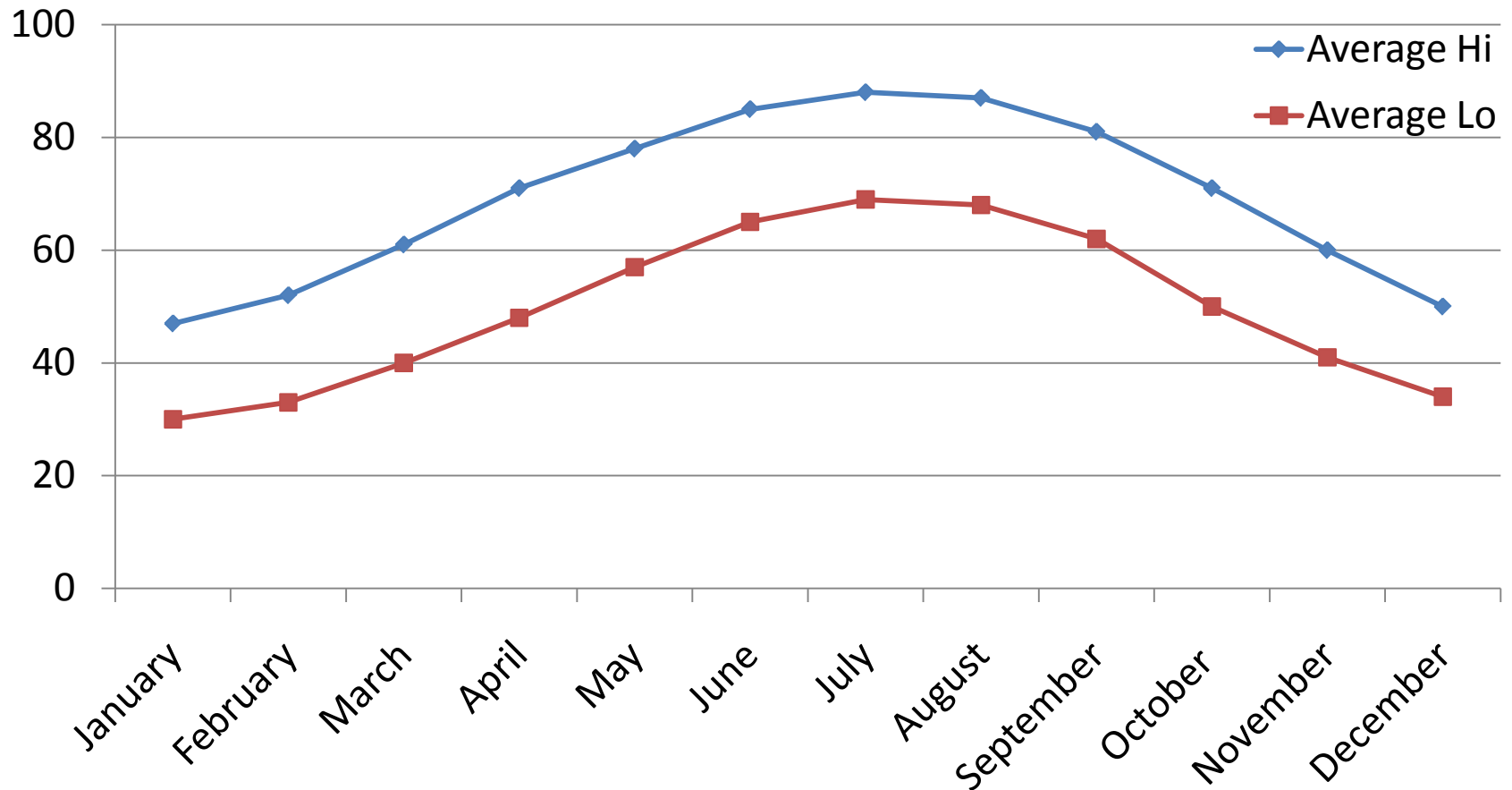
Cool Season Vegetable Production

Mary Rogers
Organic Crops Research Associate

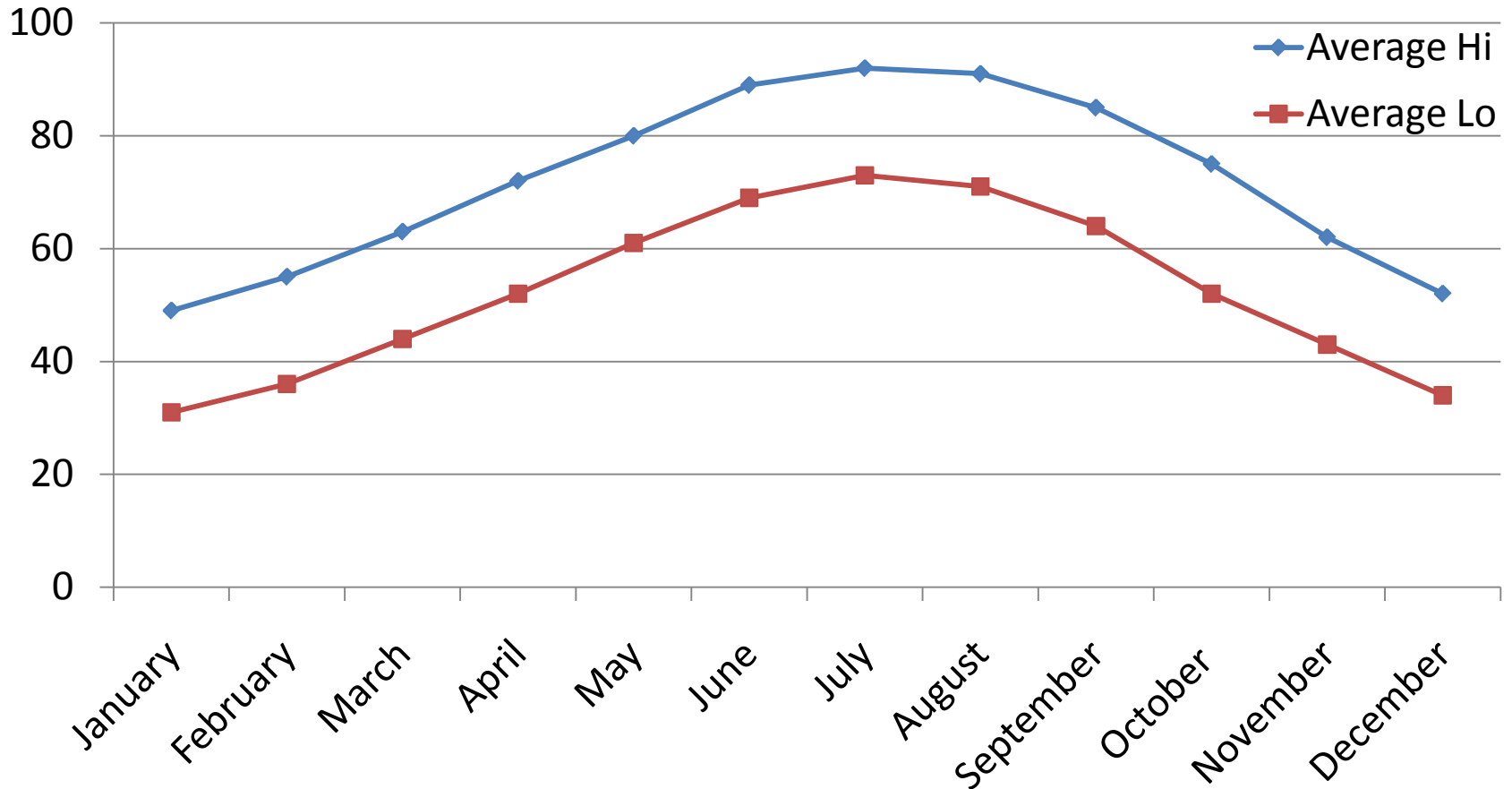
Outline

- Planning the cool season garden
- Transplants and direct seeding
- Starting seeds
 - Timing
 - Production & media
 - Organic fertility
 - Transplant problems
 - Seed selection
- Soil preparation
- Season extension

Average Temp in Knoxville

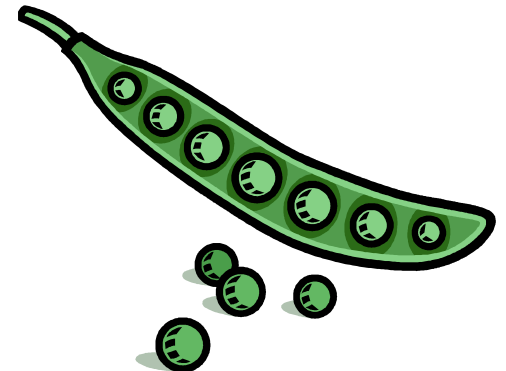


Average Temp in Memphis



What is a cool season vegetable?

- Able to withstand some frost
- Can be annual (i.e. sweet pea) or perennial (asparagus)
- Temperature may affect taste: carrots, broccoli, cauliflower and Brussels sprouts
- May be planted in the fall or spring
- Bolt in warm weather (i.e. broccoli, lettuce)



Cool Season Crops

Vegetable	Variety	Planting date	Row spacing	Plant spacing	Days to 1 st harvest	Length of harvest
Beets	Detroit Dark Red	Mar 1-10	14-36"	2-3"	55-60	4 wks
Broccoli	Arcadia	Mar 1- Apr 1	24-36"	15"	60-70	4 wks
Cabbage	Round green types	Feb 20- Apr 1	24-36"	15"	60-75	3 wks
Carrots	Danvers, Nantes	Mar 1- Apr 1	14-36"	2-3"	55-65	2 wks
Kale	Dwarf Blue	Feb	18-36"	12-15"	55-65	4-20 wks
Head Lettuce	Buttercrunch	Feb or Mar	14-36"	12-15"	65-80	4-6 wks
Onions (bunch)	Evergreen bunching	Feb or Mar	14-36"	2-3"	30-60	3 wks

Cool Season Crops

Vegetable	Variety	Planting date	Row spacing	Plant spacing	Days to 1 st harvest	Length of harvest
Onions (storage)	Sweet Sandwich	Feb or Mar	14-36"	3-6"	100-120	2 wks
English peas	Little Marvel	Feb 1- Mar 20	12-36"	2-4"	65-70	2-3 wks
Snap peas	Sugar Snap	Feb 1- Mar 20	12-36"	2-4"	60-70	2-3 wks
Irish potatoes	Yukon Gold	Mar	30-36"	12	90-100	4 months stored
Radish	Cherry Belle	Feb 15- Apr 15	14-36"	1-2"	25-30	3 wks
Spinach	Longstanding Bloomsdale	Feb	14-36"	3-4"	40-50	3 wks
Swiss Chard	Fordhook Giant	Mar	18-36"	6-8"	50-60	4-30 wks

From: UT Extension Guide to Spring-Planted Cool-Season Vegetables

Transplant vs. Direct Seed?

Transplant

- The most reliable way to obtain a uniform stand with a predictable harvest
- Earlier maturity
- Requires controlled environment
- Not good for plants that can't handle root disturbance

Direct Seed

- Can result in less uniform stand
- Less costly production
- Best for plants with tap-root (carrots, parsnip)
- Best for plants that mature quickly (radish, spinach)
- May need to be thinned



Direct Seeding with Precision Seeders

- Straight rows
- Proper plant spacing & depth
- Efficient use of space
- Ease of planting & harvesting
- Available as single or 6-row



Transplant Timing

Vegetable	Transplant Age (wks)	Ideal Growth Stage	Date Seeded	Date Transplanted
Beet*	3-4 wks	4-5 true leaves	Feb 1, Feb 10	Mar 1, Mar 10
Broccoli	4 wks	4-5 true leaves	Feb 1	Mar 1
Cabbage	4 wks	4-5 true leaves	Feb 1, Feb 15	Mar 1; Mar 15
Kale	4 wks	3-4 true leaves	Feb 1	Mar 1
Leeks	4-8 wks	4-5" tall	Jan 1	Mar 1
Onions (storage)	4-8 wks	4-5" tall	Jan 1	Mar 1

* Also direct seeded

Transplant Production

Plug trays, flats



Soil block method



Plug Trays

- Larger cells = more time = bigger plant
- 50, 72, 128 cell flats
- About \$1 per tray
- Vacuum seeders available



Soil Blocks

- Plant seeds in lightly compressed cubes of potting soil
- No root bound plugs, less transplant shock
- Available in different sizes (1 ½ , 2, 3")
- No plastic waste
- No cost of pots
- May dry out quicker
- Diseases?



Potting Media

- Mix your own with peat, sand, compost, soil, perlite, vermiculite, coir, shredded bark etc...
- Buy it pre-mixed (organic mix: peat moss, perlite, dolomite lime and an organic wetting agent)



Potting Media

Mixing yourself

- Less expensive
- Can be time consuming
- More variable
- Can create a custom mix to suit your needs
- Potential problems with diseases, weeds

Buying pre-made

- More expensive
- Easy
- More uniform
- Sterile
- May be difficult to find an organic formulation

Compost

- Adds fertility, holds water
- Must be kept at 131-170 ° F for at least 3 days in an enclosed system, or 15 days in a windrow system with at least 5 turnings
- Can be made from animal manures and bedding, farm and garden wastes, grass and alfalfa hay etc...

Soil

- Diseases and weed seeds are concerns-- consider solarizing, steam pasteurization or oven heating
- If you're buying a commercial topsoil, make sure it wasn't treated with fumigants or other restricted products

Peat Moss

Peat moss, or sphagnum moss:

- partly decayed, moisture absorbing plant residue found in bogs
- provides fiber and organic matter “body”
- Poor-quality peat is dusty, contains sticks
- Be aware of “wetting agents”

Composted Pine Bark

- Lightens mix, increases air space, decreases water holding capacity
- Used more for ornamentals
- May require additional nitrogen

Coir

- Coconut fiber
- Lasts 2-4 times longer and is easier to wet than peat moss
- Good water holding capacity
- More expensive
- May need to increase nitrogen and cut back on potassium
- Salinity may be an issue

Sand, Vermiculite, Perlite

- Increase porosity, aeration
- Coarse sand 1/8 - 1/16" is best
- Sand is inexpensive but heavy
- Vermiculite: mined mica-like mineral, lightweight
- Perlite: volcanic rock that is expanded with heat, lightweight

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Organic Fertility

Fertilizer	Estimated NPK	Rate of Release	Salt & pH Effects
Alfalfa Meal	2.5 - 0.5 - 2	slow	
Bat Guano	5.5 – 8.6 – 1.5	medium	
Blood Meal	12.5 – 1.5 – 0.6	medium-fast	
Bone Meal	4 – 21 – 0.2	slow	
Cottonseed Meal	7 – 2.5 – 1.5	slow-medium	
Feather Meal	15 – 0 – 0	slow	
Fish Emulsion	10 – 5 – 0	medium-fast	
Greensand	0 – 1.5 – 5	very slow	
Kelp Meal	1 – 0.5 – 8	slow	Possibly high salt
Mushroom Compost	2 – 1 – 2	medium	?
Rock Phosphate	0 – 18– 0	slow	
Soybean Meal	7 – 2 – 1	slow-medium	
Wood Ash	0 – 1.5 – 5	fast	Very alkaline
Worm Castings	1.5 – 2.5 – 1.3	medium	

Table from ATTRA: Potting Mixes for Certified Organic Production

Hardening Off

- Greenhouse grown transplants need to be hardened-off before setting out into the field, or they may experience transplant shock
- Gradually reduce temperature, water and fertilizer application in the greenhouse before setting out



Nutrient Deficiencies

Nitrogen: stunting,
chlorosis, defoliation

Phosphorus: purple
discoloration in young
leaves

Potassium: marginal
leaf burn, chlorosis



Nitrogen deficiency on kale

Nutrient Deficiencies



Phosphorus deficiency on cauliflower

Photo courtesy of gumshoegardener@wordpress.com

Nutrient Deficiencies



Potassium deficiency on cabbage

Photo credit Sin Chee Tham International Plant Nutrition Institute

Nutrient Deficiencies



Diseases

- Damping-off:

Seeds rot in the ground pre-emergence (*Pythium*)

Seedlings topple and die (*Rhizoctonia*)

Favored by cool, wet soils. Avoid splashing water in the greenhouse. Look for brown lesions on roots of seedlings.

Diseases



Crucifer Diseases



Early blight on broccoli

Crucifer Diseases

Black rot: caused by *Xanthomonas campestris* pv. *Campestris*



Black leg: caused by *Phoma lingam* (*Leptosphaeria macutans*)



Cool Season Pests



Flea beetles on broccoli

Cool Season Pests



Aphids on kale

Cool Season Pests

- Flea beetles
- Harlequin bugs
- Aphids
- Diamondback moth
- Imported cabbageworm
- Cabbage looper



Harlequin bug on broccoli

Cool Season Seeds

- Organic, untreated
- Clean, disease-free
- Look for early maturing varieties (i.e. 'DeCicco' broccoli is 48 days vs. 60-65)
- Look for slow-to bolt varieties
- Choose disease resistant varieties when available

Cool Season Varieties

- Kale 'Lacinato' and 'Red Russian'
- Leeks 'Blaugruner'
- Bunching onion 'White Spear' and 'Deep Purple'
- Radish 'Cherry Belle' and 'Champion'
- Lettuce 'Rouge D'Hiver'
- Spinach 'Butterflay' and 'Bloomsdale Longstanding'

Soil Preparation

- Consider experimenting with strip or no-till planting into your residue or winter cover
- Broadforks—good for loosening soil on a small scale
- Rotary tillers—help warm up soil, incorporate amendments



Season Extension

Benefits of quick hoops or low tunnels

- Frost protection
- Provides microclimate
- Shelters plants from wind, excessive evaporation
- Allows soil and air to warm up during the day
- Protects against insects and birds

Can use lightweight, floating row covers or heavier weight fabric on hoops

Season Extension



Season Extension

Benefits of Cold Frames

- Can be made inexpensively with recycled glass window panes
- Can be used for hardening off transplants or overwintering greens and spinach
- Good for smaller scale production

Season Extension

Benefits of High Tunnels

- Less expensive than greenhouses
- Provides a microclimate
- Big enough to walk and work inside
- Retains heat better than low tunnels
- Increases quality and yield of vegetables without requiring electricity or energy

Season Extension



Season Extension

Benefits of Greenhouses

- Greater structural stability than high tunnels
- Provides supplementary heat
- Flexibility in design
- Ideal for seedling production

Questions?

