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 Memphis

- **Average Hi**
- **Average Lo**
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)
<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Variety</th>
<th>Planting date</th>
<th>Row spacing</th>
<th>Plant spacing</th>
<th>Days to 1st harvest</th>
<th>Length of harvest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beets</td>
<td>Detroit Dark Red</td>
<td>Mar 1-10</td>
<td>14-36”</td>
<td>2-3”</td>
<td>55-60</td>
<td>4 wks</td>
</tr>
<tr>
<td>Broccoli</td>
<td>Arcadia</td>
<td>Mar 1-Apr 1</td>
<td>24-36”</td>
<td>15”</td>
<td>60-70</td>
<td>4 wks</td>
</tr>
<tr>
<td>Cabbage</td>
<td>Round green types</td>
<td>Feb 20-Apr 1</td>
<td>24-36”</td>
<td>15”</td>
<td>60-75</td>
<td>3 wks</td>
</tr>
<tr>
<td>Carrots</td>
<td>Danvers, Nantes</td>
<td>Mar 1-Apr 1</td>
<td>14-36”</td>
<td>2-3”</td>
<td>55-65</td>
<td>2 wks</td>
</tr>
<tr>
<td>Kale</td>
<td>Dwarf Blue</td>
<td>Feb</td>
<td>18-36”</td>
<td>12-15”</td>
<td>55-65</td>
<td>4-20 wks</td>
</tr>
<tr>
<td>Head Lettuce</td>
<td>Buttercrunch</td>
<td>Feb or Mar</td>
<td>14-36”</td>
<td>12-15”</td>
<td>65-80</td>
<td>4-6 wks</td>
</tr>
<tr>
<td>Onions (bunch)</td>
<td>Evergreen bunching</td>
<td>Feb or Mar</td>
<td>14-36”</td>
<td>2-3”</td>
<td>30-60</td>
<td>3 wks</td>
</tr>
</tbody>
</table>
# Cool Season Crops

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

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
<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Transplant Age (wks)</th>
<th>Ideal Growth Stage</th>
<th>Date Seeded</th>
<th>Date Transplanted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beet*</td>
<td>3-4 wks</td>
<td>4-5 true leaves</td>
<td>Feb 1, Feb 10</td>
<td>Mar 1, Mar 10</td>
</tr>
<tr>
<td>Broccoli</td>
<td>4 wks</td>
<td>4-5 true leaves</td>
<td>Feb 1</td>
<td>Mar 1</td>
</tr>
<tr>
<td>Cabbage</td>
<td>4 wks</td>
<td>4-5 true leaves</td>
<td>Feb 1, Feb 15</td>
<td>Mar 1; Mar 15</td>
</tr>
<tr>
<td>Kale</td>
<td>4 wks</td>
<td>3-4 true leaves</td>
<td>Feb 1</td>
<td>Mar 1</td>
</tr>
<tr>
<td>Leeks</td>
<td>4-8 wks</td>
<td>4-5” tall</td>
<td>Jan 1</td>
<td>Mar 1</td>
</tr>
<tr>
<td>Onions (storage)</td>
<td>4-8 wks</td>
<td>4-5” tall</td>
<td>Jan 1</td>
<td>Mar 1</td>
</tr>
</tbody>
</table>

* 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 spaghnum 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
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
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
# Organic Fertility

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

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

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?