Keep Your Cool: Planning & Production of Cool Season Crops
Annette Wszelaki
Vegetable Extension Specialist
Planning Considerations: The Big Picture

- Separate similar crops or families
- Alternate heavy feeders with light feeders
- Be aware of crop interactions
- Alternate deep-rooted crops with shallow-rooted crops
- Interplant crops to reduce pest pressure
Separate similar crops or families

- **Apiaceae**
  - Carrot, parsnip, parsley, celery

- **Asteraceae**
  - Lettuce, endive, radicchio

- **Brassicaceae**
  - Cabbage, broccoli, cauliflower, Brussels sprouts, kohlrabi, turnip, radish, Chinese cabbage, kale, collards, rutabaga
Separate similar crops or families

• Chenopodiaceae
  – Beet, Swiss chard, spinach

• Fabaceae
  – English peas, soybean, snapbean, lima bean

• Liliaceae
  – Onion, garlic, leek, shallot, chive
## Characteristics of crops by family

<table>
<thead>
<tr>
<th>Family</th>
<th>Part harvested</th>
<th>Cold tolerance</th>
<th>Typical planting</th>
<th>Weed competitiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apiaceae</td>
<td>Root, leaf</td>
<td>Half-hardy</td>
<td>Small</td>
<td>Low</td>
</tr>
<tr>
<td>Asteraceae</td>
<td>Leaf</td>
<td>Half-hardy</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Brassicaceae</td>
<td>Flower bud, leaf, root</td>
<td>Hardy</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Chenopodiaceae</td>
<td>Leaf, root</td>
<td>Half-hardy to hardy</td>
<td>Small</td>
<td>Medium</td>
</tr>
<tr>
<td>Fabaceae</td>
<td>Fruit</td>
<td>Tender to hardy</td>
<td>Small</td>
<td>Low</td>
</tr>
<tr>
<td>Liliaceae</td>
<td>Root</td>
<td>Hardy</td>
<td>Small</td>
<td>Low</td>
</tr>
</tbody>
</table>

Resource: Vern Grubinger
Alternate heavy feeders & light feeders

- **Heavy feeders:**
  - Broccoli, Brussels sprouts, cabbage, cauliflower, celery, collards, endive, escarole, kale, kohlrabi, lettuce, onions, spinach

- **Light feeders:**
  - Beets, carrots, garlic, leeks, mustard, parsnips, potatoes, radishes, rutabagas, shallots, Swiss chard, turnips

- **Soil builders:**
  - Peas

Resource: Alex Hitt
Be aware of crop interactions

• Brassicas are known to cause yield decline in many crops that follow them (not sweet corn!)
• Carrots and beets can also cause detrimental effects on crops the following year (but not beans!)
• Some preceding crops (peas, oats, barley) increase incidence of scab in potato, others (soybean) decrease it
• Members of the chicory family (endive, radicchio, etc.) are beneficial to following crops

Resources: Eliot Coleman & Alex Hitt
<table>
<thead>
<tr>
<th>Plant</th>
<th>Plant(s) It Enhances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chamomile</td>
<td>Cabbage family, cucumber, most herbs, melon, onion</td>
</tr>
<tr>
<td>Chervil</td>
<td>Radish</td>
</tr>
<tr>
<td>Chives</td>
<td>Carrot, grape, rose, tomato</td>
</tr>
<tr>
<td>Dead nettle</td>
<td>Potato</td>
</tr>
<tr>
<td>Dill</td>
<td>Cabbage family, lettuce, onion</td>
</tr>
<tr>
<td>Garlic</td>
<td>Rose, beet, cabbage family</td>
</tr>
<tr>
<td>Horseradish</td>
<td>Potato</td>
</tr>
<tr>
<td>Hyssop</td>
<td>Cabbage, grape</td>
</tr>
<tr>
<td>Mint</td>
<td>Cabbage, pea, tomato</td>
</tr>
<tr>
<td>Onion</td>
<td>Beet, cabbage, lettuce, strawberry</td>
</tr>
</tbody>
</table>
## Plants Harming Other Plants

<table>
<thead>
<tr>
<th>Plant</th>
<th>Plant(s) It Harms</th>
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</thead>
<tbody>
<tr>
<td>Anise</td>
<td>Carrot</td>
</tr>
<tr>
<td>Chives</td>
<td>Bean, pea</td>
</tr>
<tr>
<td>Garlic</td>
<td>Bean, pea</td>
</tr>
<tr>
<td>Hyssop</td>
<td>Radish</td>
</tr>
<tr>
<td>Mustard</td>
<td>Turnip</td>
</tr>
<tr>
<td>Onion</td>
<td>Bean, pea, sage</td>
</tr>
<tr>
<td>Pole bean</td>
<td>Beets</td>
</tr>
<tr>
<td>Potato</td>
<td>Pumpkin, squash, turnip</td>
</tr>
<tr>
<td>Rue</td>
<td>Basil, cabbage, sage</td>
</tr>
<tr>
<td>Sage</td>
<td>Onion</td>
</tr>
</tbody>
</table>
Alternate deep-rooted crops with shallow-rooted crops

• Shallow-rooted crops:
  – Main root system in top 1-2’ of soil
  – Cabbage, cauliflower, lettuce, celery, onion, potato, radish, sweet corn

• Moderately-rooted crops:
  – Main root system in top 1-4’ of soil
  – Carrot, peas, snapbean, cucumber, eggplant, pepper, summer squash

• Deep-rooted crops:
  – Main root system in top 1-6’ of soil
  – Cantaloupe, pumpkin, tomato, watermelon

Resource: Alex Hitt
Interplant crops to reduce pest pressure

- **Carrots**
  - Onions, leeks and herbs such as rosemary, wormwood and sage act as repellents to the carrot fly

- **Onions**
  - Since onion maggots travel from plant to plant when set in a row, scatter onion plants throughout your field or interplant with radishes

Resource: Carrots Love Tomatoes by Louise Riotte
Crop Scheduling- Making Your Plan

• What season does it grow best in?
  – What season will it not grow in?
  – Best temperatures for growth

• Should you succession plant this crop?
  – How long does a planting produce?
  – How many times to plant?
  – How much time between plantings?

Resource: Alex Hitt
Crop Scheduling - Making Your Plan

• Direct seed or transplant or both?
  - How long does it take to germinate?
  - How long does it take to grow a transplant?

• Germination requirements?
  - Optimum soil temperatures?

• Plant spacing?
  - How many plants per bed?
  - How many seeds per foot?

Resource: Alex Hitt
Cool Season Plan

- Determine last harvest date based on temperatures for good growth
- Count weeks backwards to get the plant in the field date based on days to maturity
- If transplanted, count the weeks backwards to get seeding date based on weeks to grow transplant
- Plan for slower germination in cool soils early and slower growth in the field
- Plan for faster growth in last few weeks of growth periods as temperatures and daylength increases

Resource: Alex Hitt
Fall Cool Season Plan

- Crops need to reach maturity by the first frost date
- Crops stop growing when daylight hours drop below 10 hours
- Most crops are direct seeded in August and early September
- Transplanted crops in late August and early September

Resource: Alex Hitt
Harvest and Postharvest

• Harvest at proper time and maturity
• Get the heat out and keep it out
• The less handling, the better
• Store it properly
  – For cool season crops, this will generally be as close to 32 degrees as possible
• Get it to market!
Sample Storage at Farm

• Cooler #1 (at 32° F)
  - Asparagus
  - Beets
  - Carrots
  - Crucifers
  - Lettuce
  - Ripe muskmelons
  - Onions
  - Parsley
  - Green peas
  - Radishes
  - Spinach
  - Sweet corn
  - Turnips

• Cooler #2 (at 50° F)
  - Green beans
  - Cucumbers
  - Eggplant
  - Peppers
  - Potatoes
  - Pumpkins
  - Summer squash
  - Tomatoes (ripe)
  - Watermelons
  - Winter squash
Crop Specifics
Asparagus

• Perennial, produces for 15 year or more
• Prefers sun or partial shade, limed to pH 7.0
• Plant crowns 8-14” apart in furrows 6-8” deep and 3-5’ apart in early to mid-spring
• Harvest lightly for first two years
• Store at 32° F for 2-3 weeks
• Varieties: Purple Passion, Jersey Supreme, Jersey Knight
Beets

- Cool temperatures produce the best color
- Transplant or direct seed, days to maturity 45-60

Transplant:
- Sow indoors 5-6 weeks before transplanting
- Sow seeds ¼” deep, 3-4 seeds/inch
- Transplant 3” apart in rows 12-18” apart

Direct seed:
- Begin sowing when soil has warmed after thawing
- Sow in 2-4” wide band, 10-15 seeds/ft., ½” deep rows
- Sow at 2-week intervals until 8 weeks before heavy frosts expected

- Store at 32° F for 10 days
- Varieties: Chioggia, Red Ace, Golden, Bull’s Blood

UT Extension
Broccoli Raab (Rapini)

- Transplant or direct seed, days to maturity 35-45
- Transplant:
  - Transplant from 1 ½” plug trays
- Direct seed:
  - Tolerates light frost
  - Sow 10-12 seeds/ft., ¼- ½” deep, rows 18-24” early spring to late summer
- Clip and bunch entire plants when buds appear
- Store at 32° F for up to 5-7 days
- Varieties: Sessantina Grossa, Spring Raab
Broccoli

• Days to maturity 50-70
• Transplant:
  - 8” apart in-row, 18” apart between rows
• Clip center head, then harvest secondary shoots regularly to encourage continued production
• Store at 32° F for up to 10-14 days
• Varieties: Belstar, Gypsy, Arcadia, Green Magic, De Ciccio
Brussels Sprouts

- Does best in fall and harvest after frost, 90-110 DTH
- Transplant:
  - Sow in 1 ½” cell trays
  - Transplant in 4-6 weeks
  - 18-24” apart in-row, 30” between rows
- Marketing whole-stem: pinch out growing point when lower sprouts are ½- ¾”; full stem of sprouts will develop in ~ 4 weeks
- Store at 32° F for up to 4-6 weeks
- Varieties: Catskill, Churchill, Diablo
Cabbage

- Early crop 60-75 DTH, Storage 90-100 DTH
- Transplant:
  - Sow in 1 ½” cell trays
  - Transplant in 4-6 weeks
  - 12-18” apart in-row, 18-30” between rows
- Cultivate deeply next to plants to avoid splitting
- Store at 32° F for up to 4-6 weeks
- Varieties:
  - Early- Tendersweet, Early Thunder, Early Jersey Wakefield
  - Storage- Premium Late Dutch Flat, Storage No. 4
  - Specialty- Caraflex, Gonzales
  - Savoy- Famosa, Deadon
  - Chinese- Rubicon, Minuet (both better as fall crop- tendency to bolt in spring)
Carrot

- Prefers deep, loose soil
- 50-75 DTH
- Direct sow from early spring to mid-summer
- Seed \( \frac{3}{4} - 1" \) apart, \( \frac{1}{4} - \frac{1}{2}" \) deep, 2” wide rows
- Sow 3 weeks apart for continuous supply
- Store at 32° F for 4-6 weeks
- Varieties: Nelson (Early), Sugarsnax 54 (Main crop), Bolero (Storage), Purple Haze, Parmex
Cauliflower

- Look for self-blanching varieties, 50-80 DTH
- Transplant from 1 ½-2” cell trays when 4-5 weeks old
- Plant 18” apart in-row, 24-36” between rows
- Harvest before curd becomes loose
- Store at 32° F for 2-3 weeks
- Varieties:
  - White- Cassius, Snow Crown, Fremont*, Snowball*
  - Purple- Violet Queen, Graffiti
  - Orange- Cheddar
  - Green- Panther
  - Romanesco- Veronica
Celery and Celeriac

- Celeriac (Celery Root) can provide celery flavor all winter long
- Celery: 80 DTH
- Celeriac: 100 DTH
- Sow 6 seeds/inch, \( \frac{1}{8} \)” deep, 10-12 weeks before transplanting outdoors
- When seedling shave 2 true leaves, transplant to 1 ½” cell trays, transplant outdoors when warm
- Temperatures below 55° F can cause bolting, harden by reducing water
- Plant 6-8” apart in-row, 24-36” between rows
- Store at 32° F for 5-7 weeks (celery), 4-6 months (celeriac)
- Varieties:
  - Celery- Tango, Golden Self-Blanching
  - Celeriac- Brilliant, Large Smooth Prague
Chicory (Belgian Endive, Radicchio)

- Belgian Endive (Witloof) can produce all winter long (115 DTH)
- Radicchio: 60-65 DTH
- Belgian Endive grows best by forcing the root
- Radicchio is grown like lettuce
- Store at 32° F for 2-3 weeks (radicchio), 3-4 weeks (Belgian endive)
- Varieties:
  - Belgian Endive- Totem
  - Radicchio- Chioggia Red, Indigo, Fiero
Garlic

- Plant mid-late September through November
- Insert individual cloves, root end down, 1 ½-2” deep, 4-6” apart, mulch heavily
- Harvest in summer when bottom 2-3 leaves have yellowed
- Dry bunches for storage
- Store at 32°F for 5-8 months under low humidity (60-70%)
- Varieties:
  - Stiffneck (send up hard scape and forms clustered bulbils)
    - German Extra-Hardy, Russian Red
  - Softneck (necks soft at maturity for braiding)
    - New York White, Italian Softneck, Silver Rose
  - Elephant (less hardy, huge bulbs)
Greens

• Arugula
  - Direct seed from mid-spring on, 2-4” wide band, 30 seeds/ft., 35-50 DTH
  - Sow every 3 weeks for continuous crop
  - Varieties: Discovery, Sylvetta, Surrey, Astro

• Asian Greens
  - Well adapted for spring or fall planting, 35-45 DTH
  - Sow ¼” deep, 15 seeds/ft., 2” wide bands in rows 18” apart
  - Clip leaves when 4-5 weeks old
  - Varieties: Mizuna, Komatsuna, Tatsoi, Pac Choi

• Corn Salad/Mache
  - Avoid hot weather! Early spring or fall crop
  - Plant September/October for spring crop (like spinach); early spring for late spring crop (50 DTH)
  - Sow 1” apart in solid bed, thin to 2”
  - Harvest rosette when 2 ½” tall
  - Varieties: Jade, Vit
Greens

• Mesclun
  - Mix of baby lettuces
  - Works well in tunnel on 42 inch wide bed, with 4 lines of drip tape per bed, with a row of mesclun on either side of the drip tape
  - The Wiediger’s run an Earthway seeder (with NO seed in it!) on either side of the drip tape, giving them 8 “furrows”
  - In fall and spring, mesclun takes 21 days from sowing to first harvest in a tunnel; can recut every 5 to 7 days
  - From mid-December to the early February, growth really slows down and it can take 28 to 35 days from sowing to harvest with as much as 21 days between harvests
  - During spring, fall and winter get usually 4 - 6 cuttings off the mesclun
Kale

- Plant 3 months before expected frost
- Sow 3 seeds every 8”, thin to 1 plant, \(\frac{1}{4}-\frac{1}{2}”\) deep in rows 18-30”
- Harvest individual leaves about 2 months after planting (50-65 DTH)
- Does well under row cover through winter
- Store at 32° F for 3-4 weeks
- Varieties: Starbor, Winterbor, Toscano, Red Russian
Kohlrabi

- Best fall and winter in South (35-45 DTH or 80 DTH for storage types)
- Sow 1” apart, ¼-½” deep, in rows 12-18” apart, thin to 4” between plants
- Harvest when roots 2”
- Store at 32° F
- Varieties:
  - White- Eder, Winner
  - Purple- Kolibri, Early Purple Vienna
  - Storage- Kossack
Leeks

• Non-bulbing onion, sweet
• Can be direct seeded or transplanted (75-110 DTH)
• Sow in flats February to March, ¼” apart, ¼” deep
• Transplant to 1 ½” plugs when able to handle
• Transplant outdoors when 8-18” tall and thick as a pencil, 6” apart, rows 24” apart
• Can blanch stalks by mounding soil 2-3 times during growing season
• Store at 32° F for 2-3 months
• Varieties:
  – King Richard, Lancelot, Upton, Pandora
Parsnip

- Grown similarly to carrots, but need full season of growth and cold weather for sweet flavor (110-120 DTH)
- Sow early to mid-spring in 2” band about 1” apart, ½” deep, rows 18-24” apart
- Thin plants to 2-3” apart
- Store at 32º F for 2-3 months
- Varieties:
  - Javelin, Lancer, Andover
Peas

- Sow early spring as soon as soil can be worked
- Sow 1-1 ½” apart in 3” band, ½-1” deep, rows 12-18” apart for dwarf types, 4-6’ apart for trellising
- Store at 32° F for 2 weeks
- Varieties:
  - Shelling type- Caselode, Strike, Premium (50-60 DTH)
  - Snap peas- Sugar Ann, Cascadia, Amish Snap, Sugar Snap (50-60 DTH)
  - Snow/Sugar peas- Snow Sweet, Oregon Giant, Mammoth Melting Sugar (50-60 DTH)
  - Greens and Garnish- Dwarf Grey Sugar Pea (32 DTH greens, 39 DTH blossoms, 57 DTH pods)
Potato

- Cut tubers into 1 ½-2 oz. pieces (1-1 ¼” diam.) with at least one ‘eye’/piece
- Best to cut seed pieces a day ahead and allow cut surfaces to dry before planting
- Plant pieces 2-3” deep, 12” apart, in rows 30-36” apart
- Hill plants when they reach 1’ and repeat 2-3 weeks later
- New potatoes can be harvested 7-8 weeks after planting; or in fall when foliage is dry and tubers are full size
- Store full size potatoes at 35-45° F
- Varieties:
  - Dark Red Norland, Superior, Adirondack Blue, Yukon Gold, Kennebec
  - Fingerlings- French Fingerling, Russian Banana
Radish

- Can sow anytime beginning early spring
- Sow in 2-3” wide bands, seeds $\frac{3}{4}-1”$ apart, $\frac{1}{2}”$ deep
- Amount of water given controls spiciness
- Harvest starting about 3-4 weeks after planting
- Store at 32° F for 3-4 weeks
- Varieties:
  - Round- Cherriette, Crunchy Royale, Easter Egg
  - Long French- D’Avignon
  - Daikon- Snowy, Summer Cross
  - Specialty- Red Meat, Nero Tondo
Rutabaga

• Plant mid-July for fall harvest
• Sow 6 seeds/ft., $\frac{3}{8}$” deep, thin to 6” apart, in rows 18-24”
• Harvest after second good frost,
• Cut tops and store at 32° F for up to 6 months
• Varieties:
  – Helenor, Laurentian
Spinach

• Can sow early spring or in September for early harvest following spring
• For full size, sow 9-10 seeds/ft., ½” deep, rows 12-18” apart
• For baby, sow in 2-4” band, ¾” apart, clip leaves after 3-5 weeks
• Succession plant weekly
• Store at 32° F for 10-14 days
• Varieties:
  – Smooth-leaf- Space, Emu
  – Savoy-leaf- Spargo, Winter Bloomsdale
  – Specialty- Bordeaux
Turnips

• Sow early spring through summer in 2” band, 1” apart or more space for larger turnips, \( \frac{1}{4}-\frac{1}{2}” \) deep, rows 12-18” apart

• Can also be transplanted

• Begin harvesting young turnips in about 30 days, full size 40-50 days

• Store at 32° F for 10-14 days with greens

• Varieties:
  - Hakurei, Scarlet Queen Red Stems, Purple Top White Globe
Future Organic Crop Production Workshops

- What’s All The Buzz About?- Beekeeping & Native Pollinators  (April 12)
  - This workshop will be LIVE at the UT Organic Farm in Knoxville ONLY!
- Insect Management: The Good, the Bad & the Bugly  (May 10)
- Disease Management: Molds, Mildews & Blights, Oh My!  (June 14)
- * Find Your Thrill with Blueberry Production  (July 12)
- * Parsley, Sage, Rosemary & Thyme- Herb Production  (August 9)
- Get the Dirt on Soil Management  (September 13)
- Weed ‘Em and Reap: Tips on Weed Management  (October 11)
- Year-Round Production: See the Light at the End of the (High and Low) Tunnel  (November 8)

- More information and archived 2010 workshops available at: http://organics.tennessee.edu/workshops.htm
6-part series to provide new growers with the business planning & management, vegetable & small fruit planning & production & direct marketing skills that they need to properly plan & carryout a farming venture.

These half-day workshops, planned from 1-4 PM EST on the final Monday of the month, will be offered in Knoxville **ONLY**:

- **February 22**- Business Planning
  - *Now archived on the web!*
- **March 29**- Production Planning
  - *This workshop will cover crop scheduling, seed selection & farm design.*
- **April 26**- Transplant Production
- **May 24**- Marketing Strategies
- **June 28**- Market Garden Planting & Maintenance
- **July 26**- Harvest and Handling

More information available at: [http://organics.tennessee.edu/sprouting_growers_workshops.htm](http://organics.tennessee.edu/sprouting_growers_workshops.htm)
Questions?

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Organic Crops Field Tour: April 29