



Keep Your Cool: Planning & Production of Cool Season Crops

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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*

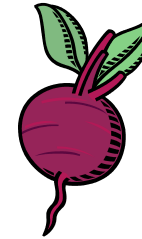
- Cabbage, broccoli, cauliflower, Brussels sprouts, kohlrabi, turnip, radish, Chinese cabbage, kale, collards, rutabaga



Separate similar crops or families

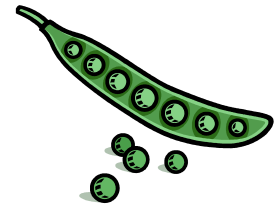
- Chenopodiaceae

- Beet, Swiss chard, spinach



- Fabaceae

- English peas, soybean, snapbean, lima bean



- Liliaceae

- Onion, garlic, leek, shallot, chive



Characteristics of crops by family

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

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

Plants Helping Other Plants

Plant	Plant(s) It Enhances
Chamomile	Cabbage family, cucumber, most herbs, melon, onion
Chervil	Radish
Chives	Carrot, grape, rose, tomato
Dead nettle	Potato
Dill	Cabbage family, lettuce, onion
Garlic	Rose, beet, cabbage family
Horseradish	Potato
Hyssop	Cabbage, grape
Mint	Cabbage, pea, tomato
Onion	Beet, cabbage, lettuce, strawberry

Plants Harming Other Plants

Plant	Plant(s) It Harms
Anise	Carrot
Chives	Bean, pea
Garlic	Bean, pea
Hyssop	Radish
Mustard	Turnip
Onion	Bean, pea, sage
Pole bean	Beets
Potato	Pumpkin, squash, turnip
Rue	Basil, cabbage, sage
Sage	Onion

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



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, 1/8" deep, 10-12 weeks before transplanting outdoors
- When seedling have 2 true leaves, transplant to 1 1/2" 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
 - Varieties: *Black Seeded Simpson*, *Buttercrunch*, *Red Sails*, *Red Salad Bowl*, *Tango* (green oak), *Rouge D'Hiver* (red Romaine), *Parris Island...* *many, many options!*

Kale



- Plant 3 months before expected frost
- Sow 3 seeds every 8" , thin to 1 plant, ¼-½" 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 32° 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



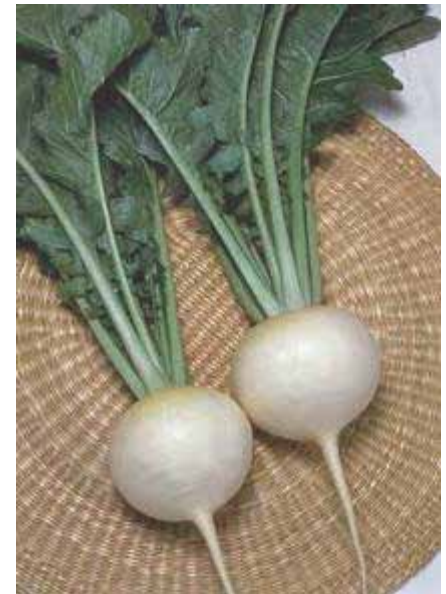
Spinach

- 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, ¼-½" 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>

Sprouting Growers



- 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

Questions?



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Organic Crops Field Tour: April 29