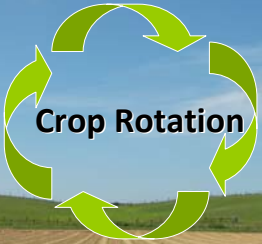




Organic Crop Production:



Crop Rotation

Annette Wszelaki
Vegetable Specialist






Well-thought-out crop rotation is worth 75% of everything else that might be done, including fertilization, tillage and pest control.

-Firmin Bear

What is crop rotation?


- Crop rotation is selecting a sequence of crops for a field that improves soil quality while it sustains the farmer.






Why rotate?


- Maintains good soil health and quality
- Fosters the most effective use of soil fertility
- Helps control weeds, some diseases and insects
- Reduces need for off-farm inputs
- Enhances moisture management
- Promotes income diversity and stability
- Improves crop quality and yields
- Reduces soil erosion
- Increases biodiversity
- Improves water quality
- Reduces drought impact





Decisions, decisions...

- With a 3 crop, 4 year rotation, there are 6 possible sequences
- With a 3 crop, 8 year rotation, there are 5,040 sequences!



Why bother?

- A good rotational sequence can accentuate every possible advantage
- Different crops use soil nutrients differently
- All may alter or be altered by the succeeding or preceding crop
- Time spent planning a rotation is never wasted!
- **THINK IT THROUGH!**

Insect, Disease and Weed Control

- Monoculture encourages pest problems
- A good rotation can prevent the build-up of specific pests and weeds



Rotation Lengths to Reduce Soilborne Pathogens

| Vegetable | Disease | Yrs w/o Susceptible Crop |
|-----------|---------------|--------------------------|
| Asparagus | Fusarium rot | 8 |
| Cabbage | Clubroot | 7 |
| Cabbage | Blackleg | 3-4 |
| Cabbage | Black rot | 2-3 |
| Muskmelon | Fusarium wilt | 5 |
| Parsnip | Root canker | 2 |
| Peas | Root rots | 3-4 |
| Peas | Fusarium wilt | 5 |
| Pumpkin | Black rot | 2 |
| Radish | Clubroot | 7 |

Source: S.A. Johnson & P.J. Nitzche, USDA

Plant Nutrition

- Rotations can make nutrients more available
- Plants of a lower order of evolution better feeders on less soluble sources of nutrients
 - i.e., alfalfa, clovers and cabbage versus lettuce and cucumbers



Soil Structure

- Rotations preserve and improve soil structure
- Maximize benefits of crops with different rooting depths




Yields

- Some crops helped, others hindered by preceding crop
- How they help:
 - Increase soil N
 - Improve soil condition
 - Increase microbial activity
 - Excrete beneficial substances
 - Control pests
- How they hinder:
 - Deplete soil nutrients
 - Excrete toxic substances
 - Increase soil acidity
 - Make soil condition unfavorable
 - Lack of proper aeration
 - Remove moisture
 - Vector disease

Things to consider:

- Number of blocks or sections
 - Rotation works best if sections are all the same size
- Number of years in rotation cycle
 - 10 sections does not necessarily = 10 year rotation
 - Do what makes sense for your operation!
- Number of crops in rotation
 - Most small growers have many diversified crops
 - Crops must be further divided based on botanical classification, plant part consumed or space utilized


Crop Families

- **Brassicaceae (Cabbage Family)** 
 - Cabbages, cauliflowers, kale, broccoli, turnips, radishes, mustard, Brussels sprouts
 - Can have allelopathic effect on subsequent crops
- **Solanaceae (Tomato Family)**
 - Tomatoes, potatoes, peppers, eggplant (okra)
 - Need fairly high level of nitrogen
 - Potato prefers soil slightly more acidic



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Crop Families

- **Fabaceae (Bean Family)** 
 - Snapbeans, lima beans, broad beans, half-runners, field peas, English peas
 - Fix nitrogen from the air for their own fertilizer and for subsequent crop
- **Alliaceae (Onion Family)**
 - Onions, leeks, shallots, garlic
 - Monocot



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Crop Families

- **Cucurbitaceae (Squash Family)** 
 - Squash, cucumber, melons, pumpkins, gourds
 - Long growing season
- **Apiaceae (Carrot Family)**
 - Carrots, parsnips, parsley, celery, celeriac, dill
 - Dill enhances cabbage family, onion and lettuce



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Crop Families

- **Chenipodiaceae (Chard Family)** 
 - Beet, spinach, Swiss chard, lambsquarters
 - Mycorrhizae will not associate
- **Asteraceae (Lettuce Family)** 
 - Lettuce, salsify, Jerusalem artichoke
- **Poaceae (Grass Family)** 
 - Corn

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Crop Space Requirements

| More Space ← | | | | | | → Less Space |
|--------------|---|---------------|-------------|---------------|------------------|--------------|
| 6 | 5 | 4 | 3 | 2 | 1 | |
| Corn | | Potato | Tomato | Lettuce | Onion | |
| | | Pea | Cauliflower | Pepper | Beet | |
| | | Winter squash | Broccoli | Carrot | Chard | |
| | | | | Summer squash | Parsley | |
| | | | | Celery | Celery | |
| | | | | Bean | Parsnip | |
| | | | | Cabbage | Rutabaga | |
| | | | | Spinach | Kale | |
| | | | | | Radish | |
| | | | | | Brussels sprouts | |
| | | | | | Cucumber | |



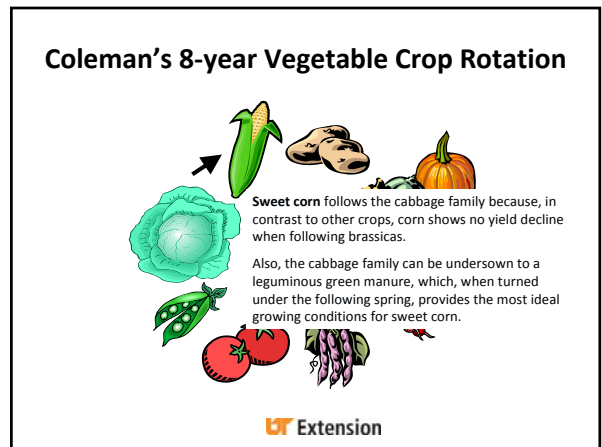
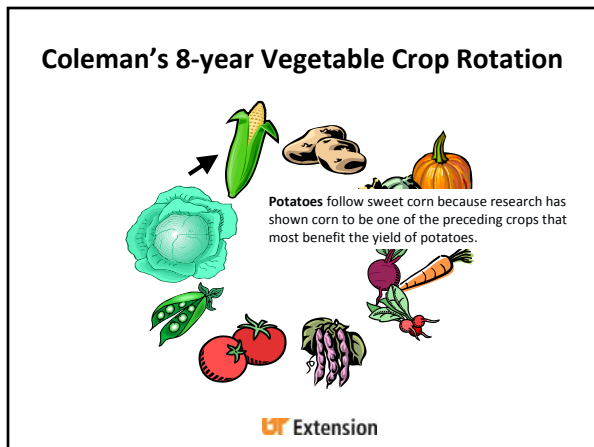
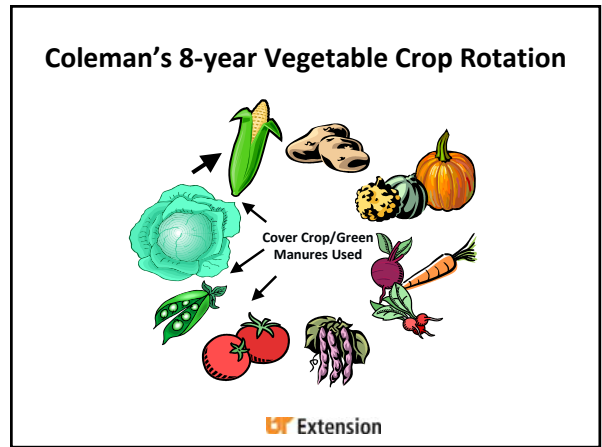
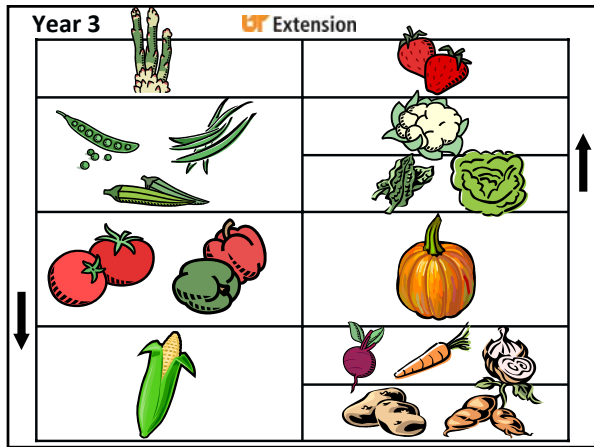
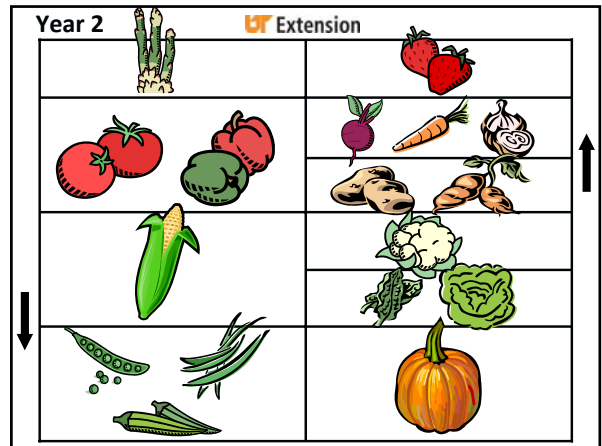
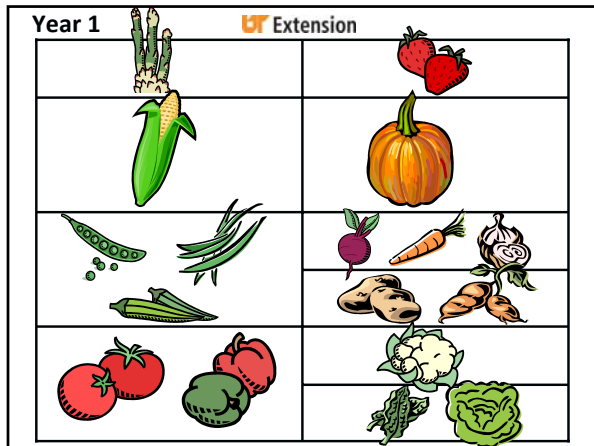
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Nutrient Feeding

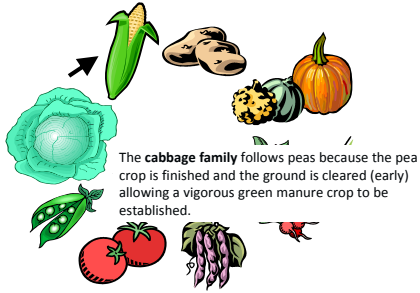
Some crops are *heavy feeders* that *deplete* soils, while other crops are *light feeders* that *build* soils.

- **Soil Depleting Crops**
 - Row crops- corn, soybeans, vegetables, potatoes
- **Soil Neutral or Soil Conserving Crops**
 - Cereal crops- wheat, barley, oats
- **Soil Building Crops**
 - Legume sods- alfalfa, clover
 - Grass sods- prairie grass, meadows, pastures

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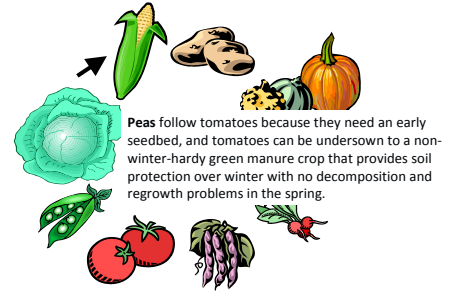


Coleman's 8-year Vegetable Crop Rotation



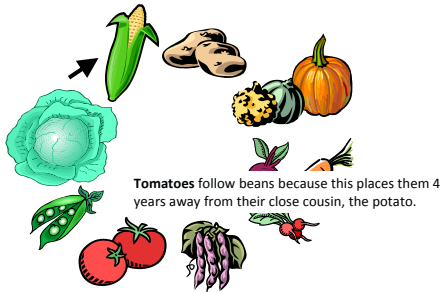
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Coleman's 8-year Vegetable Crop Rotation



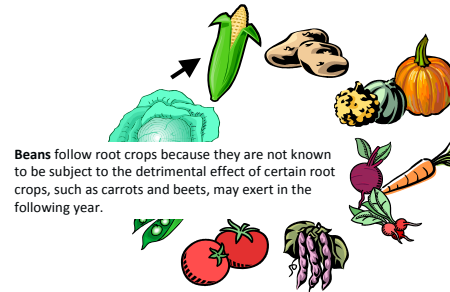
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Coleman's 8-year Vegetable Crop Rotation



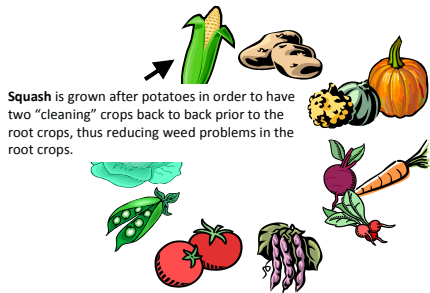
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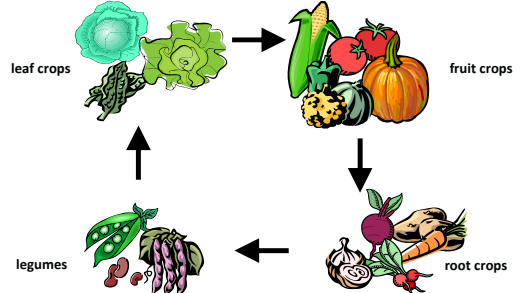
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Coleman's 8-year Vegetable Crop Rotation



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Ogden's 4-year Rotation Cycle



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Don't forget cover crops or green manures in your rotation!

- Investment in weed and pest control
- Vegetable systems have many windows to include cover crops or green manures
 - Example: Between harvest of early planted spring crop and planting of fall crops
 - Buckwheat, cowpeas, sorghum-sudan
 - Plant winter annual on fields that would lie fallow
 - Many veg crops can be overseeded with cover
 - Select crops that can tolerate shade and traffic

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Companion Planting

- Mix it up!
- All of one crop or crop family does not have to go in the same block!
- Three Sisters
- Herb-Vegetable Combinations



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UT Organic Crops Field Tour



- May 15, 8 AM – 11:15 AM
- Pre-register with ETREC by calling 865.974.7201
- Visit <http://organics.tennessee.edu> for more info

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Future Workshops

- ✓ **Planting: Seed Sources & Transplants** (May 11)
- ✓ **Identifying and Managing Weeds** (June 8)
- ✓ **Identifying and Managing Pests** (July 13)
- ✓ **High Tunnel Production** (August 10)
- ✓ **Identifying and Managing Diseases** (September 14)
- ✓ **Developing an Organic System Plan** (October 12)
- ✓ **Marketing Organic** (November 9)

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Questions?



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Organic Crops Field Tour: May 15

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