ORGANIC GARDENING

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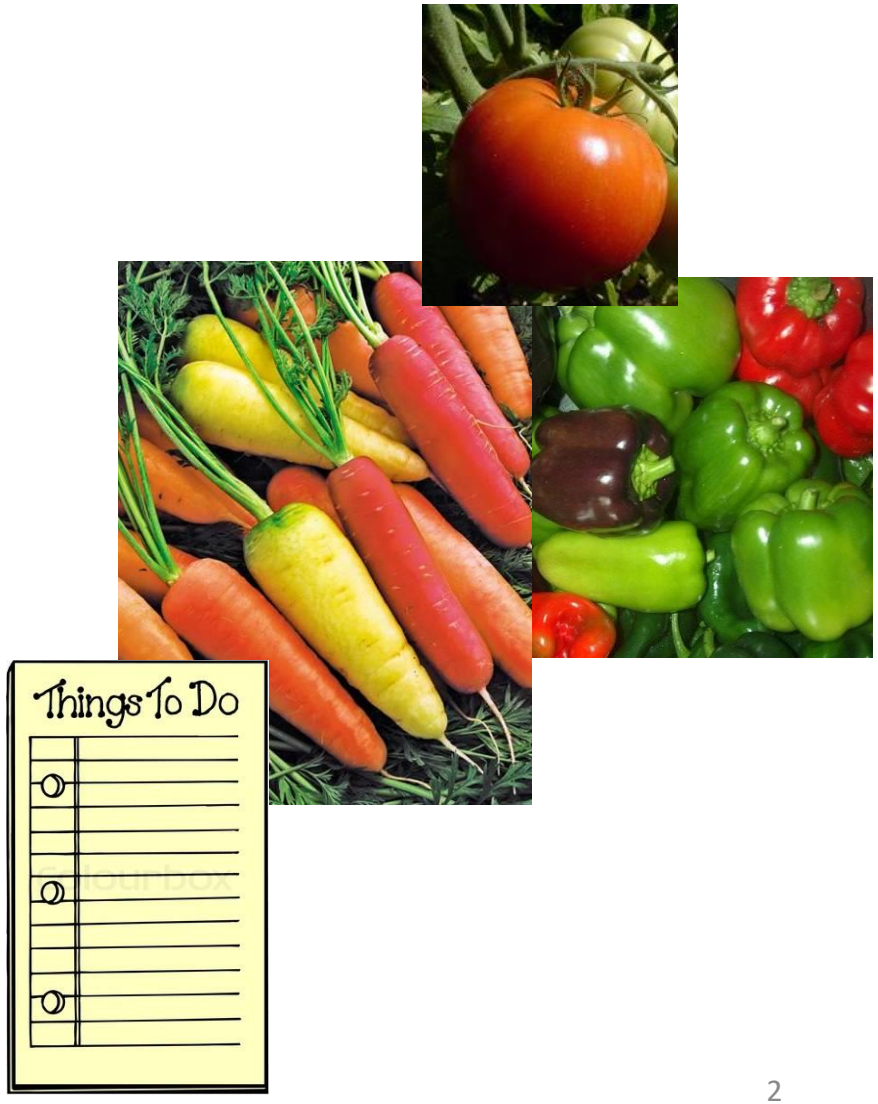
What You Will Learn Today

- What “organic” means
- Five steps to building a healthy organic vegetable garden
- Ways to take action in your own garden



The Definition of Organic

- Organic is a labeling term that indicates that the food or other agricultural product has been produced through approved methods. These methods integrate cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity. Synthetic fertilizers, sewage sludge, irradiation, and genetic engineering may not be used.

From the USDA National Organic Program website

http://www.ams.usda.gov/

What Organic is Not

- Not just the avoidance of conventional chemicals
- More than just substituting organic inputs for inorganic ones

Principles of Organic Gardening

Organic gardeners generally subscribe to the following principles:

- A strong emphasis on building healthy garden soil, which has a diverse microbial population, adequate organic matter, proper pH, and good fertility
- Building a nutrient reservoir into the soil, as opposed to relying heavily on fertilizer applications
- A holistic approach to pest management
- Use of only naturally-derived fertilizers and pest control products, and using them sparingly

Modified Organic Gardening

- Most homeowners should and do use a balanced approach
- Be willing to accept some damage
- Be willing to spend more time conditioning soil and scouting the garden for problems

USDA - NOP

- U.S. Department of Agriculture
  - National Organic Program
  - www.ams.usda.gov/AMSv1.0/NOPNationalOrganicProgramHome
  - Organic is a labeling term that indicates that the product has been produced through approved methods integrating cultural, biological, and mechanical practices
  - Foster cycling of resources, promote ecological balance, conserve biodiversity
  - Synthetic fertilizers, sewage sludge, irradiation, and genetic engineering may not be used

What does natural mean?

No definition of natural

Undefined

No one is checking this

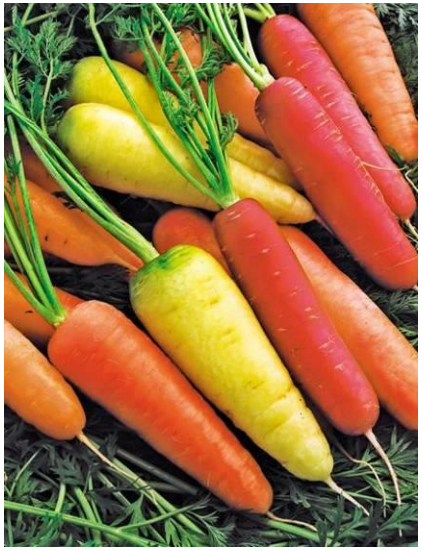
Buyer beware

Logo you should look for

KY Department of Ag (KDA)

- Accredited by the USDA-NOP as a Certifying Agent for the scopes of Crops, Wild Crops, Livestock, and Handling Operations
- KDA currently certifies only entities located within the state of Kentucky.
  - Applications for certifications
  - Organic regulations and guidance
- www.kyagr.com/marketing/plantmktg/organic/index.htm

Five Steps to Your Organic Garden



1

Build the soil

Organic Matter is the Key

- Improves soil structure and drainage
- Increases good microbes and earthworms
- Holds, then releases nutrients slowly

Organic Amendments

- Cover crops
  - Source of organic matter and nutrients
  - Helps prevent erosion

- Manure
  - Source of organic matter and nutrients
  - Use composted manure or apply in fall and turn under

- Compost
  - Source of organic matter and nutrients
  - Make it or buy it - recycle food scraps, grass, paper, and leaves
  - Better as an amendment than a mulch (may cake on surface)

- Mulch
  - Source of organic matter
  - Hardwood mulches may breakdown rapidly and tie up nitrogen

Is Your Soil Healthy?

- Crumbly loam
- Optimum pH of 6.0-6.8
- Organic matter ≥ 4%

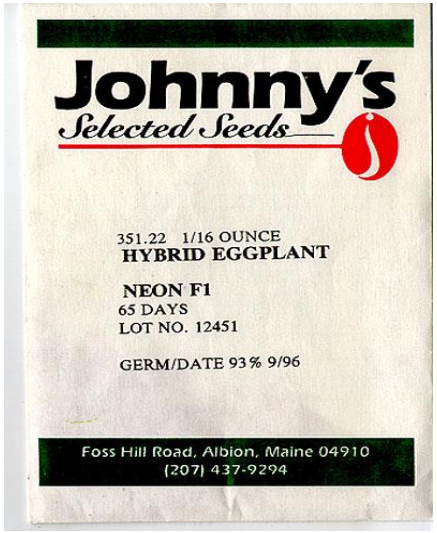
Not sure? Test your soil!
Your local cooperative extension office can help! Find your county office here:
http://extension.ca.uky.edu/county

2

Right plant, right place and time

Choose the Right Plants and Seed

- Healthy seedlings
- Seeds:
  - open-pollinated, heirloom
  - hybrid
  - organic



Plant in the Right Place

- Containers, in-ground or raised beds
- Six hours of sun
- Access to water
- Protected from critters

Mounded Soil

Plant at the Right Time

Table 15. Earliest and latest planting dates in the garden in Kentucky. (The person producing his own transplants must begin two to 12 weeks earlier than these listed dates.)

	Earliest Safe Planting Date			Latest Safe Planting Date[1]		
Crops	Western	Central	Eastern Mt.	Eastern Mt.	Central	Western
Asparagus (crowns)	Mar. 10	Mar. 15	Mar. 20	(Spring only)		
Beans (snap)	Apr. 10	Apr. 25	May 1	July 15	July 25	Aug. 1
Beans (lima)	Apr. 15	May 1	May 10	June 15	June 20	July 1
Beets	Mar. 10	Mar. 15	Mar. 20	July 15	July 20	Aug. 15
Broccoli (plants)	Mar. 30	Apr. 5	Apr. 10	July 15	Aug. 1	Aug. 15
B. Sprouts (plants)	Mar. 30	Apr. 5	Apr. 10	July 1	July 15	Aug. 1
Cabbage	Mar. 15	Mar. 25	Apr. 1	July 1	July 15	Aug. 1
Carrots	Mar. 10	Mar. 20	Apr. 1	July 1	July 15	Aug. 1
Cauliflower (plants)	Mar. 30	Apr. 5	Apr. 10	July 15	July 20	Aug. 5
Celery	Apr. 1	Apr. 5	Apr. 10	June 15	July 1	July 15
Chard	Mar. 15	Mar. 20	Apr. 1	June 15	July 15	Aug. 1
Collards	Mar. 1	Mar. 10	Mar. 15	July 15	Aug. 1	Aug. 15
Sweet Corn	Apr. 10	Apr. 20	May 1	June 15	July 10	July 20
Cucumbers	Apr. 20	May 1	May 10	June 15	July 1	July 15
Eggplant (plants)	May 1	May 10	May 15	June 1	June 15	July 1
Kale	Mar. 10	Mar. 20	Apr. 1	July 15	Aug. 1	Aug. 15
Kohlrabi	Mar. 15	Mar. 20	Mar. 25	July 15	Aug. 1	Aug. 15
Lettuce (leaf)	Mar. 15	Mar. 25	Apr. 1	Aug. 1	Aug. 15	Sept. 1
Lettuce (bibb plants)	Mar. 15	Mar. 25	Apr. 1	July 15	Aug. 1	Aug. 15
Lettuce (head plants)	Mar. 15	Mar. 25	Apr. 1	July 1	July 15	Aug. 1
Muskmelons	Apr. 20	May 10	May 15	June 15	July 1	July 15
Okra	Apr. 20	May 10	May 15	July 1	July 15	Aug. 1
Onions (sets)	Mar. 1	Mar. 10	Mar. 15	(Spring only)		
Onions (plants)	Mar. 15	Mar. 25	Apr. 1	June 15	July 1	July 15
Onions (seed)	Mar. 10	Mar. 20	Apr. 1	June 1	June 15	July 1

Planting Dates

- Cool season (Spring/Fall) crops
- Warm season (Summer) crops
- Planting dates for various crops
  - ID-128, Table 14, page 16
- Transplant scheduling
  - ID-128, Table 5, page 10

3

Fertilize wisely

Three Main Plant Nutrients

- N = Nitrogen
  - Leaves

- P = Phosphorus
  - Roots, flowers, fruits

- K = Potassium
  - Overall health and disease resistance

Example: All-purpose organic fertilizer (Garden Tone)

N-P-K: 3-4-4

Why Organic Fertilizers?

- May supply a wide range of nutrients
- Usually provide nutrients slowly
- Some are supplemented with beneficial microbes
- A central tenet in sustainable and organic agriculture is to “feed the soil to feed the crop”

Table 2. Nutrient content and release rates of organic fertilizers.

Materials	N (%)	P_2O_5 (%)	K_2O (%)	Relative Availability
Alfalfa meal	3.0	1.0	2.0	Medium-Slow
Blood meal	12.0	1.5	0.6	Medium-Rapid
Bone meal	0.7-4.0	11.0-34.0	0.0	Slow-Medium
Feather meal	11.0-15.0	0.0	0.0	Slow
Fertrell "Super N"	4.0	2.0	4.0	Slow
Fish meal	10.0	4.0	0.0	Slow
Fish emulsion	5.0	1.0	2.0	Medium-Rapid
Greensand	0.0	1.0-2.0	5.0	Slow
Kelp[1]	0.9	0.5	1.0-4.0	Slow
Manure[2] (fresh)				
Cattle	0.25	0.15	0.25	Medium
Horse	0.3	0.15	0.5	Medium
Poultry (50% water)	2.0	2.0	1.0	Medium-Rapid
Poultry (15% water)	6.0	4.0	3.0	Medium-Rapid
Manure[2] (dry)				
Dairy	0.7	0.3	0.6	Medium
Steer	2.0	0.5	1.9	Medium
Horse	0.7	0.3	0.5	Medium
Marl	0.0	2.0	4.5	Very Slow
Mushroom compost	0.7	0.9	0.6	Medium
Sulfate of potash magnesia (K-Mag)	0.0	0.0	22.0	Rapid-Medium
Soybean meal	6.7	1.6	2.3	Slow
Wood ashes[3]	0.0	1.0-2.0	3.0-7.0	Rapid

Source: Adapted from How to Convert an Inorganic Fertilizer Recommendation to an Organic One, University of Georgia Cooperative Extension. Adapted from Boyhan, 2009. See Additional Resources.

[1] Kelp also contains common salt, sodium carbonates, and sodium and potassium sulfates.

[2] Manure contents may vary with amount of straw/bedding included, feed quality, and method of storage. (See the health and safety questions in the Cooperative Extension Publication *Composting* (ID-192).

[3] Potash content depends on the tree species burned. Wood ashes are alkaline and contain approximately 32% CaO.

Table 17. Recommended times for sidedressing vegetables. (General rate for sidedressing is 5 Tbs of ammonium nitrate/10 ft row for all vegetables except asparagus and onions, which require 10 Tbs/10 ft row, and potatoes, which require 7 Tbs/10 ft row.)	
Crop	**Time of Application**
Asparagus	Before growth starts in spring.
Beans	After heavy blossom and set of pods.
Beets	Additional nitrogen might reduce yield or lower quality.
Broccoli	3 weeks after transplanting.
Cabbage	3 weeks after transplanting.
Cauliflower	3 weeks after transplanting.
Carrots	Additional nitrogen might reduce yield or lower quality.
Cucumbers	Apply 1 week after blossoming begins and same amount 3 weeks later.
Eggplant	After first fruit set.
Kale	When plants are about one-third grown.
Lettuce	Additional nitrogen might reduce yield or lower quality.
Muskmelons	Apply 1 week after blossoming begins and same amount 3 weeks later.
Onions	1 to 2 weeks after bulb formation starts.
Parsnips	Additional nitrogen might reduce yield or lower quality.
Peas	After heavy bloom and set of pods.
Peppers	After first fruit set.
Potatoes	After tuber formation starts (bloom stage), about 6 weeks after planting.
Spinach	When plants are about one-third grown.
Squash	Additional nitrogen might reduce yield or lower quality.
Sweet corn	When plants are 12 inches tall.

4

Manage problems organically

Destroy Egg Masses of Bad Bugs

Colorado Potato Beetle

Squash Bug

Stink Bug

Exclude Pests with Row Cover

Recognize and Keep Good Bugs

Lady Bird Beetle adult and larva

Lacewing

Assassin Bug

Plant Companions

Many flowers attract and feed beneficial insects:

- Dill and parsley
- Mint, thyme, sage, basil
- Zinnias, marigold, daisies
- Salvia and nasturtiums

Insects

- There is no ‘silver bullet’ for insect control in organic gardening
  - Control begins with growing healthy plants
  - Avoid excess fertilizers
  - Avoid excess irrigation

Organic Insecticides

- Made from natural products
- Safer for the environment
- Examples:
  - Pyrethrins
  - Biological controls (Bt)
  - Insecticidal Soaps
  - Kaolin clay (Surround)

Table 5. Insecticides approved for use in organic production.

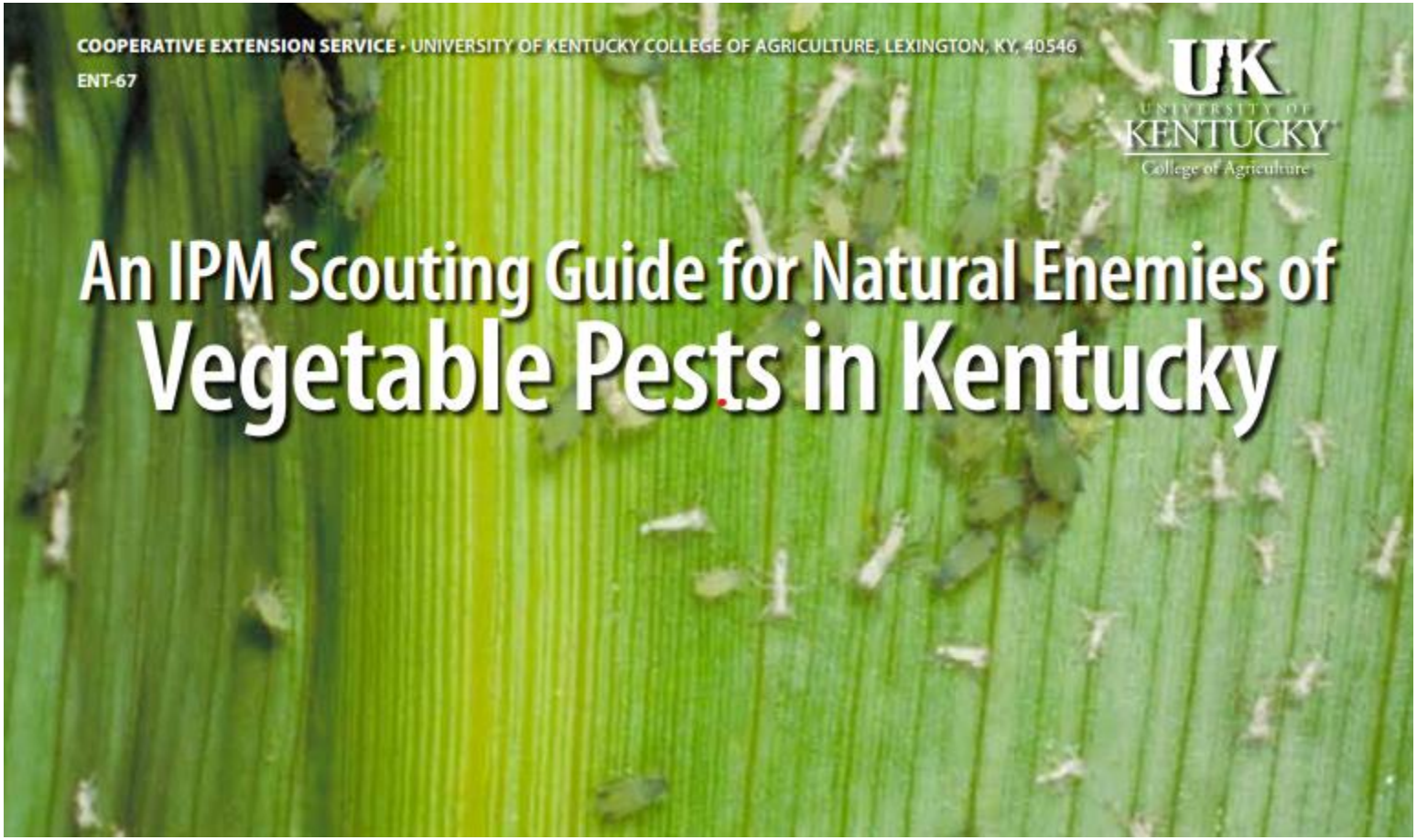
Active Ingredient	Origin of Active Ingredient	Pest Insects Controlled
Bacillus thuringiensis (Bt)	A toxin produced by the soil bacterium *Bacillus thuringiensis*	Caterpillars, such as cabbage looper, hornworm, imported cabbageworm, corn ear worm, etc.
Diatomaceous earth	Fossilized remains of diatoms, algae with a silica-based hard shell	Particularly effective on soft-bodies insects but also deters beetle, flea, and ant activity on plants
Insecticidal soaps	Salts of fatty acids derived from coconut and other oils	Soft-bodies insects such as aphids, thrips, whiteflies, etc.
Kaolin clay	A naturally occurring clay mineralogy ground into a fine powder	Numerous. Kaolin clay is sprayed on crop plants, deterring pests from landing, feeding, and depositing eggs.
Neem	The neem tree *(Azadirachta indica)*, an evergreen native to the Indian subcontinent	Gypsy moths, leaf miners, whiteflies, thrips, loopers, caterpillars, and mealybugs (disrupts feeding and development)
Pyrethrins	Chrysanthemum *(Dendranthema grandiflora)* flowers	Numerous. Pyrethrins are general insectides and affect beetles, caterpillars, and various sucking insects.
Sabadilla	Seeds of a tropical lily plant *Schoenocaulon officinale*, native to Central and South America	Sap-feeding insects, caterpillars, and thrips.[1]
Spinosads	Soil actinomycete, *Saccharopolyspora spinosa*	Numerous. Disrupts nuerotransmittors and feeding patterns in moths, caterpillars, leaf miners, thrips, Colorado potato beetles, and fire ants
Sulfur	The mineral sulfur	Spider mites, psyllids, and thrips

[1] Highly toxic to honeybees, so application at sunset is recommended.

Example of insect control from ID-128

Insect Control, Tomatoes:
See insect descriptions, pgs 29-33.

	Insect Treatments
Aphids	1, 2, 3, 5, 8, 9, 10, 14
Blister Beetles	5, 14
Cabbage Looper	4, 5, 6, 12, 13, 14
Colorado Potato Beetle	3, 4, 5, 9, 12, 13, 14
Corn Earworm (tomato fruitworm)	4, 5, 6, 12, 14
Cutworms	4, 5, 7, 12
Flea Beetles	3, 4, 5, 9, 13
Hornworms	4, 5, 6, 12, 13, 14
Mites	1, 8
Sowbugs	9, 13
Stink Bugs	4, 5, 14
Whiteflies	1, 3, 5, 8, 10, 14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College of Agriculture
An IPM Scouting Guide for Natural Enemies of
Vegetable Pests in Kentucky


4a


4b


4c


4d


4e


4f

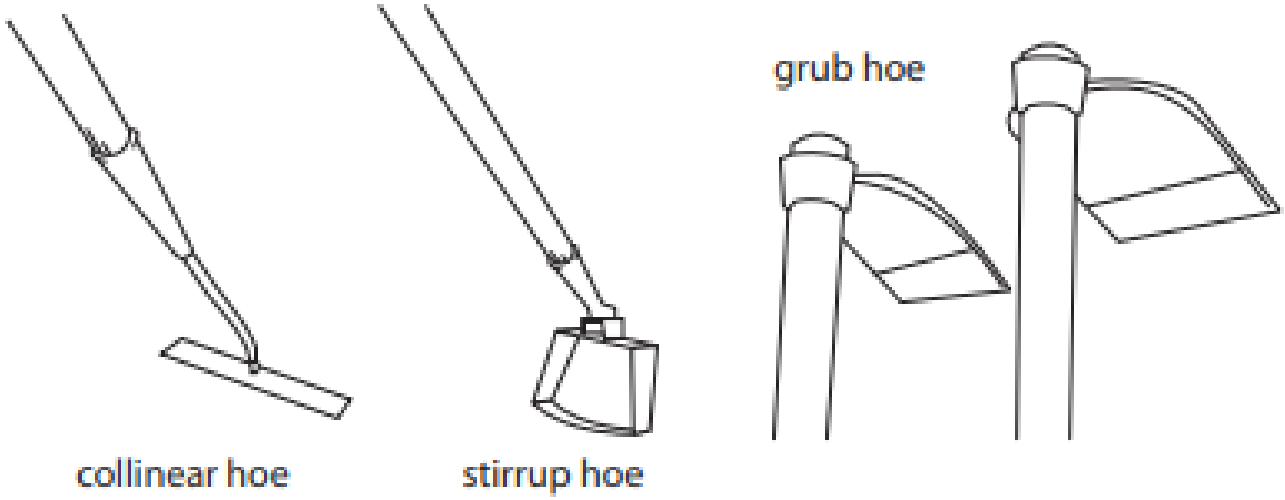
Suppress Weeds

- Mulch to suppress weeds.
- Space plants to shade out weeds.
- Pull or hoe weeds.
- Plant cover crops in open areas.
- Bringing into the garden only materials that you know to be free of weed seed
- Not allowing existing weeds to go to seed

Mulching

- Newspaper
- Cardboard
- Pine straw
- Chopped/composted leaves
- Hardwood mulch
- Wheat straw
- Plastic
- Cover crops
- Landscape fabric

Figure 4. Specialty garden hoes.



Manage Diseases

- Choose resistant varieties.
- Remove and destroy diseased plants.
- Trim plants to let air in.
- Rotate crops.

Rotate Crops

- Crop rotation is one of the best ways of avoiding disease and pest problems.
- Helps to prevent crop specific pests from building up to damaging levels.
- Examples: bean root rot, bacterial diseases of tomatoes, potato diseases, etc..
- Avoid rotating between similar groups of vegetables.

Rotate crops by Nutrient Cycling

Examples of crops in these categories are:

- **Heavy givers:** Beans (snap, pole, bush), peas, green manure crops such as clovers, and field peas
- **Light feeders:** Beets, carrots, garlic, onions, sweet potatoes, turnips
- **Heavy feeders:** Broccoli, cabbage, corn, cucumbers, squash, tomatoes

Groups of Related Vegetables

- **Cole crops** - cabbage, cauliflower, collards, Brussel sprouts, broccoli
- **Solanaceous crops** - tomato, pepper, eggplant, potato
- **Greens** - lettuce, endive, mustard, turnips (tops)
- **Root crops** - radishes, turnips, beets, carrots, sweet potatoes
- **Legumes** - green beans, peas, lima beans
- **Cucurbit crops** - cucumbers, gourds, melons, pumpkins, squash

Plants by family

Table 1. Common garden vegetables and their botanical families.

Botanical Family	Common Family Name	Crop
Solanaceae	Nightshade	Tomato, pepper, potato, eggplant, tomatillo
Brassicaceae	Cole crop	Broccoli, cauliflower, cabbage, kale, Brussels sprouts, radish, rutabaga, turnip
Cucurbitaceae	Gourd	Winter squash, summer squash, melons, cucumber, pumpkin
Apiaceae	Carrot	Carrot, parsley, celery, parsnip
Chenopodiaceae	Goosefoot	Beet, chard, spinach
Fabaceae	Legume	Pea, bean
Asteraceae	Sunflower	Lettuce
Liliaceae	Lily	Onion, garlic, shallot, leek
Poaceae	Grass	Corn

Organically Approved Fungicides

- *Bacillus subtilis*: broad-spectrum fungicide
  - Serenade, Sonata
- Neem oil: broad spectrum fungicide / insecticide
- Copper compounds: broad-spectrum fungicides / bactericides
  - Not all fixed coppers are OMRI-approved – see labels
- Potassium bicarbonate: powdery mildew
  - Bi-Carb Old Fashioned Fungicide
  - Kaligreen

More Fungicides. . .

- Sulfur: powdery mildew/miticide (protectant)
  - Not all formulations are OMRI-approved – see labels
  - Avoid application when temperatures are above 90°F (phytotoxicity)

- Kaolin clay (physical barrier; coats leaves/fruit)
  - Surround

5

Observe and care for your garden

Walk in Your Garden

- Observe.
- Manage weeds.
- Destroy bad bugs.
- Fertilize if needed.
- Succession plant.
- Keep a log.

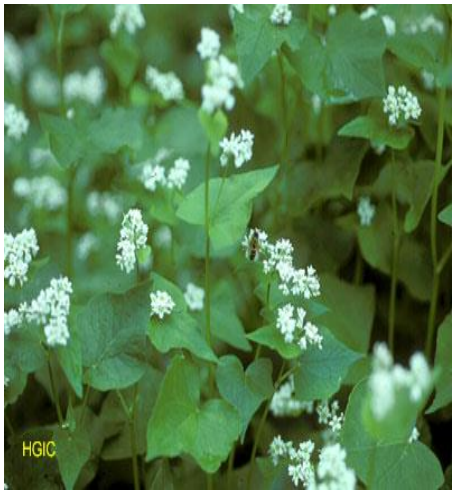
Water Wisely

- Water in morning, if possible; not in the evening.
- Water the soil, not the leaves.
- Water deeply, less often.
- Use drip irrigation or soaker hoses.

Vegetable	Critical Period of Water Needed
Snap Bean	Bloom, pollination, and pod enlargement
Cabbage and Cauliflower	Establishment, growth, head development
Sweet Corn	Silking, tasseling, and ear development
Cucumber	Flowering and fruit development
Pea	Flowering and seed enlargement
Potato	Tuber set and tuber enlargement
Tomato	Uniform supply from flowering through harvest

As the Season Ends…

- Remove plant debris.
- Mulch bare soil.
- Plant crops like garlic.
- Plant cover crops.



Buckwheat

Peas and oats

Five Steps to Your Organic Garden

1. Build the soil

2. Right plant, right place and time

3. Fertilize wisely

4. Manage problems organically

5. Observe and care for your garden

Resources

ID-128 Home Vegetable Gardening in Kentucky:

http://www2.ca.uky.edu/agcomm/pubs/ID/ID128/ID128.pdf

Gardening in Small Spaces:

http://www2.ca.uky.edu/agcomm/pubs/ID/ID248/ID248.pdf

Organic Fertilizers:

http://rocklandcce.org/resources/natural-organic-fertilizer

IPM Scouting Guide for Natural Enemies of Vegetable Pests in KY:

http://www2.ca.uky.edu/agcomm/pubs/ent/ent67/ent67.pdf

For additional information, Jeff Lowenfel's book, Teaming with Microbes, is an excellent gardener-friendly primer on soil ecology and the activity of soil microorganisms

Enjoy your organic garden!

Questions?

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