PURDUE EXTENSION

MASTER GARDENER PROGRAM



Organic Gardening

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What is organic gardening?

uses fewer inputs

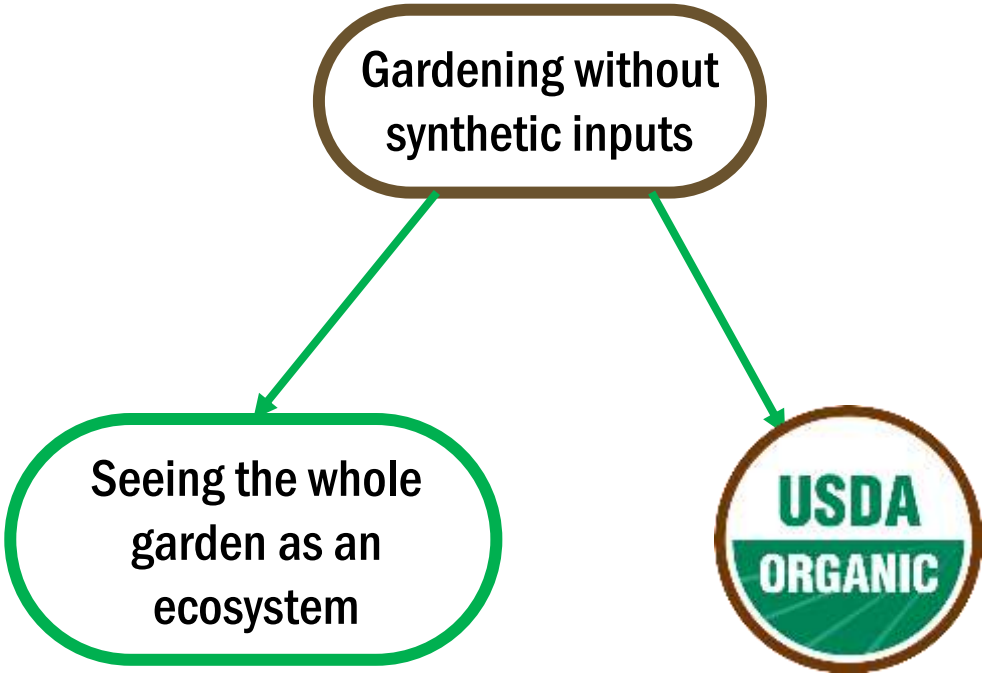
gardening naturally

no synthetic inputs

healthier than conventional

environmentally friendly

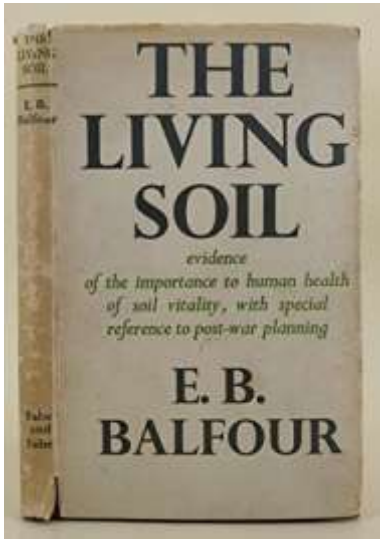
What is organic gardening?



Fact vs. Myth

- There are many testimonials and stories – it can make it difficult to distinguish fact from myth.
- "Organic" or "Natural" does NOT necessarily mean "safe!"
  - Many natural things can be unsafe, like tobacco, poisonous mushrooms, alcohol, poison ivy, and manure (think *E. coli*)
- Always read and follow product labels and directions!

A Brief History of Organic Agriculture

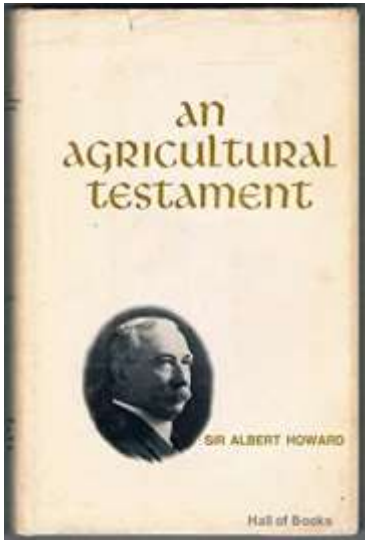


https://www.abebooks.co.uk/book-search/title/the-living-soil/author/balfour/book/

https://en.wikipedia.org/wiki/Lady_Eve_Balfour

https://en.wikipedia.org/wiki/Biodynamic_agriculture

DEMETER CERTIFIED BIODYNAMIC®



https://www.abebooks.com/Agricultural-Testament-Albert-Howard-Oxford-University/18492168776/bd

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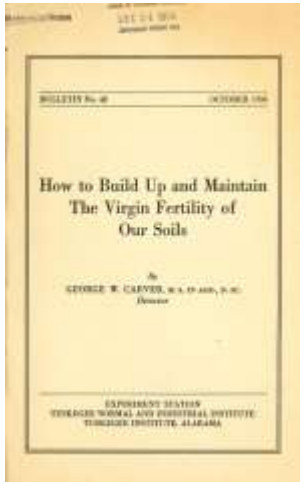
A Brief History of Organic Agriculture

https://www.nal.usda.gov/exhibits/ipd/carver/exhibits/show/bulletins/carver

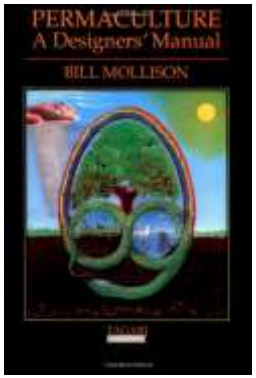
https://en.wikipedia.org/wiki/George_Washington_Carver#/media/File:George_Washington_Carver-crop.jpg

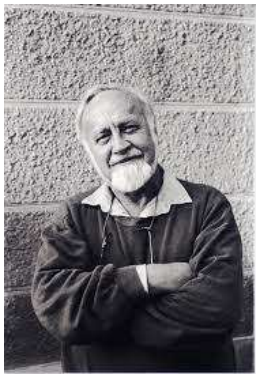


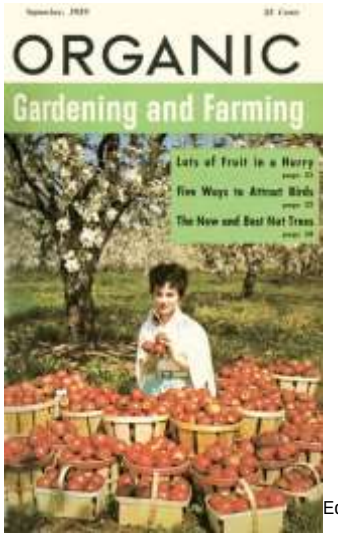
https://www.nal.usda.gov/exhibits/ipd/carver/exhibits/show/bulletins/carver

https://www.guernicamag.com/a-matter-of-scale/

https://rightlivelihood.org/the-change-makers/find-a-laureate/bill-mollison/







https://newrepublic.com/article/119007/bizarre-life-and-death-mr-organic

https://ucanr.edu/blogs/MBMG/index.cfm?tagname=organic%20gardening

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Why garden organically?

- Reduce human exposure to pesticides; the greatest risk of exposure is to the applicator!
- Reduce potential for residues on food
- Reduce potential risks to wildlife, pets, and the environment
- Increase activity of naturally occurring beneficial insects and microbes

Principles of Organic Gardening

1. Right plant, right place
2. Build the soil
3. Use non-synthetic inputs for fertilizer, weed control, etc.
4. Practice prevention
5. Use environmentally-friendly interventions for pest management (or an IPM approach)

Commercial organic is regulated by federal law; home gardeners have more flexibility to define “organic”

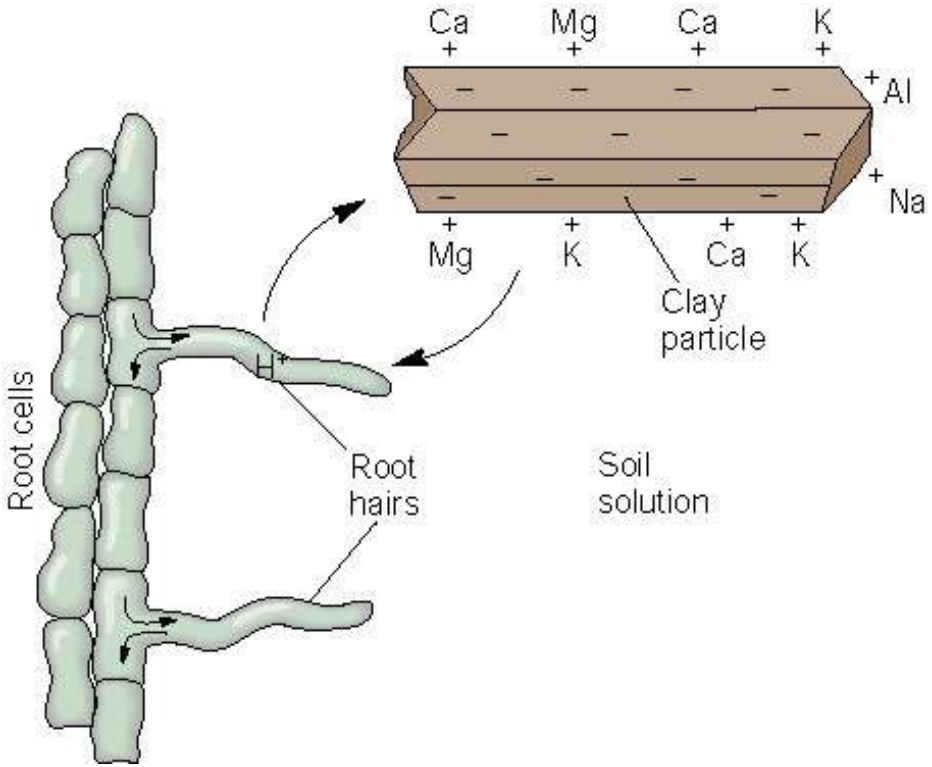
1. Right plant, right place

- Work with, rather than against, nature
- Think about:
  - Hardiness (winter, summer, etc.)
  - Soil pH
  - Drainage
  - Moisture needs
  - Disease and pest susceptibility vs. resistance
  - Light exposure (sun vs. shade)

2. Build the soil

- Add organic matter
  - What sources are available to you?
- Consider CEC (cation exchange capacity)
- Explore fertilizer and fertilizer supplements

Cation Exchange Capacity (CEC)



Sand = no charge
Clay & OM = - charge

Add OM to ⇧ CEC

Sources of Organic Matter

- Crop/organic mulch residues
- Cover crops/Green Manure
- Compost
- Manure
- Leaves

Organic Inputs – Fertilizer

N Sources

Plant by-products

Alfalfa, corn gluten, cottonseed, soybean meals,
2-9% N

Animal by-products

Manure .5 - 3% N (safety issues - *E. coli*)
Dried blood 12% N
Feather meal 7-12% N
Fish emulsion 5% N
Bat guano 3-10% N

Colorado State Univ. Extension pub. no. 7.733 Organic Fertilizers

Organic Inputs – Fertilizer

P & K Sources

Phosphorus	**% P_2O_5**	
Bone Meal, steamed	18 - 34	slow
Colloidal Phosphate	18 - 25	slow
Rock phosphate	20 - 32	slow
Potassium	**%K_2O**	
Sul-Po-Mag	21	rapid
Wood ashes (high pH)	3 - 7	rapid
Greensand	4 - 9	very slow
Granite dust	3 - 5	very slow

Colorado State Univ. Extension pub. no. 7.733 Organic Fertilizers

3. Using non-synthetic inputs – weed control

Dandelions flabbergasted by their friend's haircut

Lambsquarters

Methods for Organic Weed Control

- Mulch
  - Plastic
  - Organic (straw, leaves, etc.)
- Cultivation/hand weeding
- Mowing
- Flame, steam, boiling water (heat)
- Cover crops
- What about bio-herbicides?

Methods for Organic Weed Control – Cover Crops

- Winter cover crops (plant late summer/fall)
  - Common species include cereal rye, hairy vetch, and winter wheat
- Green manure (plant spring/summer)
  - Common species include buckwheat and sorghum sudangrass
- See resources for more info!

Photo provided by Ashley Adair

Methods for Organic Weed Control - Bio-herbicides

- Options include:
  - Corn gluten meal
  - Herbicidal soaps (FiNALSAN, others)
  - Pelargonic acid (Scythe)
    - Carrier is not NOP-approved
  - Essential oils (Dr. Earth Final Stop, others)
  - Acetic acid + citric acid (AllDown, BurnOut)

OMRI LISTED
For Organic Use · OMRI.org

Methods for Organic Weed Control – Corn Gluten Meal

- Not a new use – original patent 1991, but new products appear often
- Applied at a rate of 20 lbs/1000 sq. ft.
- Also provides some N (~9%)
- Mixed results

https://www.feedipedia.org/content/corn-gluten-meal-dried-used-fertilizer

Methods for Organic Weed Control - Read the Label!

- Signal Word: Caution
  - Bonide Bon-Neem Insecticidal Soap RTU (1.5%)
- Signal Word: Warning
  - Bonide Inseciticdal Soap Concentrate (40%)
  - Garden Safe Insecticidal Soap Concentrate (47%)
  - Safer Insect Killing Soap Concentrate (49.52%)
- Signal Word: Danger
  - Bonide Bon-Neem Insecticidal Soap Concentrate (25%)

https://bonide.com/product/insecticidal-soap-rtu/

4. Practice Prevention

Disease Management

4. Practice Prevention
Disease Management

- Use disease-resistant cultivars whenever possible
- Keep foliage dry and encourage air circulation
- Practice good sanitation (of tools, hands, shoes, etc.)
- Rotate crops when possible to avoid buildup of soil-borne diseases and pests
- Water as needed – don’t overwater
- Maintain good fertility

4. Practice Prevention – but when you need to treat...

Organic Fungicides are:

- Host- and pest-specific
- Generally low efficacy; function more as protection than cure

Products include:

- Soaps/oils
- Biofungicides (ex. Cease, a bacteria)
- Inorganic chemicals (ex. sulfur, copper, Bordeaux mix)
  - Can harm beneficial species
  - Can build up in soil
  - Can be toxic to plants (phytotoxicity)

4. Practice Prevention
Insect Management

4. Practice Prevention Insect Management

- Cultural practices to manage insects:
  - Crop rotation
  - Tillage (disrupts soil dwellers)
  - Adjusting planting dates
  - Trap crops
- Tools to manage insects
  - Physical barriers (floating row covers)
  - Flaming
  - Vacuuming
  - Natural enemies
  - Allowable insecticides

4. Practice Prevention
Insect Management

- Floating row covers physically prevent insects from accessing plants
- Must be placed prior to insect arrival
  - Does not protect against soil-emerging insects
- Must be removed for plants needing pollination
- Provides some protection from frost, but can keep plants too warm; good idea to remove during hot weather

4. Practice Prevention Insect Management

- Trapping is a multi-faceted strategy that can help control pests and monitor their populations
- Three types:
  - Sticky traps use an adhesive surface and certain colors to attract pests
  - Pheromone traps use a sex-attractant (usually species-specific)
  - Food lures (do they trap, or do they attract more??)

4. But when prevention isn't enough...

Insect Management

- Botanical insecticides are made from plant extracts or are synthesized from naturally-occurring plant material
- Products include neem oil, PyGanic (pyrethrin, *not* pyrethroid), insecticidal soaps, and diatomaceous earth

https://hydrobuilder.com/pyganic-gardening.html?opts=eyJhdHRyaWJ1dGUzNTQiOiIxMjM3In0=

https://www.johnnyseeds.com/tools-supplies/pest-and-disease-controls/insecticides/dipel-df-1-lb.-9713.0.html?utm_source=google&utm_medium=cpc&utm_campaign=BL%20|%20PMax%20|%20PRP%20|%20HPN%20-%20Smart%20Shopping%20|%20All%20Products&utm_keyword=&gad_source=1&gclid=CjwKCAiAlcyuBhBnEiwAOGZ2SwFiWzwavlDlMYBhSJK46m1VSlRMgvPmSO5B_OU8l23JKiF3TW94fBoC4j4QAvD_BwE

4. But when prevention isn't enough...

Insect Management

- Pyrethrins are a group of naturally occurring chemicals derived primarily from *Chrysanthemum* species
- Pyrethroids are the synthetic version – essentially the same, but not allowed in organic ag
- Fast-acting contact poison to numerous insects, but low mammal toxicity
- Breaks down quickly when exposed to light and air

https://hydrobuilder.com/pyganic-gardening.html?opts=eyJhdHRyaWJ1dGUzNTQiOiIxMjM3In0=

4. But when prevention isn't enough...

Insect Management

- Horticultural oils are exactly as they sound – oil!
- Products are usually petroleum-based (mineral oil, paraffinic oil)
- Work by suffocating insects and their eggs; virtually non-toxic to mammals
- Most effective against young scale insects, mites, and aphids
- Should be applied when temperatures are above 40F for 24 hours pre- and post-application

https://www.saferbrand.com/safer-brand-horticultural-dormantsprayoil-16-oz-5192-6

4. But when prevention isn't enough...

Insect Management

- Insecticidal soaps are derived from either plant or animal fatty acids
- Most effective against soft-bodied insects such as aphids, thrips, mealybugs, and whiteflies
- Relatively non-toxic to humans but can be damaging to plants and to soft-bodied beneficial insects

https://www.evergreengrowers.com/m-pede-insecticidal-soap.html

4. But when prevention isn't enough...

Insect Management

- Mineral-based insecticides are made up of tiny, sharp particles milled from the shells of fossilized sea-plants called diatoms
- These particles abrade the surface of the insects body, causing them to lose moisture and dry out
- DE is not generally harmful to human skin, but prolonged exposure can irritate lungs and other tissues (follow the label!!)
- DE may also kill beneficial insects

https://www.johnnyseeds.com/tools-supplies/pest-and-disease-controls/insecticides/dipel-df-1-lb.-9713.0.html?utm_source=google&utm_medium=cpc&utm_campaign=BL%20|%20PMax%20|%20PRP%20|%20HPN%20-%20Smart%20Shopping%20|%20All%20Products&utm_keyword=&gad_source=1&gclid=CjwKCAiAlcyuBhBnEiwAOGZ2SwFiWzwavlDIMYBhSJK46m1VSlRMgvPmSO5B_OU8l23JKiF3TW94fBoC4j4QAvD_BwE

4. But when prevention isn't enough...

Insect Management

- Kaolin clay is a mineral-based crop protectant that can be mixed with water (and some other products) and then sprayed on to labeled plants
- Forms a protective film on plants and fruits that prevents pathogen and pest attack
- Challenges: does this product block light transmission? How much will it clog the sprayer?

https://www.7springsfarm.com/products/surround-wp-crop-protectant-25-lb-bag

4. But when prevention isn't enough...

Insect Management

- Biological controls rely on natural enemies to control pests
- Natural enemies may be pathogens or may be other insects
- Use selective products only as a last resort – don't spray the entire garden routinely
- Use insect enemies with caution – there is no guarantee that they won't fly away to your neighbor's garden!
  - Lady beetles, for example, often work better in confined environments like greenhouses

4. But when prevention isn't enough...

Insect Management

Encourage predators naturally by planting diverse native plants and using cover crops where you are able

Lady beetle larvae

4. But when prevention isn't enough...

Insect Management

Encourage predators naturally by planting diverse native plants and using cover crops where you are able

Parasitic wasp larva on hornworm

4. But when prevention isn't enough...

Insect Management

- Microbial insecticides are usually microscopic living organisms like bacteria, fungi, protozoa, and nematodes; viruses may also be used
- Some microbial insecticides are derived from the toxins produced by one of the organisms above
- Examples include *Bacillus thuringiensis* (Bt), Spinosad, and milky spore

Inchworm infected with *Beauvaria bassiana*

4. But when prevention isn't enough...

Insect Management

- *Bacillus thuringiensis* is a bacteria that produces insect toxins
- Toxins from different Bt subspecies affect only specific insects (beetles vs. caterpillars vs. mosquitoes/flies)
- When using:
  - Select the correct product
  - Spray for thorough coverage
  - Be patient – toxin binds to insect digestive tract and causes gut cells to break apart; the insect will stop feeding but will not perish immediately
  - Degrades quickly under UV radiation from the sun; multiple apps may be required

https://www.pahls.com/shop/bacillus-thuringiensis-concentra/

4. But when prevention isn't enough...
Insect Management

- Bt strains on the market include:
  - Bt *aizawai* (Bta) – caterpillars
  - Bt *israelensis* (Bti) – mosquito and black fly larvae, fungus gnats
  - Bt *kurstaki (Btk)* – caterpillars
  - Bt *san diego*/*tenebrionis* (Btt) – Colorado potato beetle, elm leaf beetles

https://www.pahls.com/shop/bacillus-thuringiensis-concentra/

5. Use environmentally-friendly interventions and IPM

Crop rotation, the practice of planting different crops in sequence in the same spot, is *essential* in organic gardening.

5. Use environmentally-friendly interventions and IPM

Good crop rotation has a positive impact on:

- Disease management
  - Prevents soil-borne diseases from infecting susceptible hosts
- Insect management
  - Prevents soil-borne insects from attacking susceptible hosts
- Soil fertility
  - Keeps plants healthy and less vulnerable to attack

5. Use environmentally-friendly interventions and IPM

Implementing good crop rotation sequences involves the following:

- Alternating plant families in the cropping sequence every few years
  - Ex. Do not follow tomatoes one year with potatoes or peppers the next year. They all belong to the plant family *Solanaceae*, so they share some diseases and pests in common

Photo by Ashley Adair

5. Use environmentally-friendly interventions and IPM

- Use cover crops to “extend” the crop rotation
  - Ex. Plant crimson clover cover crop in the fall after brassicas and before leafy greens in the spring
- Avoid cover crops that are in the same plant family as the cash crop
  - Ex. do not plant mustard cover crops before or after brassicas; they are all in the same family *Brassicaceae*

Photo by Ashley Adair

5. Use environmentally-friendly interventions and IPM

Crop rotation can be challenging in a small garden.

Do your best to move crops around from bed to bed as much as space, shade, and personal preference allows!

Resources

- Extension resources from around the Midwest (search a topic followed by “extension.edu”)
- SARE (free publication downloads to PDF!)
  - Crop Rotation on Organic Farms https://www.sare.org/resources/crop-rotation-on-organic-farms/
  - Managing Cover Crops Profitably https://www.sare.org/resources/managing-cover-crops-profitably-3rd-edition/
- Your county extension educator!
- Purdue Extension Consumer Horticulture program
  - Karen Mitchell, mitcheka@purdue.edu or 765-494-1311

CREDIT:

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Questions?