Organic 101

Oahu Master Gardeners Program

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Theodore J.K. Radovich, Ph.D.
Sustainable Farming Systems Laboratory
Department of Tropical Plant and Soil Sciences
University of Hawaii at Manoa

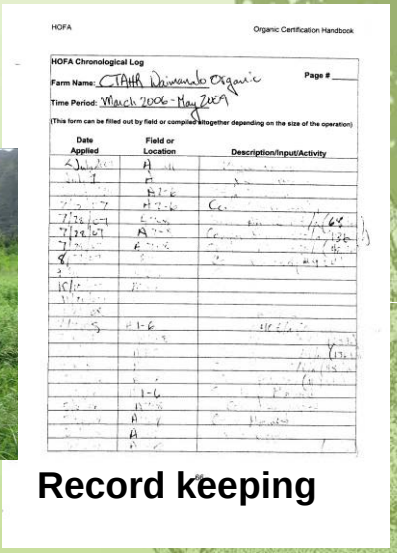
theodore@hawaii.edu

What's Organic?

Certification

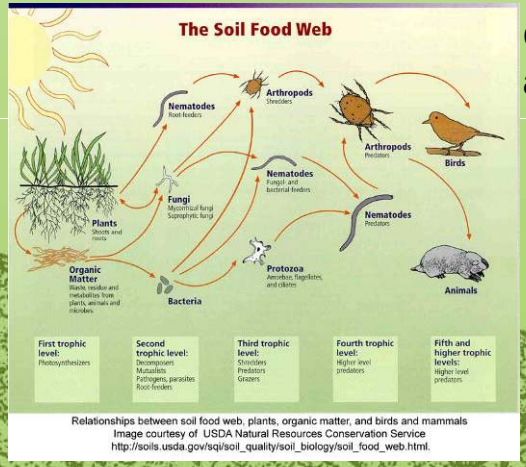
Certification agency

Inspect farm



Record keeping

Farming practices to help natural cycles



Relationships between soil food web, plants, organic matter, and birds and mammals
Image courtesy of USDA Natural Resources Conservation Service
http://soils.usda.gov/sqi/soil_quality/soil_biology/soil_food_web.html.

Organic matter and soil biology

Beneficial insects

Not used:

Synthetic fertilizers and pesticides

Genetically engineered plants and seeds

Human manure & urine

Post-harvest radiation

Organic: Hawaii

- ~200 certified farms
- 1900 acres fruits an vegetables
- Different type of operations

Organic: Hawaii

Organic Greens- Kauai

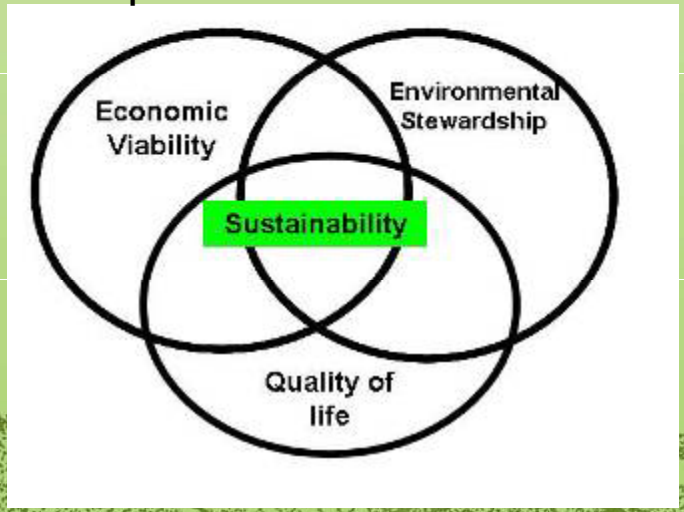
Organic Greens- Big Island

Conventional Greens- O'ahu

Basic Concepts

Adequate Food

Multiple Bottom Line



Big tool box

No silver bullet

Organic is… Unconventional

Early 1800s, Synthetic fertilizer invented

1913, Nitrogen fertilizer mass produced

1924, Rudolf Steiner; Demeter Association; Biodynamics

1931, Albert Howard; soil health = plant health

1936, Mokichi Okada; Nature farming

1943, Lady Eve Balfour; *The Living Soil*

1947, J.I Rodale; Soil and Health Foundation

1950, DDT and other synthetic biocide use in agriculture rapidly expands

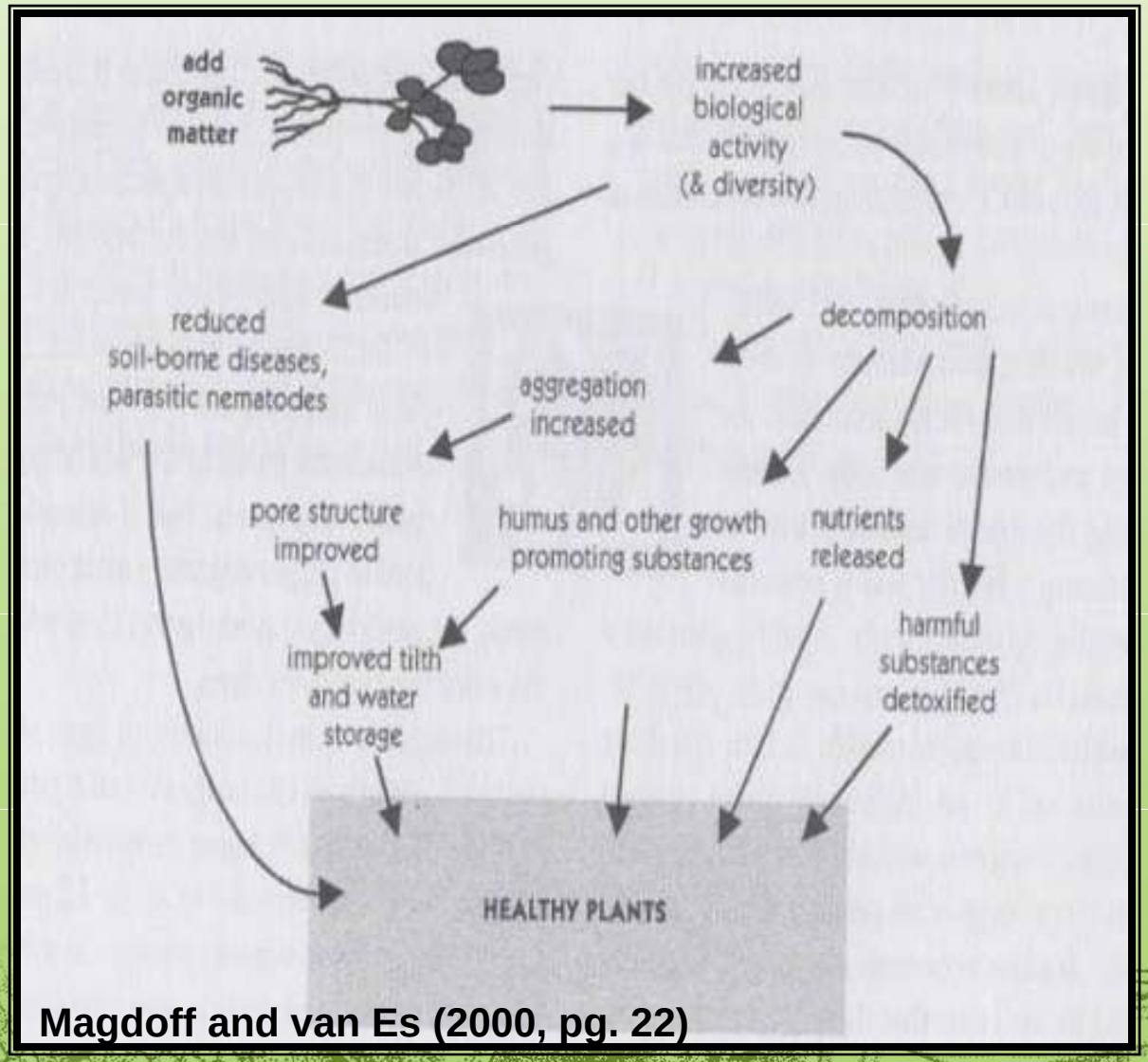
1960, Rachel Carson; Silent Spring

1971, International Federation Organic Agricultural Movements

1970's; Agroecology and Indigenous systems

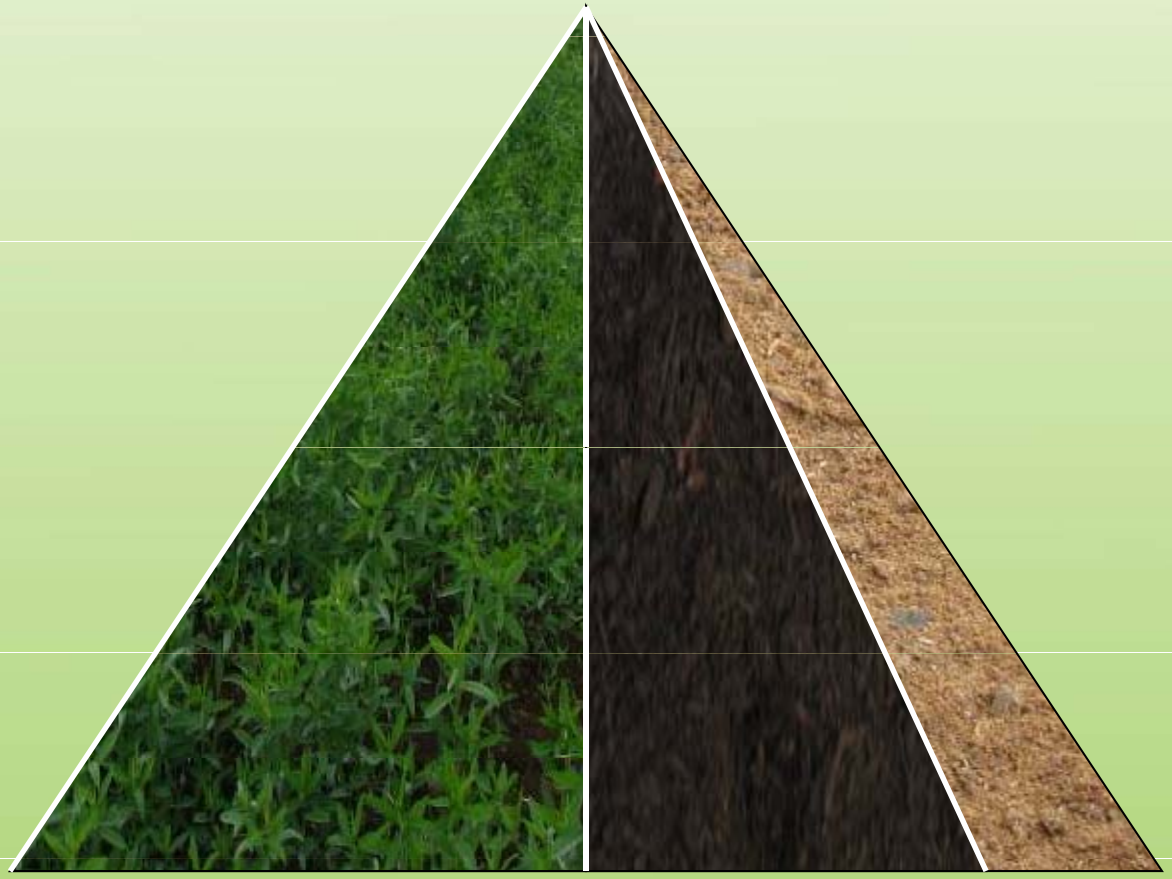
1990, US Organic Foods Act

Feed the soil



Magdoff and van Es (2000, pg. 22)

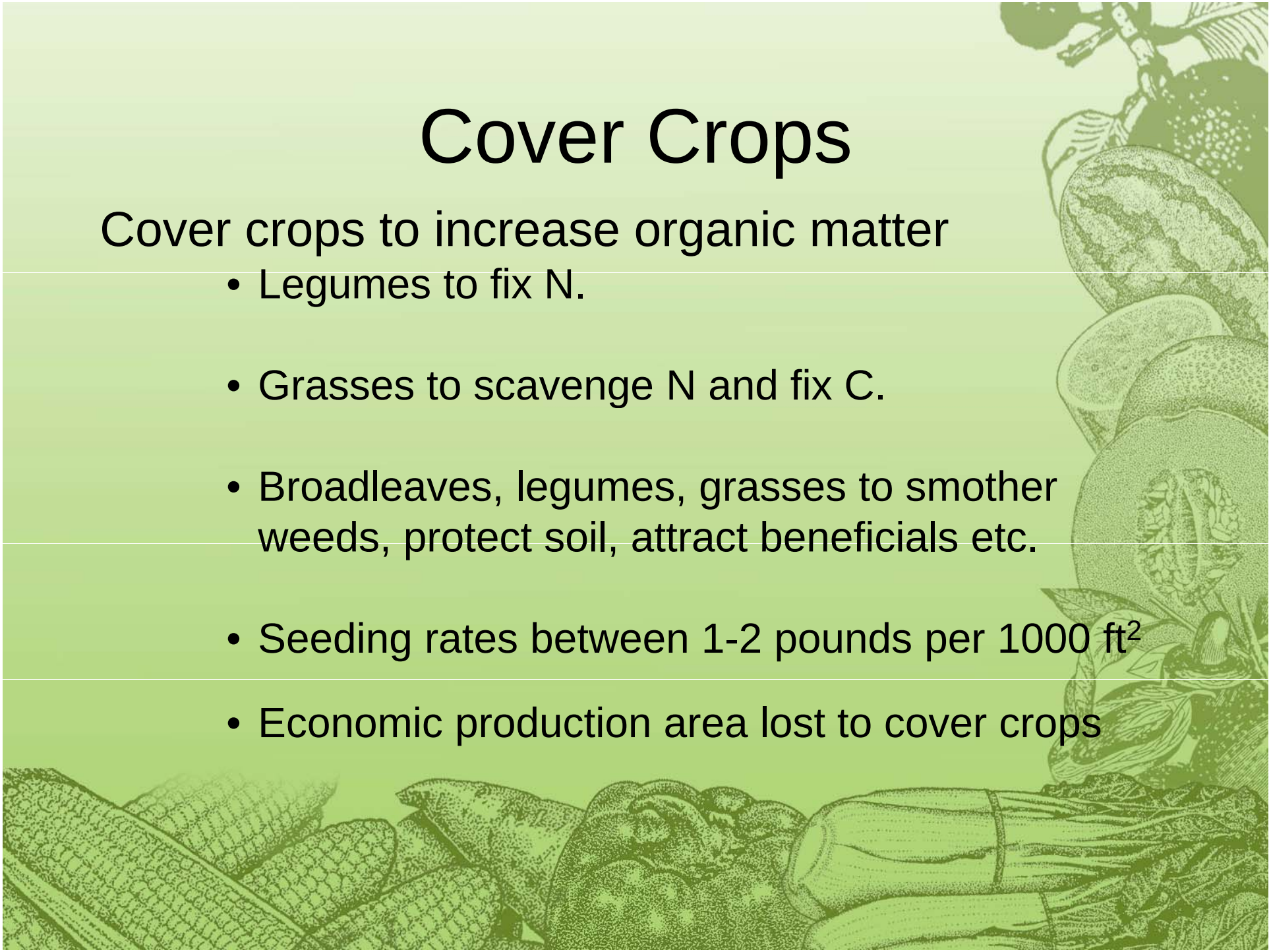
Soil food pyramid



Cover Crops

Cover crops to increase organic matter

- Legumes to fix N.
- Grasses to scavenge N and fix C.
- Broadleaves, legumes, grasses to smother weeds, protect soil, attract beneficials etc.
- Seeding rates between 1-2 pounds per 1000 ft^2
- Economic production area lost to cover crops




Clover
Peanut
Cowpea
Sunnhemp
Sorghum
x Sudan
Buckwheat

Cover Crops

Crotolaria
(Sunnhemp)

Ryegrass

Sudex

Buckwheat

Compost

Commercial Compost Operation, Oahu

Good source of organic matter

Good source of micronutrients and organic acids

Transportation costs $$

Takes time and effort

Low nitrogen

Can be woody and steal nitrogen from plants

Compost

Thermometer

On-farm compost pile, Maui

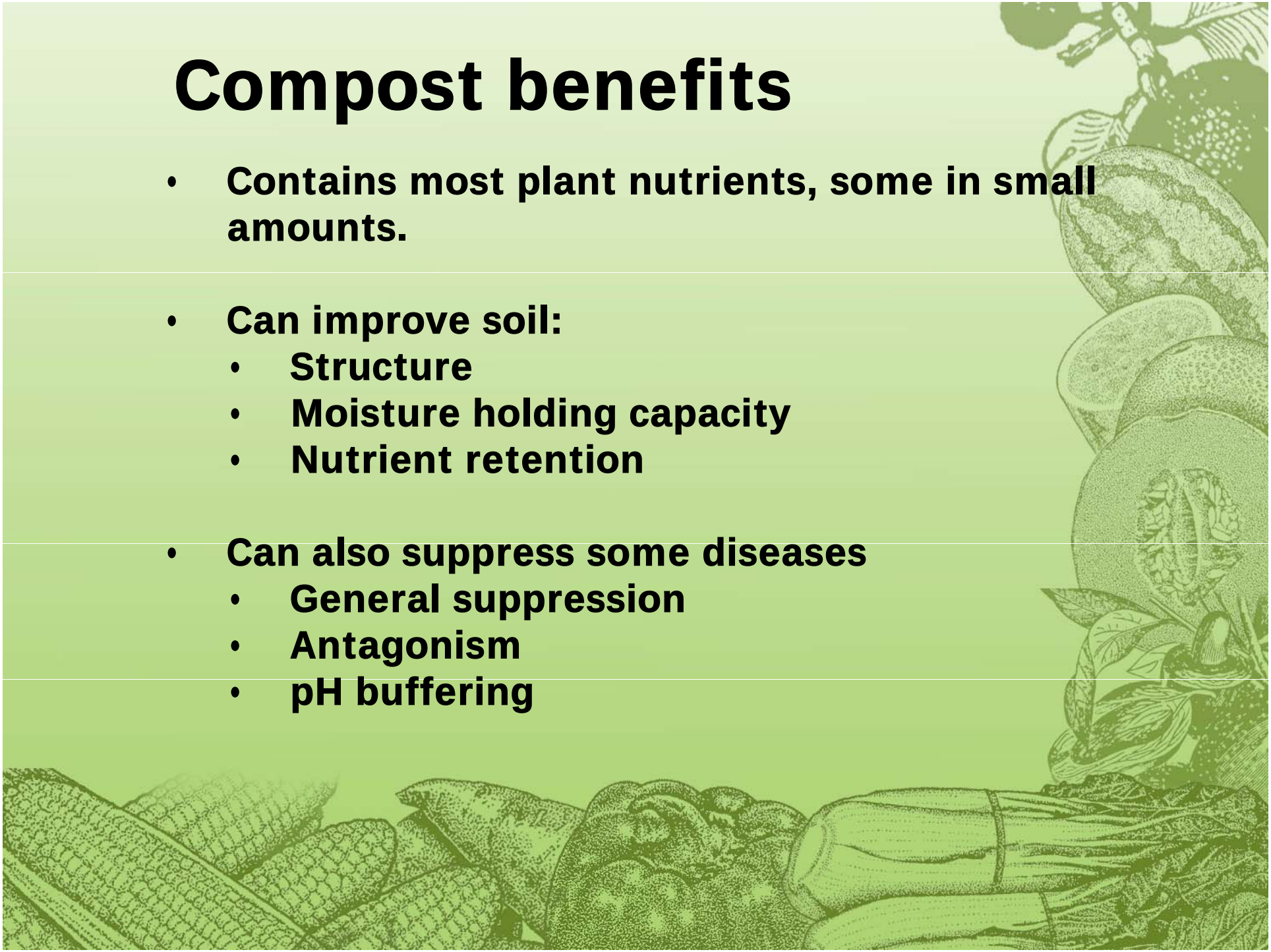
Keep moist

Compost benefits

- Contains most plant nutrients, some in small amounts.

- Can improve soil:
  - Structure
  - Moisture holding capacity
  - Nutrient retention

- Can also suppress some diseases
  - General suppression
  - Antagonism
  - pH buffering



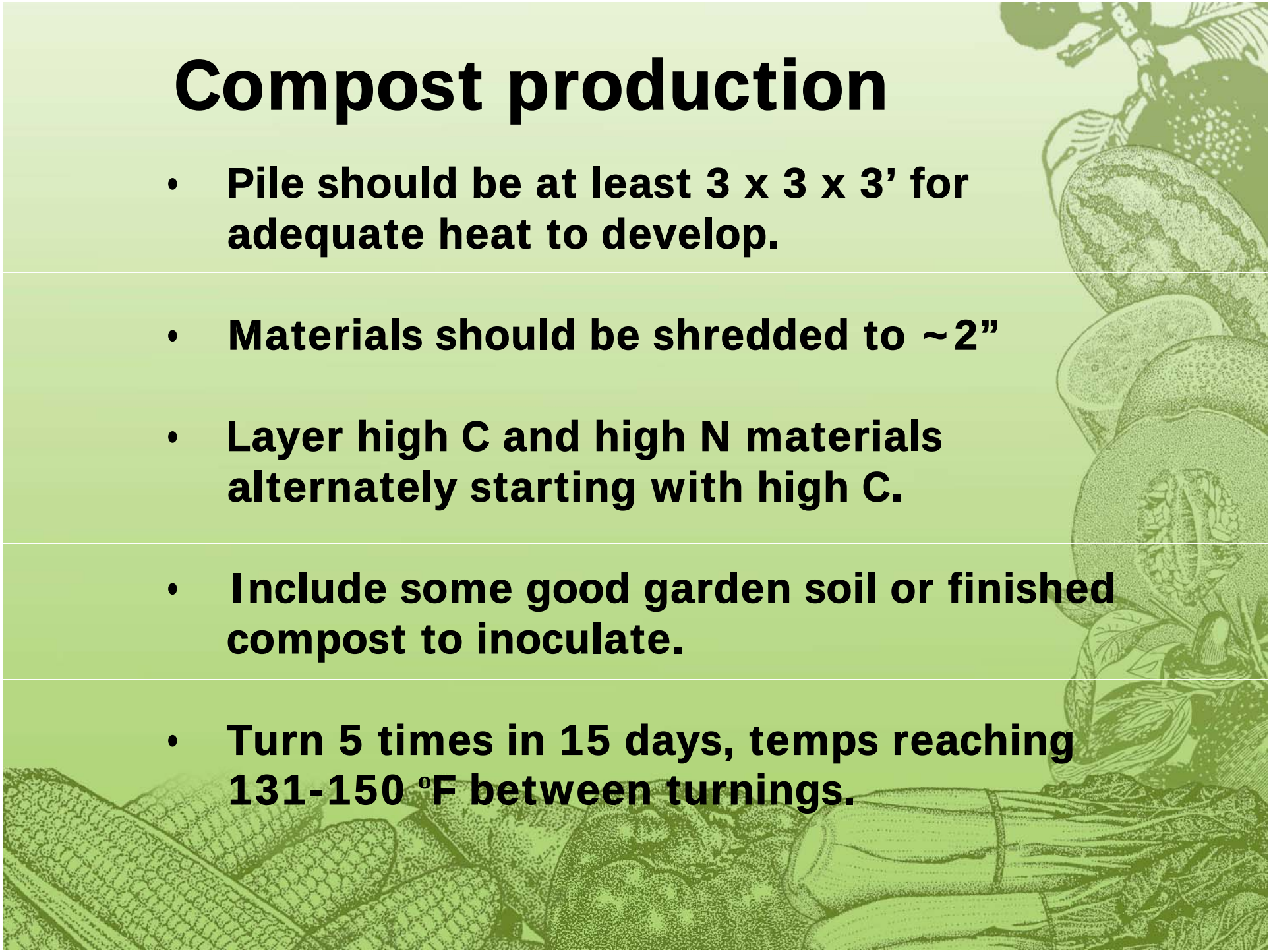
Compost production

- **Managing the decomposition of organic materials.**

- **Five essential ingredients:**
  1. **Water (wet sponge rule)**
  2. **Oxygen (Turn frequently, no off odors)**
  3. **Carbon (Wood chips, paper, cardboard)**
  4. **Nitrogen (grass, manure, kitchen scraps)**
  5. **Decomposing organisms**
     1. **Actinomycetes**
     2. **Bacteria**
     3. **Fungi**
     4. **Worms, slugs etc.**

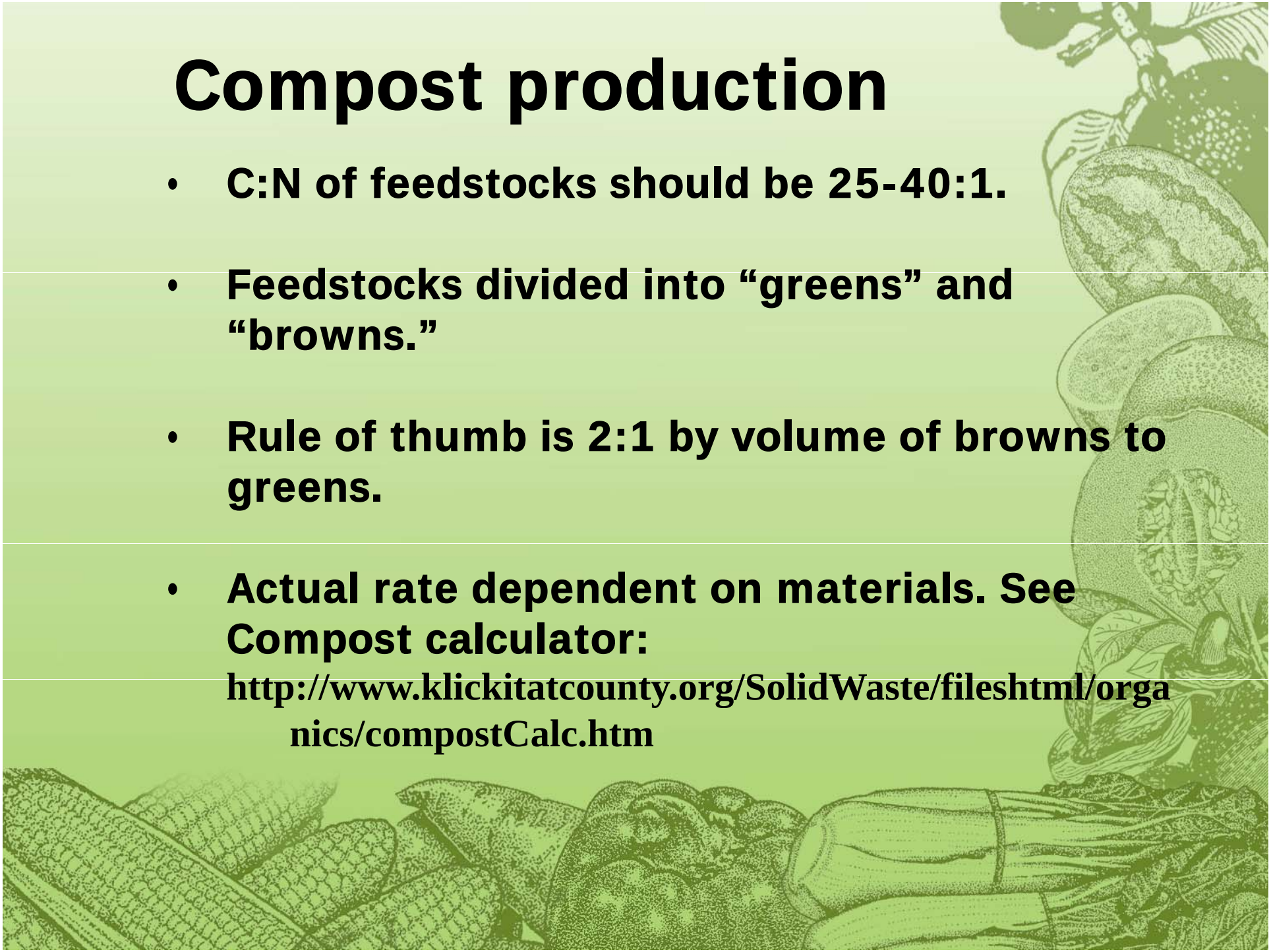
Compost production

- Pile should be at least 3 x 3 x 3’ for adequate heat to develop.
- Materials should be shredded to ~2”
- Layer high C and high N materials alternately starting with high C.
- Include some good garden soil or finished compost to inoculate.
- Turn 5 times in 15 days, temps reaching 131-150 ^{o}F between turnings.



Compost production

- **C:N of feedstocks should be 25-40:1.**
- **Feedstocks divided into “greens” and “browns.”**
- **Rule of thumb is 2:1 by volume of browns to greens.**
- **Actual rate dependent on materials. See Compost calculator:**
  http://www.klickitatcounty.org/SolidWaste/fileshtml/organics/compostCalc.htm



MATERIAL	C:N RATIO
Fresh chicken manure (laying)	6:1
Tomato processing waste	11:1
Vegetable waste	12:1
Alfalfa hay	13:1
Fresh chicken manure (broiler)	14:1
Sheep manure	16:1
Fresh turkey manure	16:1
Grass clippings	17:1
Seaweed	19:1
Fresh cattle manure	19:1
Rotted manure	20:1
Apple pomace	21:1
Fresh horse manure	22:1
Grape pomace	28:1
Legume shells	30:1
Cereal hay	32:1
Dry leaves	40–80:1
Corn stalks	50:1
Oat straw	74:1
Grain chaff and hulls (e.g., rice hulls)	80–120:1
Straw	80:1
Timothy hay	80:1
Paper	170:1
Newsprint, cardboard	400:1
Sawdust	400:1
Wood chips, shavings	500+:1

Making and Using Compost

http://casfs.ucsc.edu/education/instruction/tofg/download/unit_1.7_compost.pdf

Klickitat County

SOLID WASTE

Compost Mix Calculator

Choose a material. Enter a cubic foot measurement. Press TAB. The Total C:N ratio for your recipe will appear.

Aim for a TOTAL C:N RATIO of 30. (25-30 is good. 20-40 is OK.)

Material	CuFt	LbWet	%H2O	available %C	%N	available Lb C	Lb N	available C:N
Vegetable Waste 11:1	1	58.7	87	34.75	3.2	2.65	0.24	10.86
Wood Chips Softw ood 226:1	3	44.44	40	20.38	0.09	5.43	0.02	226.4
None 0:1	0							
None 0:1	0							
TOTALS:						8.09	0.27	30.15

For a total C:N Ratio of 30:1 mix
1 part(s) Vegetable Waste
3 part(s) Wood Chips Softw ood

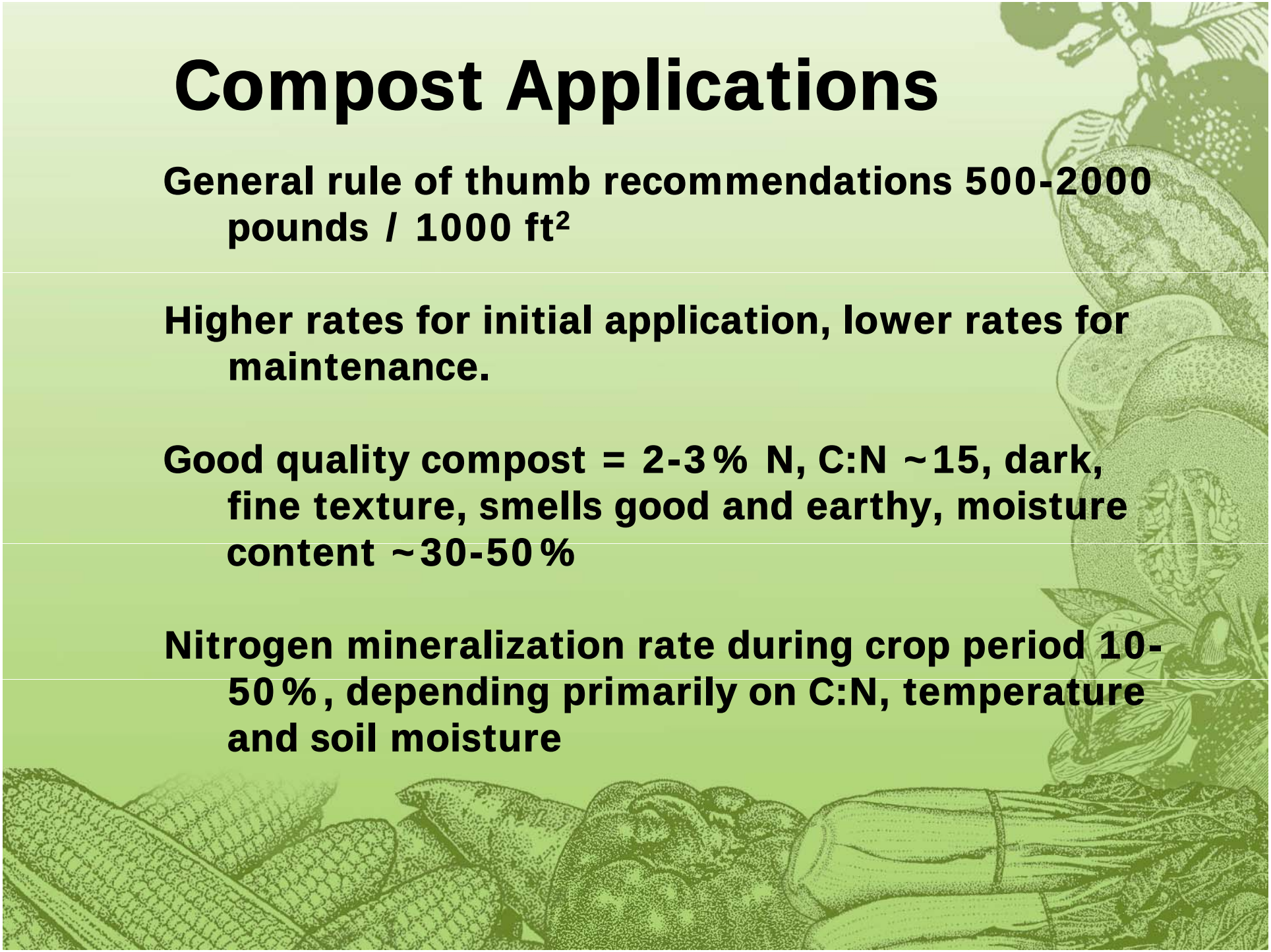
Compost Applications

General rule of thumb recommendations 500-2000 pounds / 1000 ft^2

Higher rates for initial application, lower rates for maintenance.

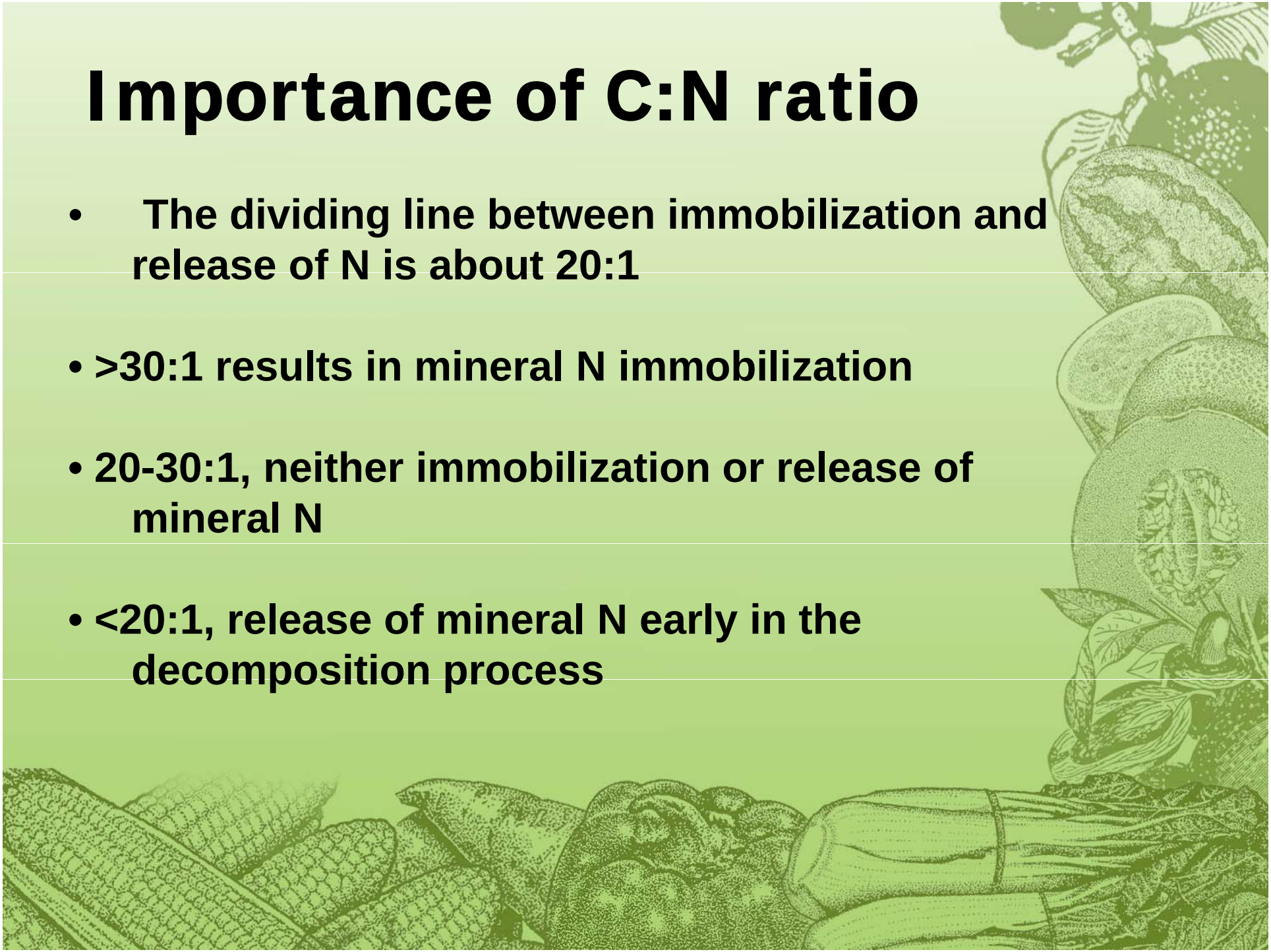
Good quality compost = 2-3% N, C:N ~15, dark, fine texture, smells good and earthy, moisture content ~30-50%

Nitrogen mineralization rate during crop period 10-50%, depending primarily on C:N, temperature and soil moisture



Importance of C:N ratio

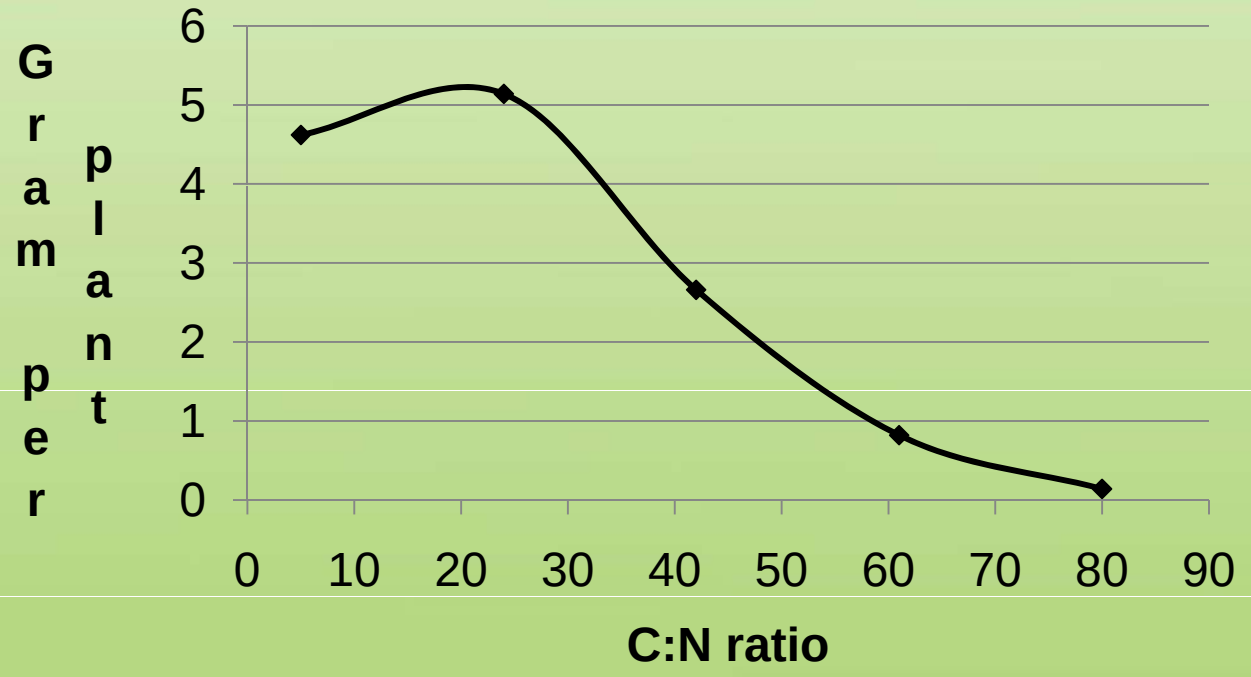
- The dividing line between immobilization and release of N is about 20:1
- >30:1 results in mineral N immobilization
- 20-30:1, neither immobilization or release of mineral N
- <20:1, release of mineral N early in the decomposition process



Adjust C:N ratio

All pots received 1 gram nitrogen as compost alone or in combination with meat product.

Carbon to Nitrogen ratio of amendment

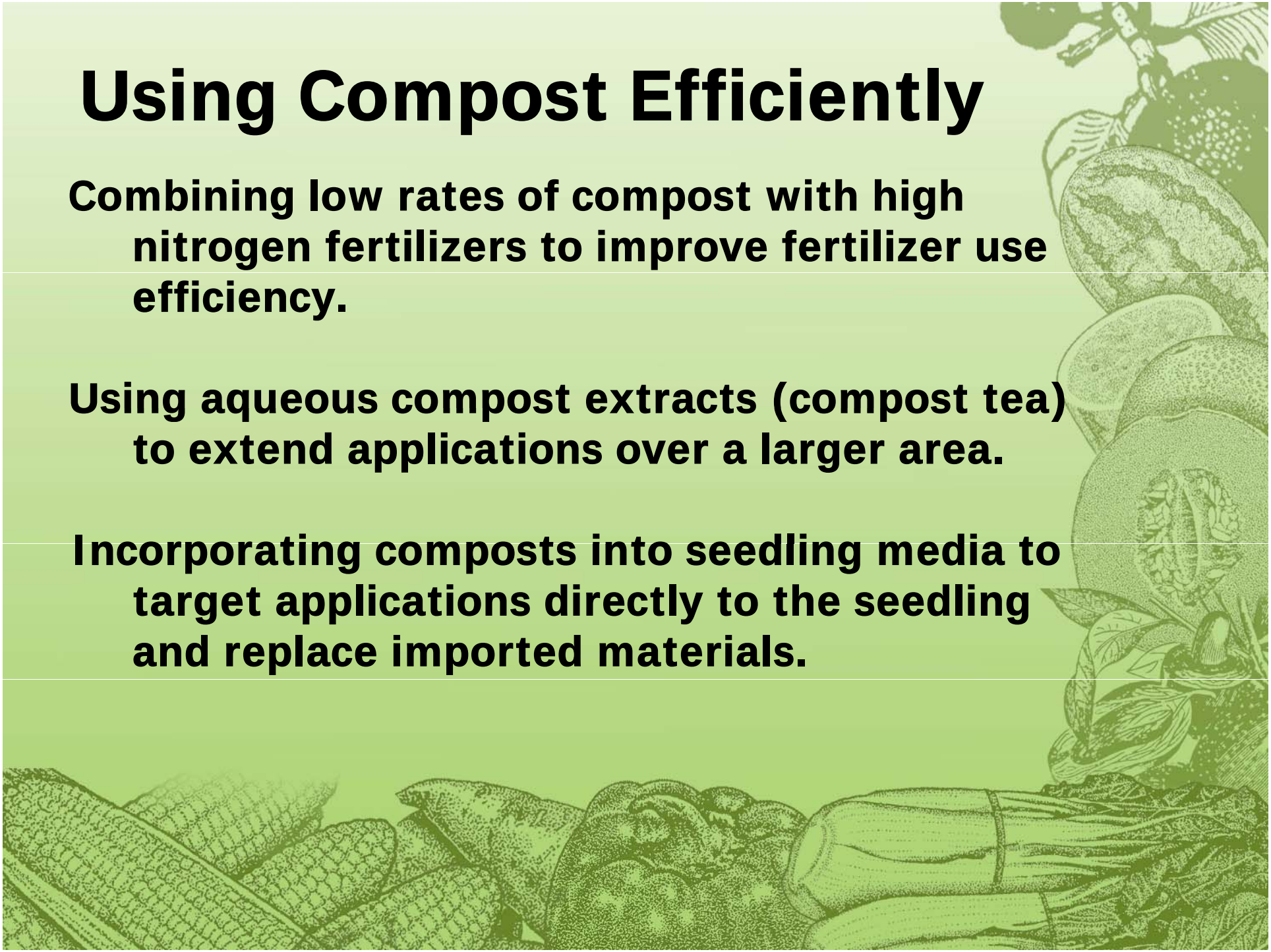


Using Compost Efficiently

Combining low rates of compost with high nitrogen fertilizers to improve fertilizer use efficiency.

Using aqueous compost extracts (compost tea) to extend applications over a larger area.

Incorporating composts into seedling media to target applications directly to the seedling and replace imported materials.



Seedlings in 100% compost

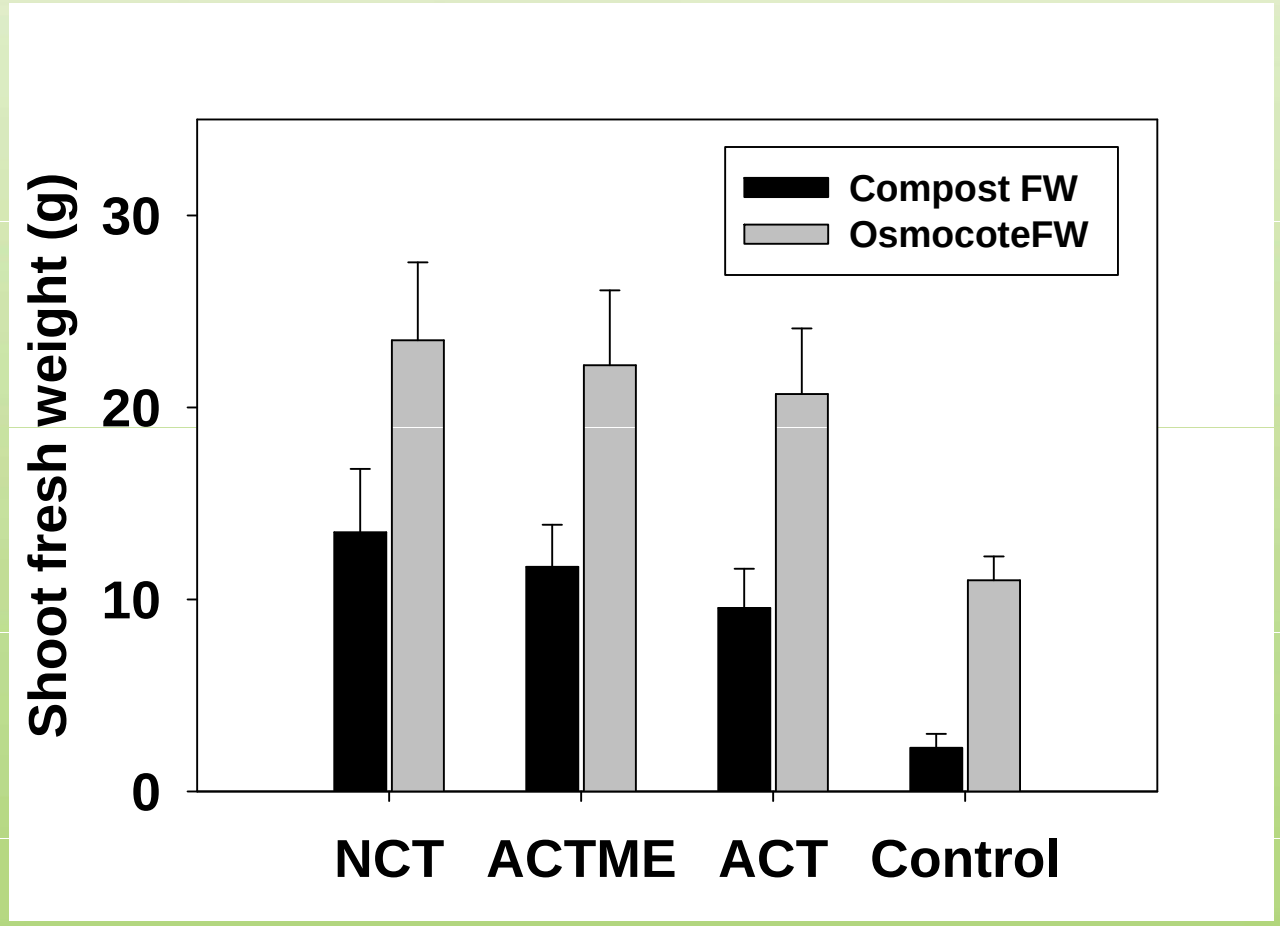
Compost “Tea”

- **Uses air and water to extract:**
  - **Nutrients**
  - **Organic acids**
  - **Microbes**
- **Ratio of water to compost ranges 10:1-100:1**
- **Water is not circulated, only air**
- **12-24 hrs**






Yield of *Brassica rapa* 'Shogun' (40 DAP)



Worm species

1. **Blue worms (*Perionyx excavatus*)**
2. **Tiger worms (*Eisenia* sp.)**
3. **Skinny Yellows - *Nematogenia panamaensis*.**
4. **Lazy Grays - *Dichogaster modiglianii***


Holiday Plant
And Craft Sale

UH Resources

- *Organic Soil Amendments for Sustainable Agriculture: Organic Sources of NPK* from Hawaii Soil Fertility Manual
- Vermicomposting website:

http://www.ctahr.hawaii.edu/sustainag/video/vermicompost_real.html

  - *Small Scale Vermicomposting, UH Free Publication,* http://www.ctahr.hawaii.edu/oc/freepubs/pdf/HG-45.pdf
  - *Composting Worms for Hawaii,* UH Free Publication, http://www.ctahr.hawaii.edu/oc/freepubs/pdf/HG-46.pdf

- *Backyard Composting: Recycling a Natural Product*, UH Free Publication, http://www.ctahr.hawaii.edu/oc/freepubs/pdf/HG-41.pdf

Organic amendments

Table 15-1. Total nutrient contents of some commonly used organic fertilizers[1]

Material	N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu
	% dry weight						ppm (mg/kg) of dry weight			
Poultry (broiler) manure[a]	4.4	2.1	2.6	2.3	1.0	0.6	1000	413	480	172
Composted chicken (layer) manure[b]	2.3	3.5	2.9	15.5	1.3					
Dairy cow manure[a]	2.4	0.7	2.1	1.4	0.8	0.3	1800	165	165	30
Swine manure[c]	2.1	0.8	1.2	1.6	0.3	0.3	1100	182	390	150
Sheep manure[c]	3.5	0.6	1.0	0.5	0.2	0.2	-	150	175	30
Horse manure[c]	1.4	0.4	1.0	1.6	0.6	0.3	-	200	125	25
Feedlot cattle manure[d]	1.9	0.7	2.0	1.3	0.7	0.5	5000	40	8	2
Young rye green manure	2.5	0.2	2.1	0.1	0.05	0.04	100	50	40	5
Spoiled legume hay	2.5	0.2	1.8	0.2	0.2	0.2	100	100	50	10
Cowpea green manure[e]	3.6	0.4	3.5	1.5	0.4					
Leucaena green manure[e]	3.8	0.2	1.7	1.1	0.3					
Sewage sludge:										
Anaerobically digested[f]	5.2	0.6	0.06	1.5	0.3	–	15,000	80	1000	400
Primary[f]	1.8	0.4	0.03	0.8	0.1	-	8000	200	450	300

[a]Composition estimated from means of approximately 800 and 400 samples analyzed by the University of Maryland manure analysis program from 1985 to 1990.
[b]Silva, J.A., et al. 1995. The use of composted poultry manure as a fertilizer. In: Hawaii Agriculture: Positioning for Growth. College of Tropical Agriculture and Human Resources, University of Hawaii at Manoa.
[c]Calculated from North Carolina Cooperative Extension Service Soil Fact Sheets prepared by Zublena et al. (1993).
[d]Composition based on average analysis reported in Eghball and Power (1994), Beef cattle feedlot manure management. J. Soil and Water Conserv. 49:113–122.
[e]Hue, N.V., and I. Amien. 1989. Aluminum detoxification with green manures. Commun. Soil Sci. Plant Anal. 20:1499–1511.
[f]Hue, N.V., and S.A. Ranjith. 1994. Sewage sludge in Hawaii: Chemical composition and reactions with soils and plants. Water, Air, and Soil Poll. 72:265–283.
[1]Modified from N.C.Brady and R.R. Weil, 1999, The nature and properties of soils.

Locally Available Organic* Fertilizers

PLANT TISSUE ANALYSES WORKSHEET

	%							ug/g	
Description	N	C	P	K	Ca	Mg	Na	NO3-N	NH4-N
UH Vermicompost	1.81	25.67	1.06	1.88	10.92	0.99	0.38	1211.84	122.17
Menhune Magic Compost	0.70	19.36	0.23	0.81	5.49	0.73	0.32	113.70	163.35
Kupa'a Compost	1.71	24.96	0.48	1.34	3.04	0.72	0.16	323.80	--
Chicken manure & mortalities	2.91	21.10	2.98	1.78	17.71	0.90	0.77	1748.03	--
Bioflor®	5.47	27.35	3.00	5.75	8.49	0.67	0.82	126.00	1784.00
Island Commdities Bone & Blood	9.38	45.52	3.38	0.77	6.13	0.18	0.70	114.00	182.00
Gorilla Ogo (Gracilaria)	0.41	20.40	0.05	14.28	0.48	0.77	5.71	__--	--

Biologically derived amendments

Requires microbial activity to make biologically complexed nutrients available to plants.

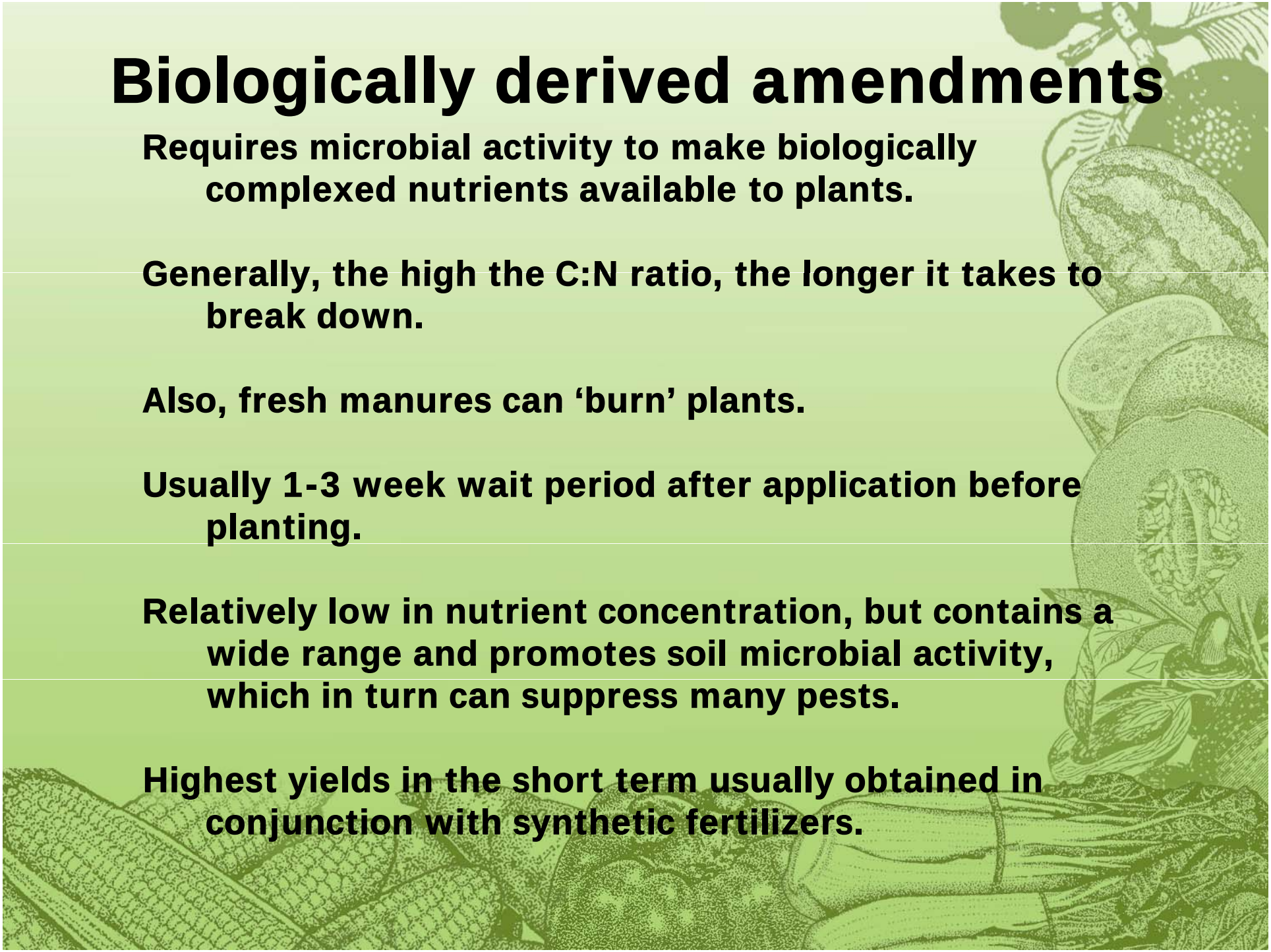
Generally, the high the C:N ratio, the longer it takes to break down.

Also, fresh manures can 'burn' plants.

Usually 1-3 week wait period after application before planting.

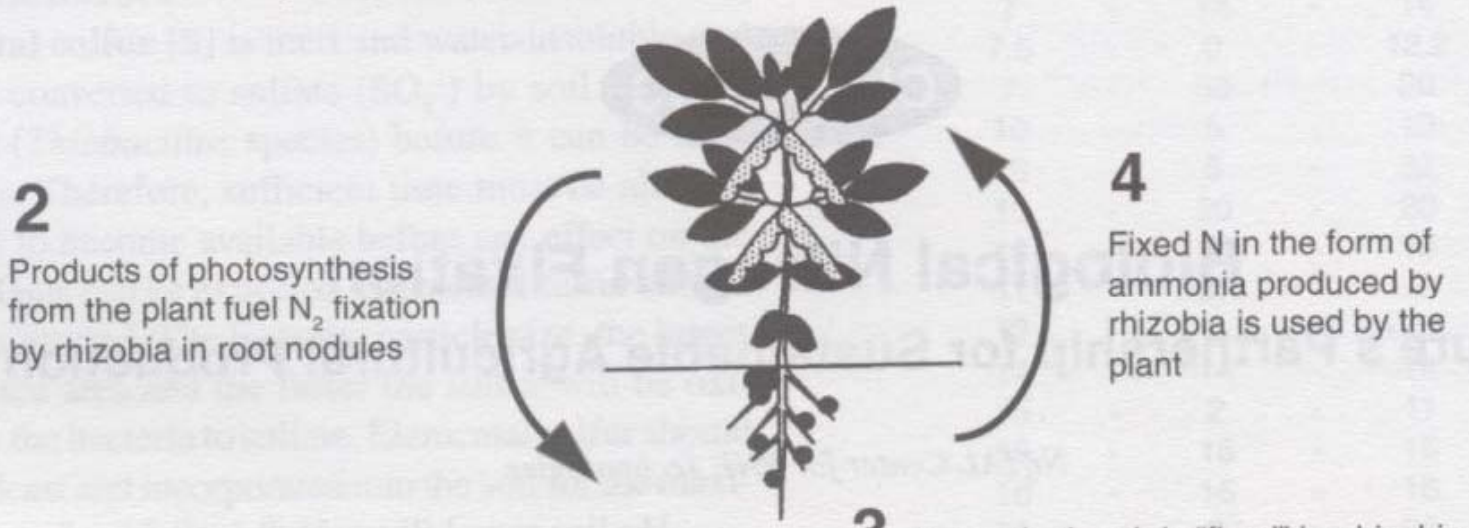
Relatively low in nutrient concentration, but contains a wide range and promotes soil microbial activity, which in turn can suppress many pests.

Highest yields in the short term usually obtained in conjunction with synthetic fertilizers.

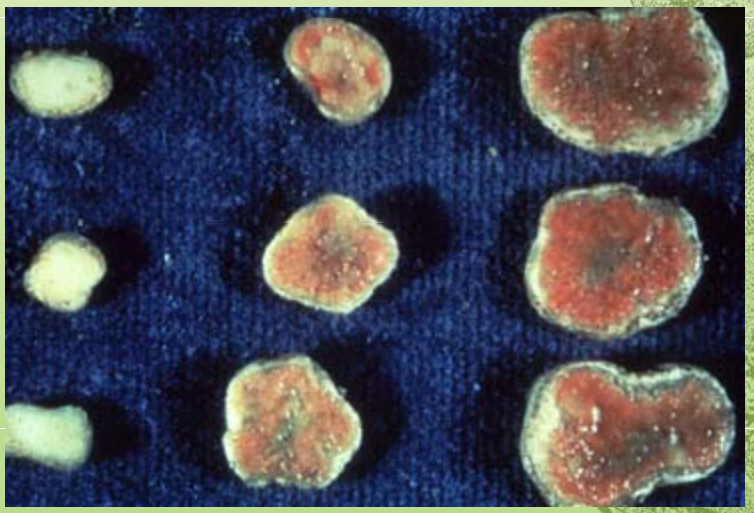


N fixation

Figure 13-1. The legume-rhizobia symbiosis.



N fixation



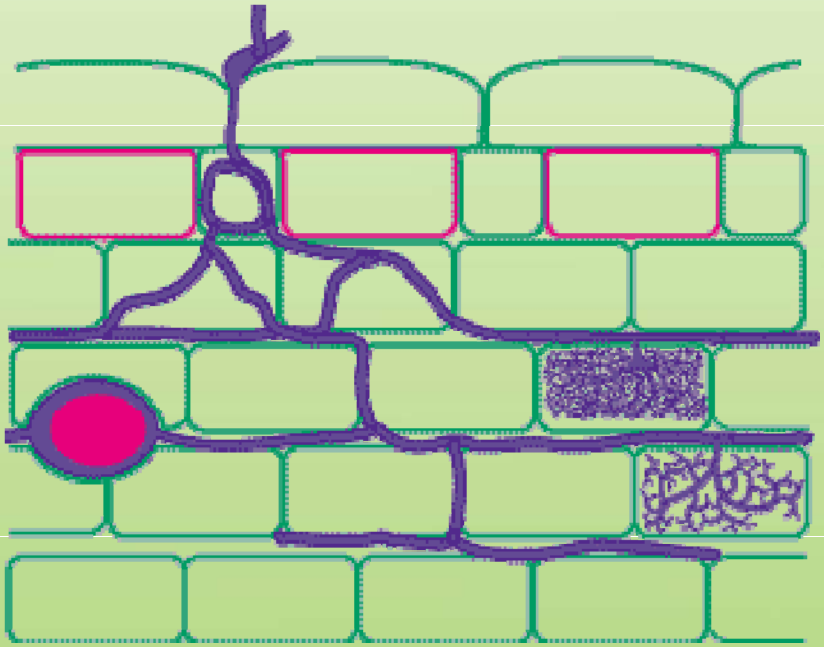
Mycorhizzae

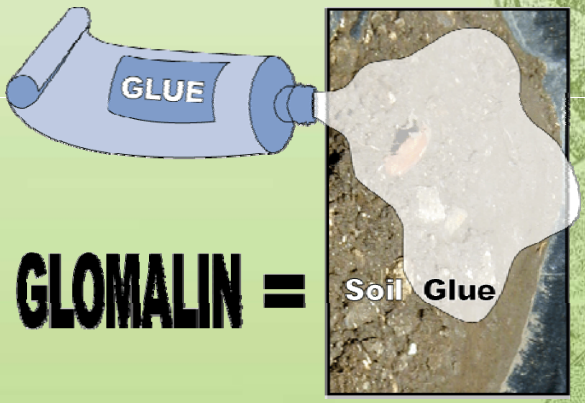
Ecto-

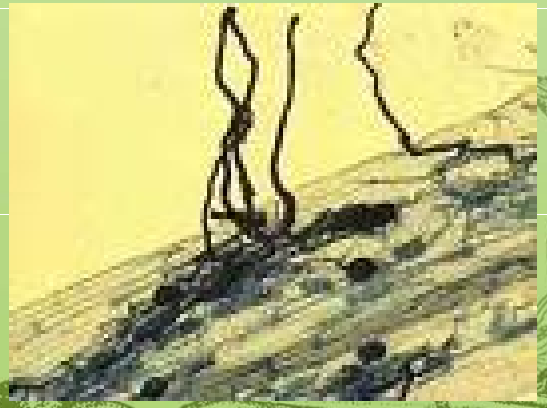
Endo-

Vesicle forming *Glomus sp.*

Mycorrhiza







http://universe-review.ca/

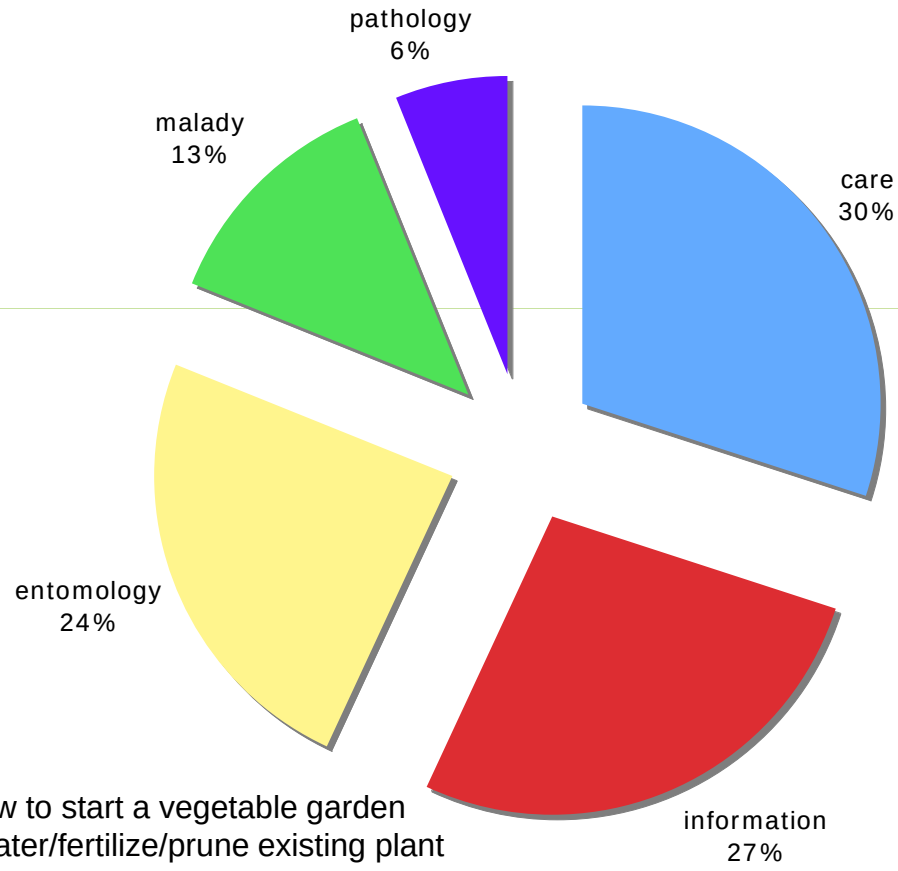
Mycorhizzae

Onion (*Allium cepa*), Pigeon Pea (*Cajanus cajan*) and Cassava (*Manihot esculentum*) are considered highly to very highly dependent on mycorrhizae.

Soy bean (*Glycine max*), Tomato (*Lycopersicon lycopersicum*) and Sweet corn (*Zea mays*) are marginally dependent.

The Amaranths (e.g. *Amaranthus* sp.), Chenopods (e.g. *Spinacia oleracea*) and Crucifers (e.g. *Brassica* sp.) are not known to form mycorrhizal associations.

Questions



Examples
- Information: how to start a vegetable garden
- Care: how to water/fertilize/prune existing plant
- Entomology: how to get rid of insects
- Pathology: what to do for virus
- Malady: plant not thriving; don't know why

Insect Pests

Not all insects are bad

- Pollination
- Organic matter decomposition
- Natural enemies

Parasitic Wasp

Lady bug larvae

Hover fly larvae

Natural Enemies

Waimanalo & Poamoho

Spider and eggs on pak choi

Lacewing and aphid on eggplant

Braconid wasp stinging fruit fly larvae on guava

Hoverfly on *Bidens*

Sphecid wasp nest

Looper & DBM larvae

Ladybug

Encyrtid wasp

Parasitized scale

Preserving Natural Enemies

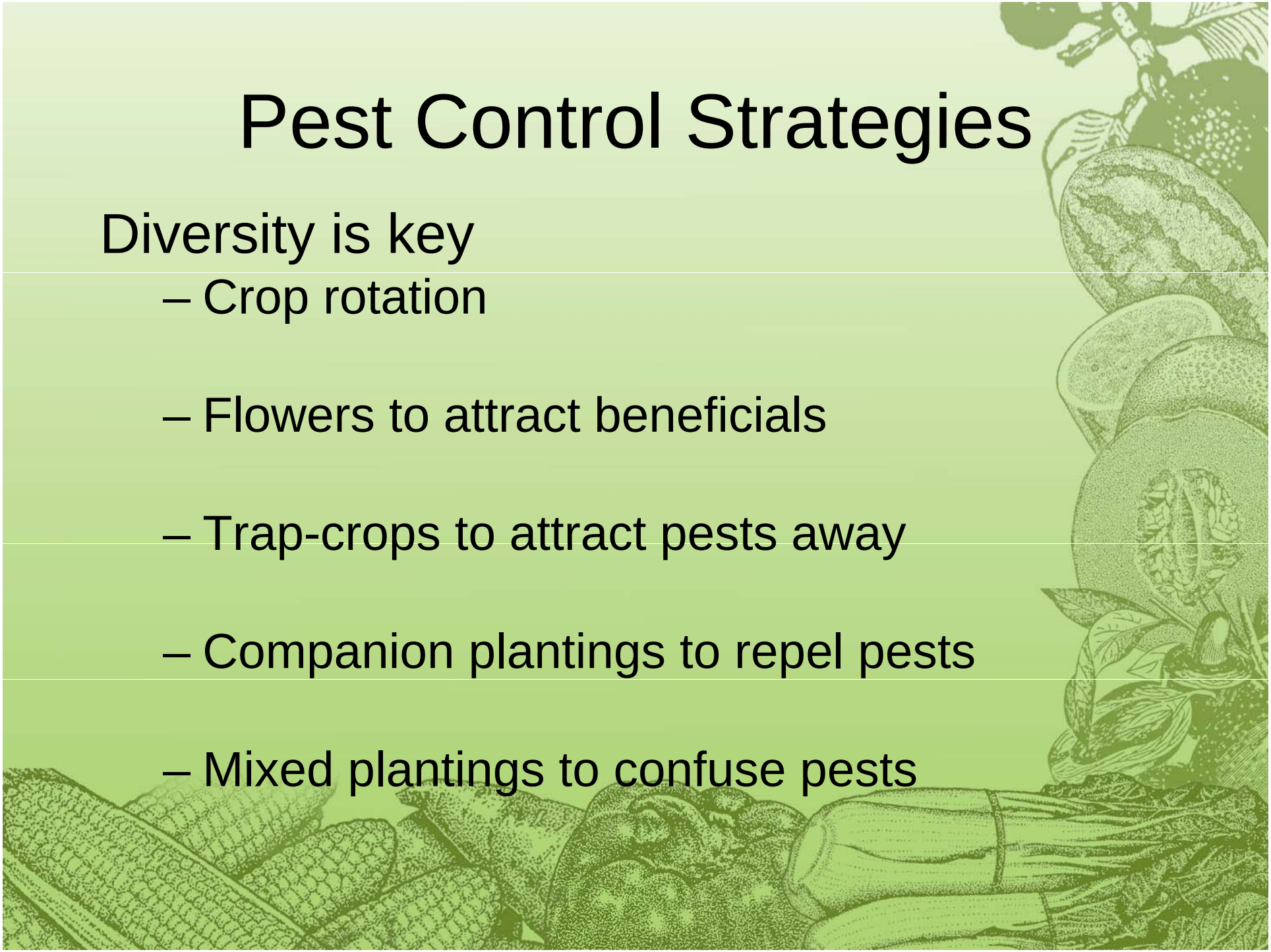
http://www.ctahr.hawaii.edu/organic/resources.asp

- Limit pesticide sprays
- Provide flowering plants

Pest Control Strategies

Diversity is key

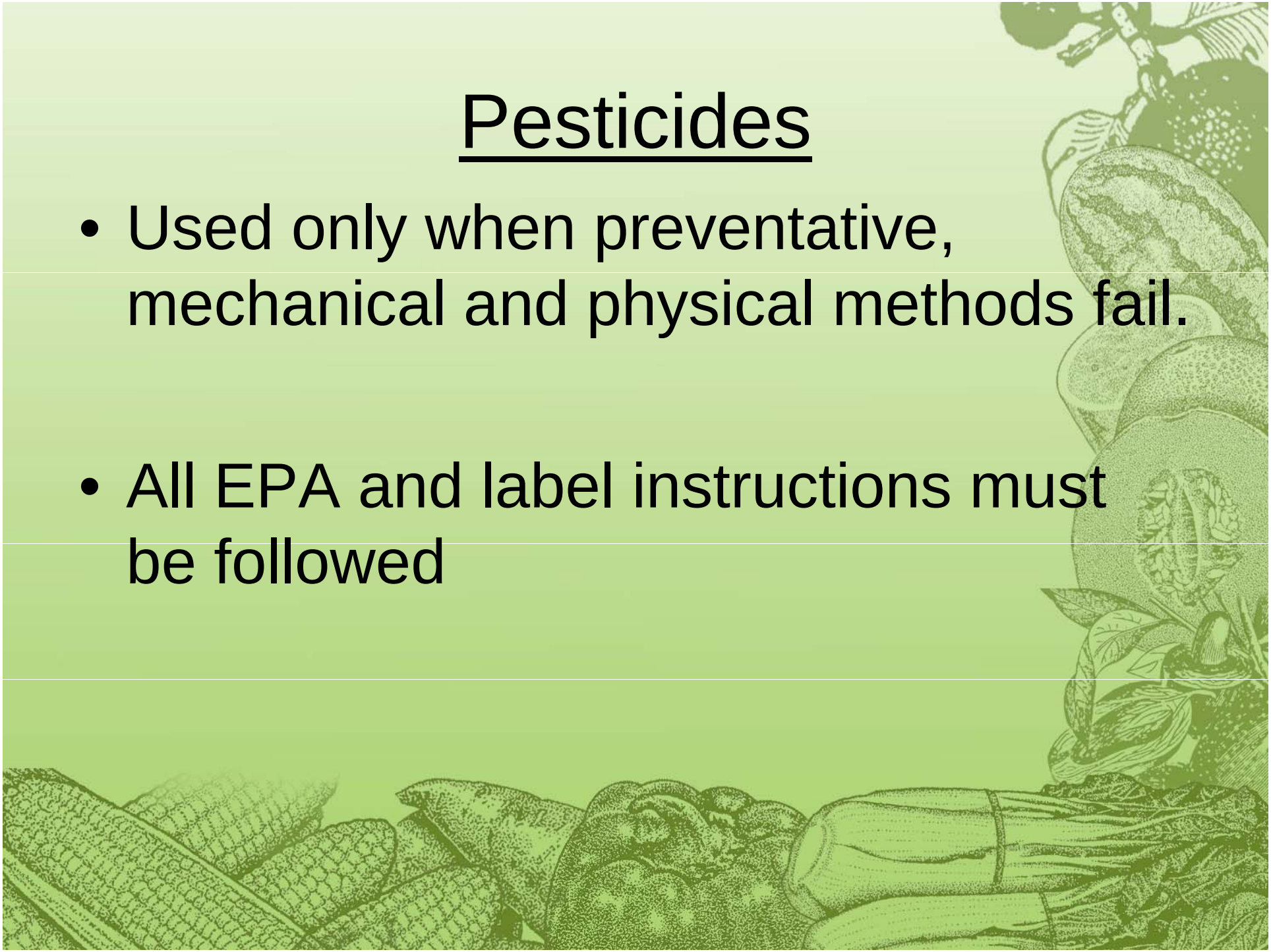
- Crop rotation
- Flowers to attract beneficials
- Trap-crops to attract pests away
- Companion plantings to repel pests
- Mixed plantings to confuse pests



Pesticides

- Used only when preventative, mechanical and physical methods fail.

- All EPA and label instructions must be followed



OMRI™

Listed

Organic Materials Review Institute

http://www.omri.org/

Organic Seed List
(Free)

INSECTICIDAL SOAP 49.52 CF

OLYMPIC HORTICULTURAL PRODUCTS™

SPECIMEN LABEL

FOR USE on FRUITS, NUTS, VEGETABLES, and ORNAMENTALS

ACTIVE INGREDIENT:	
Potassium Salts of Fatty Acids	49.52%
INERT INGREDIENTS	50.48%
Total	100.00%

EPA Reg. No. 36488-45-59807 **EPA Est. No. 44616-MO-1**

Net Contents: 2.5 gallons or 30 gallon drums

KEEP OUT OF REACH OF CHILDREN

WARNING / AVISO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

WARNING: Causes substantial but temporary eye injury. Causes skin irritation. Do not get on skin, in eyes or on clothing. Wear goggles or safety glasses. Wash thoroughly with soap and water after handling. Remove and wash contaminated clothing before reuse.

PERSONAL PROTECTIVE EQUIPMENT

Some materials that are chemical-resistant to this product are listed below. If you want more options, follow the instructions for Category C on an EPA chemical resistant category selection chart.

Applicators and other handlers of the diluted product must wear: Clothing that avoids exposure of bare skin to product including long pants, long sleeved shirt, socks, shoes, and protective gloves. Protective eyewear should be used for overhead exposure.

Mixers and loaders of the concentrate product must wear: Coveralls over short-sleeved shirt and short pants.

Chemical resistant gloves such as barrier laminate, butyl rubber, nitrile rubber, neoprene rubber, polyvinyl chloride, viton. Chemical-resistant footwear plus socks. Protective eyewear. Chemical-resistant headgear for overhead exposure. Chemical-resistant apron when cleaning equipment, mixing, or loading.

Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. Follow manufacturer's instructions for cleaning / maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

User Safety Recommendations

Users should:

- Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.
- Remove contaminated clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

STATEMENT OF PRACTICAL TREATMENT

If in Eyes: Hold eyelids open and flush with a steady, gentle stream of water for 15 minutes. Get medical attention. **If on Skin:** Wash with plenty of soap and water. Get medical attention. **If Inhaled:** Remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. Get medical attention.

ENVIRONMENTAL HAZARDS

This product may be hazardous to aquatic invertebrates. For terrestrial uses, do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water by cleaning of equipment or disposal of water.

PHYSICAL OR CHEMICAL HAZARDS

Flammable, keep away from heat and flame.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or tribe, consult the agency responsible for pesticide regulation.

AGRICULTURAL USE REQUIREMENTS

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR Part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE) and restricted-entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 12 hours.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soils, or water is:

Clothing that avoids exposure of bare skin to product including:

- Long pants
- Long-sleeved shirt
- Socks
- Shoes
- Protective gloves

INSECTICIDAL SOAP 49.52 CF is an effective contact insecticide that is ideal for use in areas such as parks, restaurants, hospitals, school grounds, malls, and other public places, as well as in agriculture, horticulture, and greenhouses.

NATURAL PYRETHRIN CONCENTRATE

ACTIVE INGREDIENTS:

Pyrethrins	0.96%
Piperonyl Butoxide Technical*	9.60%
INERT INGREDIENTS**	89.44% *

Equivalent to 7.68% (Butylcarbityl) (6-propylpiperonyl) ether and 1.92% related compounds.

** Contains Petroleum Distillates.

KEEP OUT OF REACH OF CHILDREN

CAUTION

EPA Reg. No. 655-587-829 J3 EPA EST. NO. 829-FL-1

ASPARAGUS: ASPARAGUS BEETLE

BEANS: APHIDS, LEAFHOPPERS, WHITE FLY, MEXICAN B BEETLE, 12-SPOTTED CUCUMBER BEETLE.

BROCCOLI, CABBAGE, BRUSSELS SPROUTS, CAULIFLOW APHIDS, CABBAGE LOOPER, CROSS-STRIPED CABBAGE WO DIAMONDBACK MOTH LARVAE, FLEA BEETLE, HARLEQUIN B IMPORTED CABBAGEWORM, STINKBUG.

CELERY: GREEN PEACH APHIDS, CABBAGE LOOPER, LEAF T

CRANBERRIES: FIREWORMS, LEAFHOPPER.

EGGPLANTS: BLISTER BEETLE, COLORADO POTATO BEETLE, F BEETLE, GREEN PEACH APHID.

LETTUCE: CABBAGE LOOPER, GREEN PEACH APHID, DIAMO BACK MOTH LARVAE, IMPORTED CABBAGE WORM

MUSTARD GREENS, KALE, COLLARDS, TURNIPS: IMPORTED C BAGEWORM, DIAMONDBACK CATERPILLAR, APHIDS, CABB LOOPER.

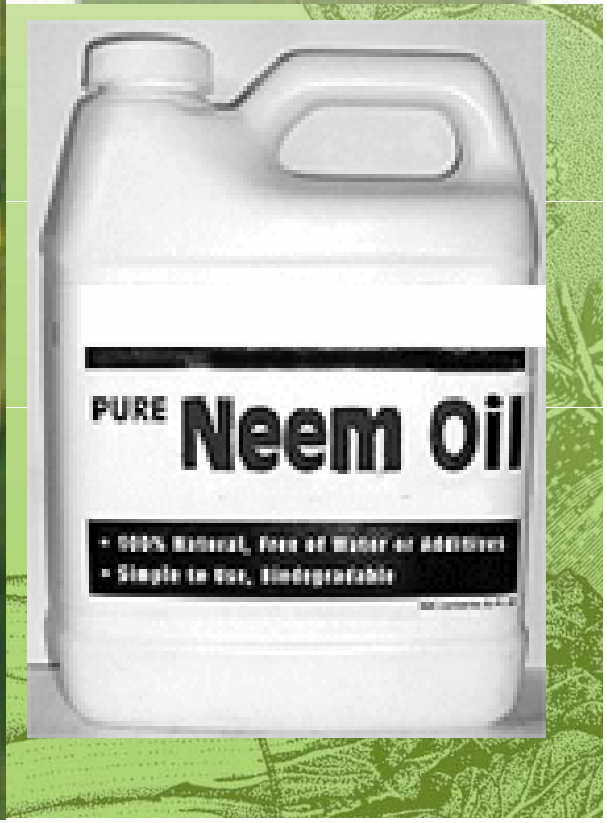
PEPPERS: GREEN PEACH APHID.

POTATOES: APHIDS, COLORADO POTATO BEETLE, FLEA BEE LEAF HOPPER.

RADISH: APHIDS, FLEA BEETLE.

SPINACH: APHIDS, CABBAGE LOOPER, WEBWORM.

TOMATOES: GREEN PEACH APHID, COLORADO POTATO BEE STINK BUG, FLEA BEETLE.


PURE Neem Oil
• 100% Natural, Free of Water or Additives
• Simple to Use, Biodegradable

AZATIN® XL

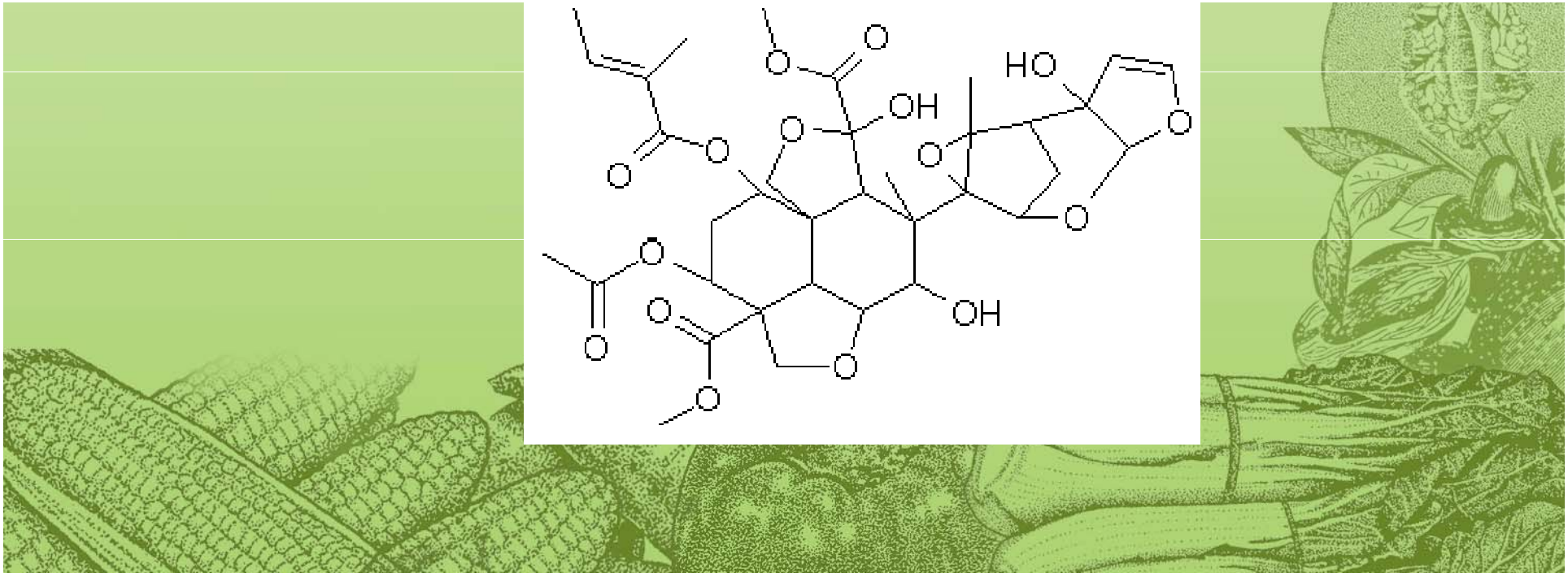
BIOLOGICAL INSECTICIDE — SPECIMEN LABEL

For Indoor and Outdoor Use on Ornamentals and Horticultural Crops
Insect Growth Regulator

ACTIVE INGREDIENT:	
Azadirachtin*	3.0%
OTHER INGREDIENTS:	97.0%
TOTAL:	100.0%

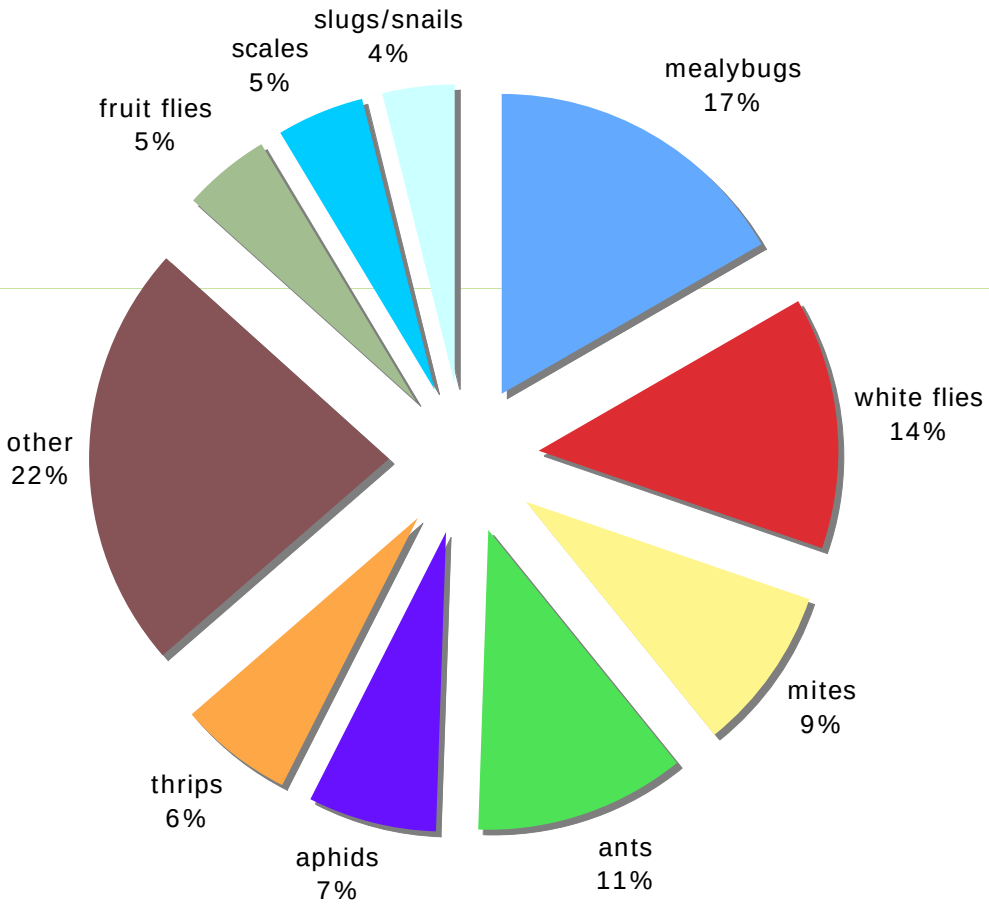
*Contains 0.265 pounds (120 grams) of azadirachtin per gallon

EPA Reg. No. 70051-27-59807 **EPA Est. No.: 44616-MO-1**



Bacillus thuringiensis

Common Pests



Disease Control Strategies

Diversity is key to break cycles

Rely heavily on disease resistant cultivars

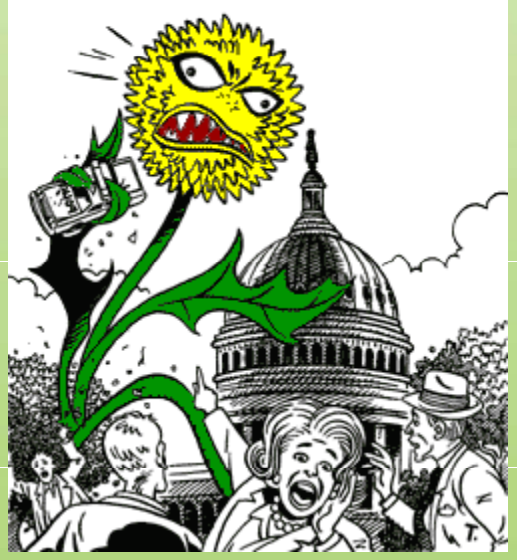
Water and fertilize properly

Neem oil has fungicidal properties

Compost is often employed for disease control.

A Weed is…

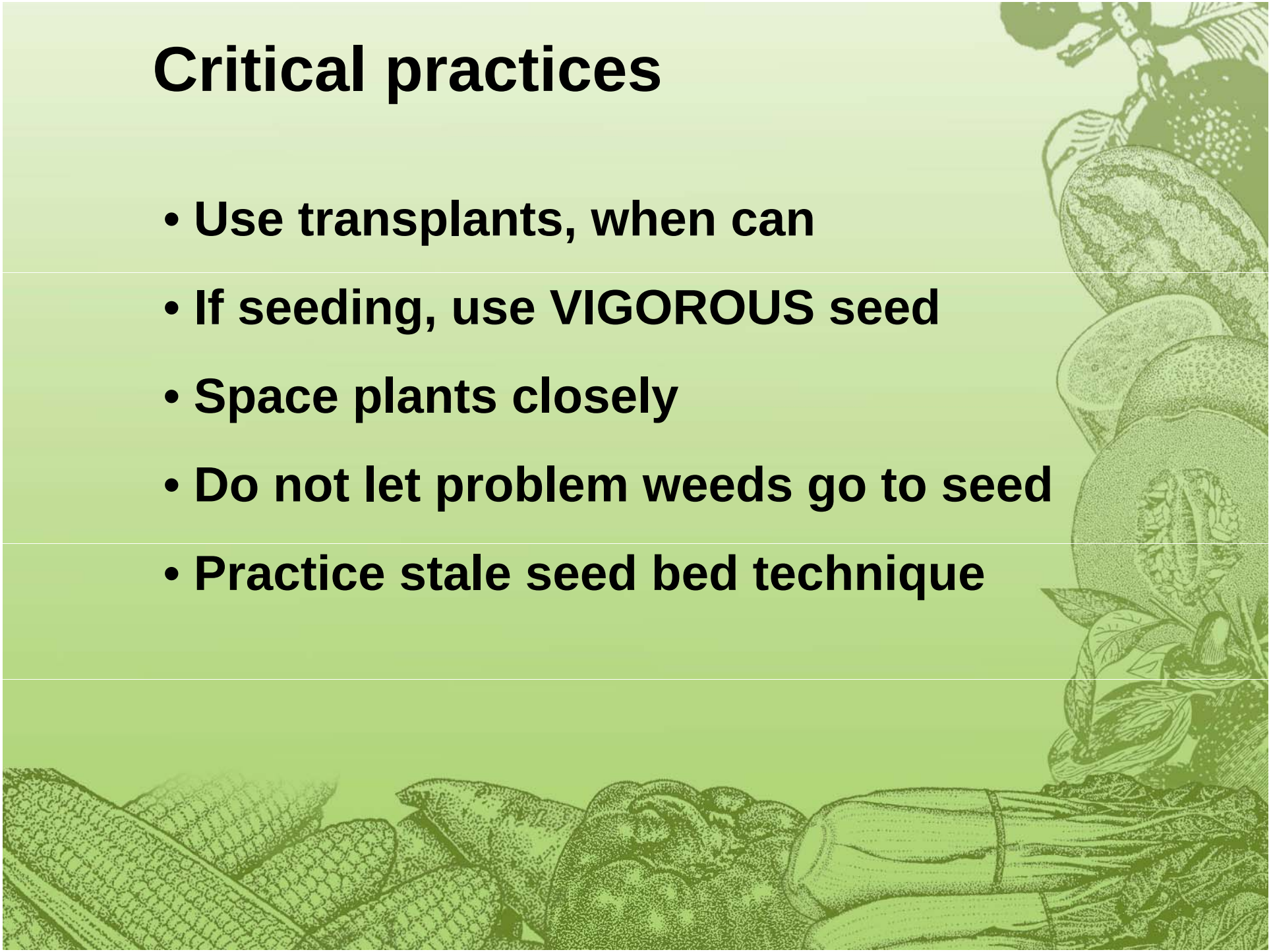
Any plant that interferes with human welfare or activity, or is otherwise objectionable.



Plants Out Of Place (P.O.O.P Rule)

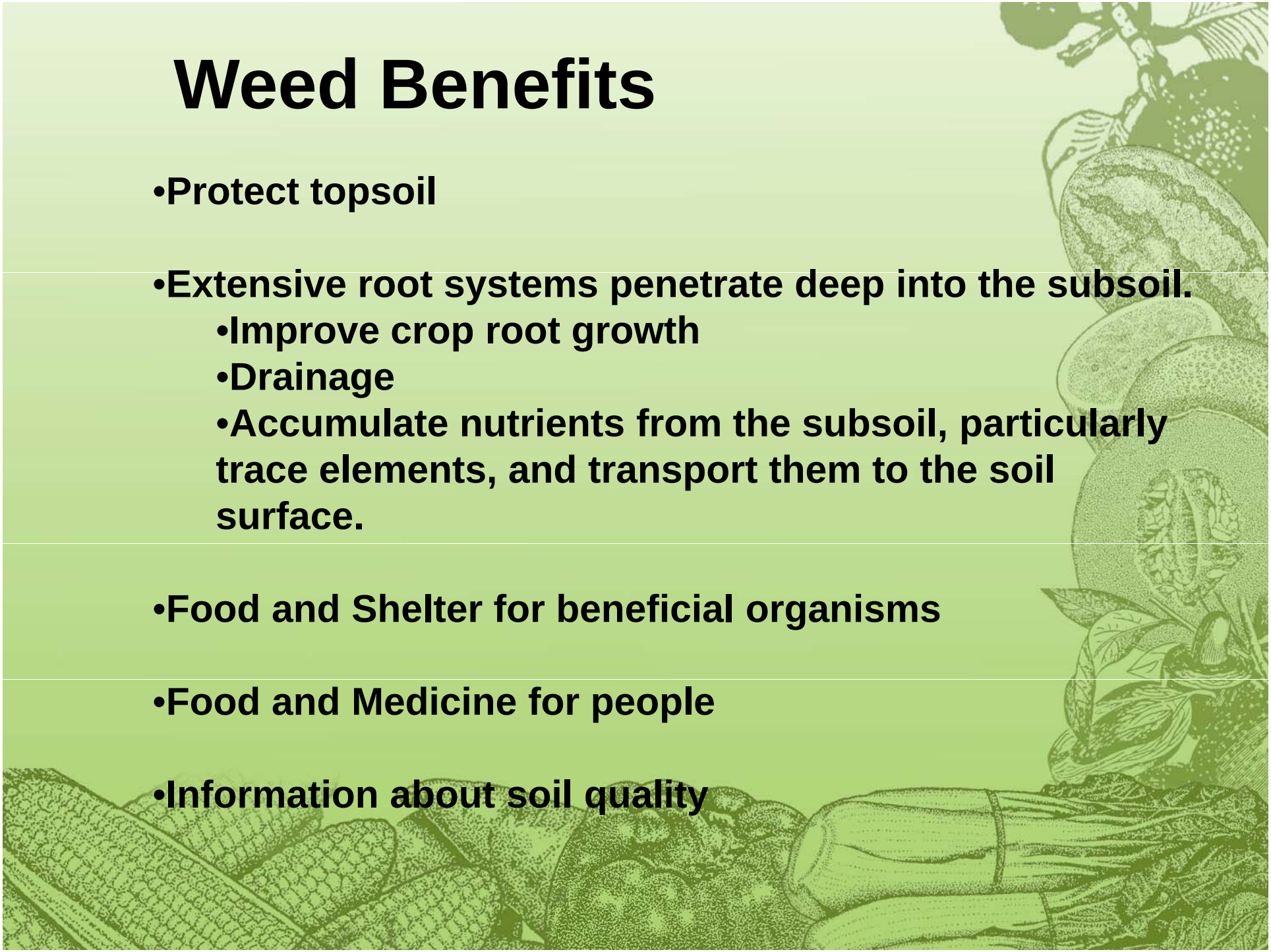
Critical practices

- Use transplants, when can
- If seeding, use VIGOROUS seed
- Space plants closely
- Do not let problem weeds go to seed
- Practice stale seed bed technique



Weed Benefits

- Protect topsoil
- Extensive root systems penetrate deep into the subsoil.
  - Improve crop root growth
  - Drainage
  - Accumulate nutrients from the subsoil, particularly trace elements, and transport them to the soil surface.
- Food and Shelter for beneficial organisms
- Food and Medicine for people
- Information about soil quality

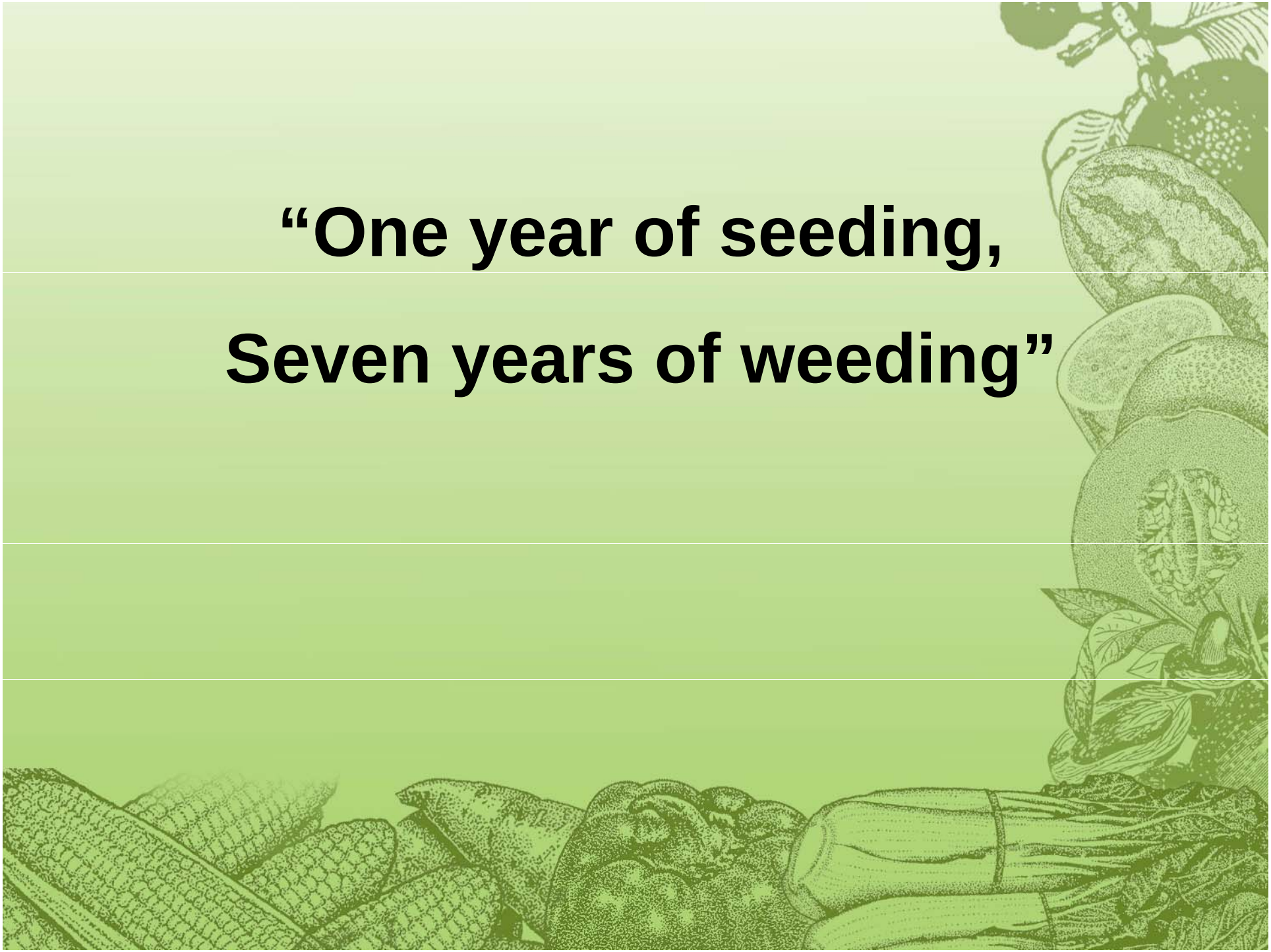


Food and Medicine for People

Visit website for Weeds as Resources: An African Example

Plant	Use
Amaranth	Leafy vegetable, grain
Spanish needle	Leafy vegetable, tonic, anti-inflammatory
Purslane	Salad green, grain, high Omega-3
Galinsoga spp.	Sap a first-aid wound treatment



“One year of seeding,

Seven years of weeding”

Weed Seed Production

Weed Seed Bank

- **Average number of seeds in soil is 30,000-350,000 weed seeds/m^2**

- **120 million-1.4 billion per acre.**

Weed	Seed#/plant
Amaranth	235,000
Lambsquarters	100,000
Crabgrass	50,000
Spurge	3,000

Critical period

- **Generally vegetable crops are kept weed free during a critical weed-free period early in development.**

- **Critical periods:**

  ~3-5 weeks for transplants and grains.

  > 5 weeks for direct seed veggies and veggies with small canopies or wide spacing.

  Onions are kept weed free throughout growth.

Cultural Strategies

Variety selection and spacing

- Choose crop varieties that are well adapted to your area.
- Plant at the best time of year for vegetative growth.
- Choose crop varieties with vigorous canopy development.
- Purchase high quality seed.
- Use transplants where possible.
- Space plants at the higher end of recommended density ranges.

Mechanical Strategies

Cultivation Steel in the Field http://www.sare.org/publications/steel/index.htm

- Very important strategy relied on by many growers.

- Plant very straight, uniformly spaced rows to allow for close cultivation to the plants.

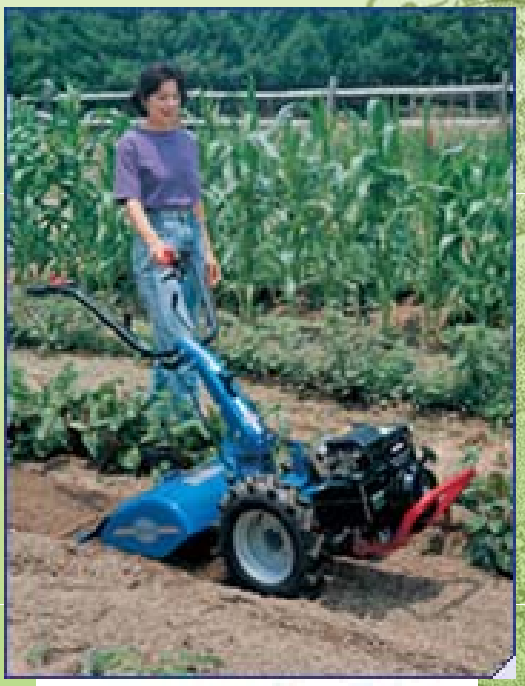
- Keep cultivation shallow to minimize weed seed germination.

- Cultivate weeds early (< 1 inch ideally) at ~50% field capacity.

- Push dirt into rows of long-stemmed plants to cover small weeds.

Mechanical Strategies

Cultivation



Chemical Strategies

Organic herbicides

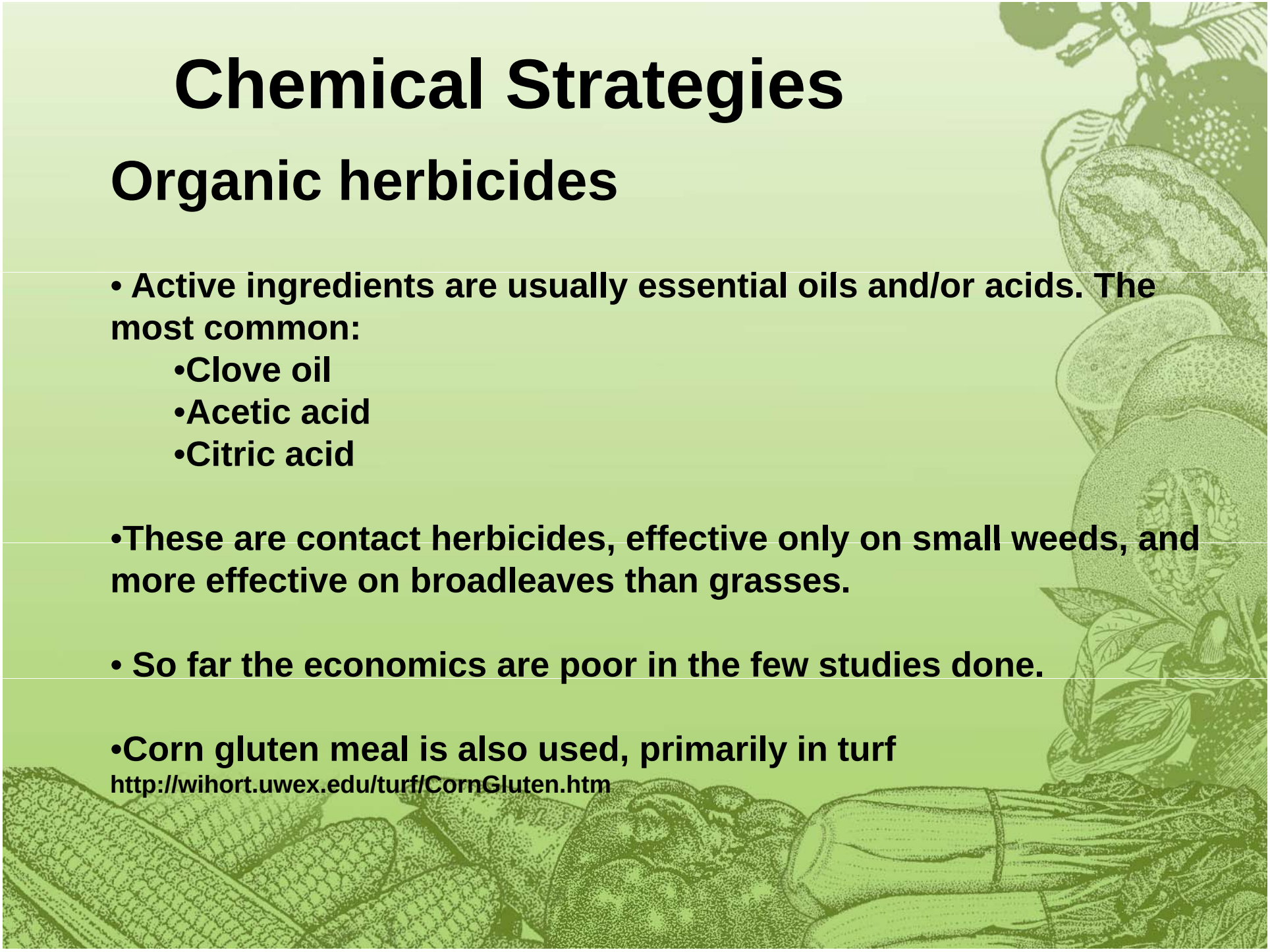
- Active ingredients are usually essential oils and/or acids. The most common:
  - Clove oil
  - Acetic acid
  - Citric acid

- These are contact herbicides, effective only on small weeds, and more effective on broadleaves than grasses.

- So far the economics are poor in the few studies done.

- Corn gluten meal is also used, primarily in turf

http://wihort.uwex.edu/turf/CornGluten.htm



Mechanical Strategies

Flaming

- High temperatures burst cells (not burn plants).
- Weeds should be small (< 3”).
- Most effective on broadleaf weeds. Grasses more resistant.
- Can be done before (1-2 days) and after crop emergence.
- Tolerance of crops to flaming varies with species and size (see handout and ATTRA document).

http://www.attra.org/attra-pub/flameweedveg.html


Sterile seed bed
Good seed
Close spacing
Banding ferts
Drip irrigation

Stale seed bed technique

- This technique is used to exhaust the active seed bank in the first several inches of soil.

- The area is tilled, fertilized and irrigated to promote weed germination.

- Young weeds are killed mechanically.

- Weeds are allowed to flush again and killed.

- Seeds or transplants are placed in the field with minimal or no tillage.

Mechanical Strategies

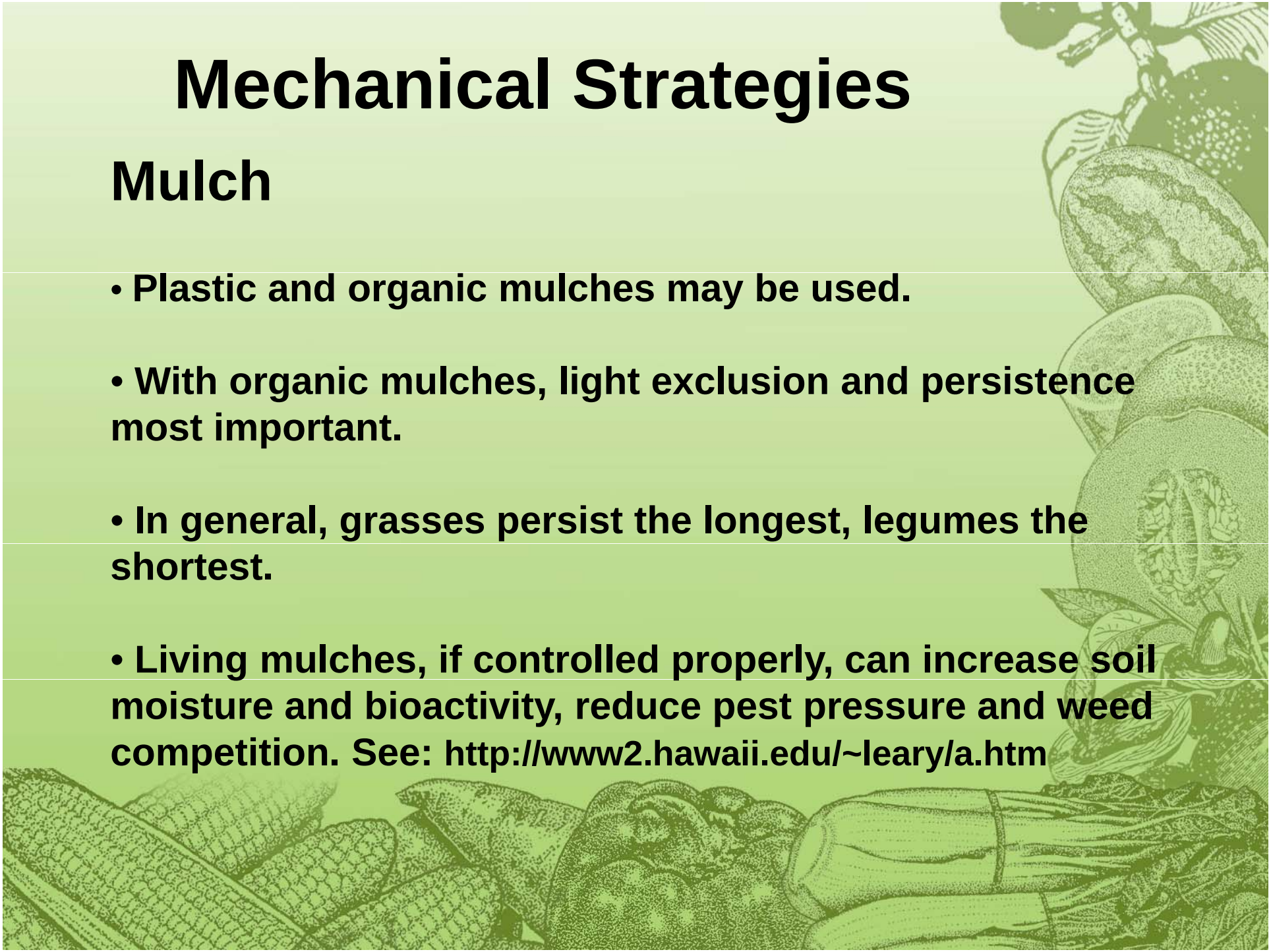
Mulch

- Plastic and organic mulches may be used.

- With organic mulches, light exclusion and persistence most important.

- In general, grasses persist the longest, legumes the shortest.

- Living mulches, if controlled properly, can increase soil moisture and bioactivity, reduce pest pressure and weed competition. See: http://www2.hawaii.edu/~leary/a.htm



Weeds imported with mulch

Mulch

Walk-behind mulch laying attachment

Woven mat in Kula

Integrating plastic and bio-strips