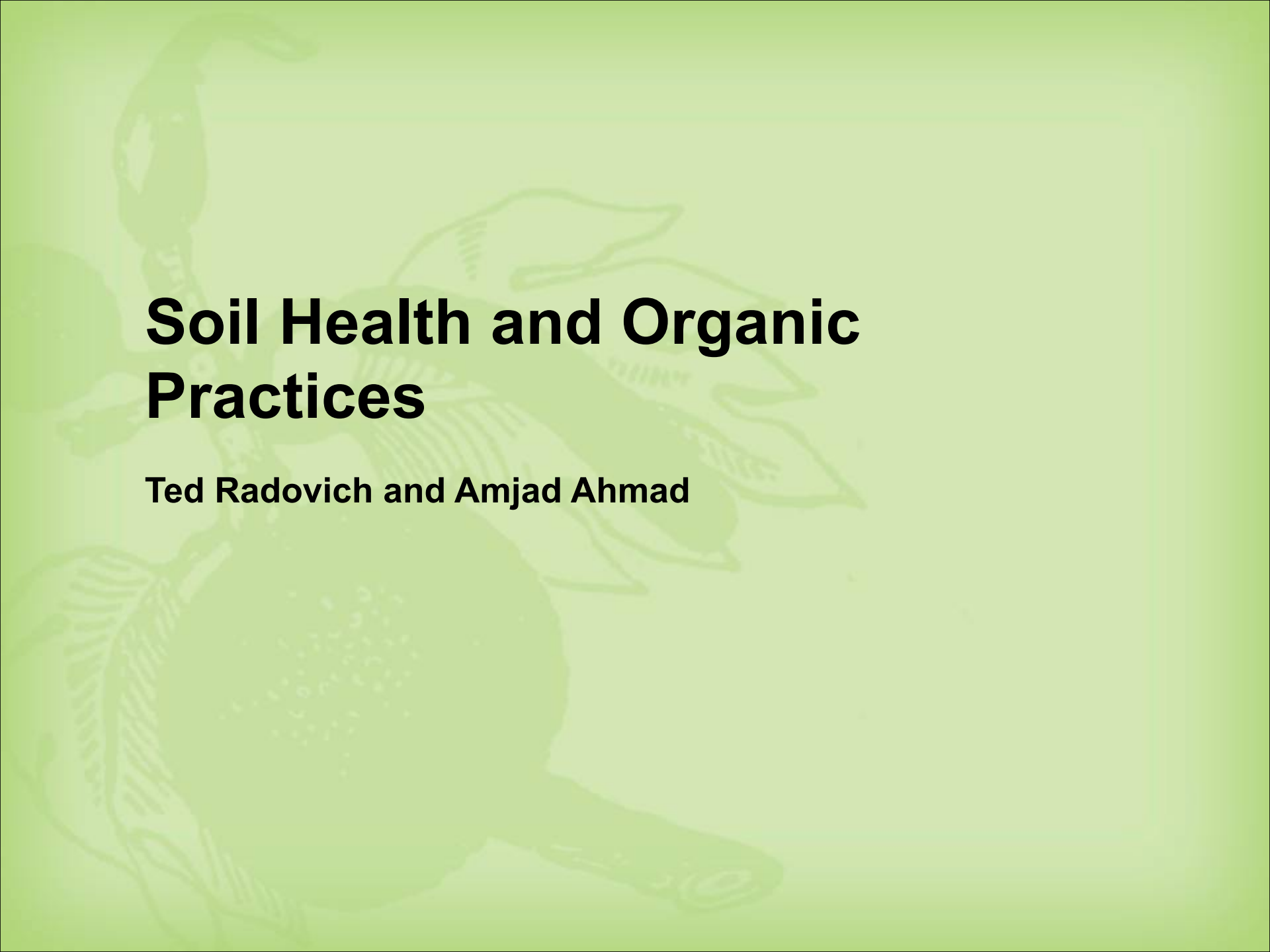
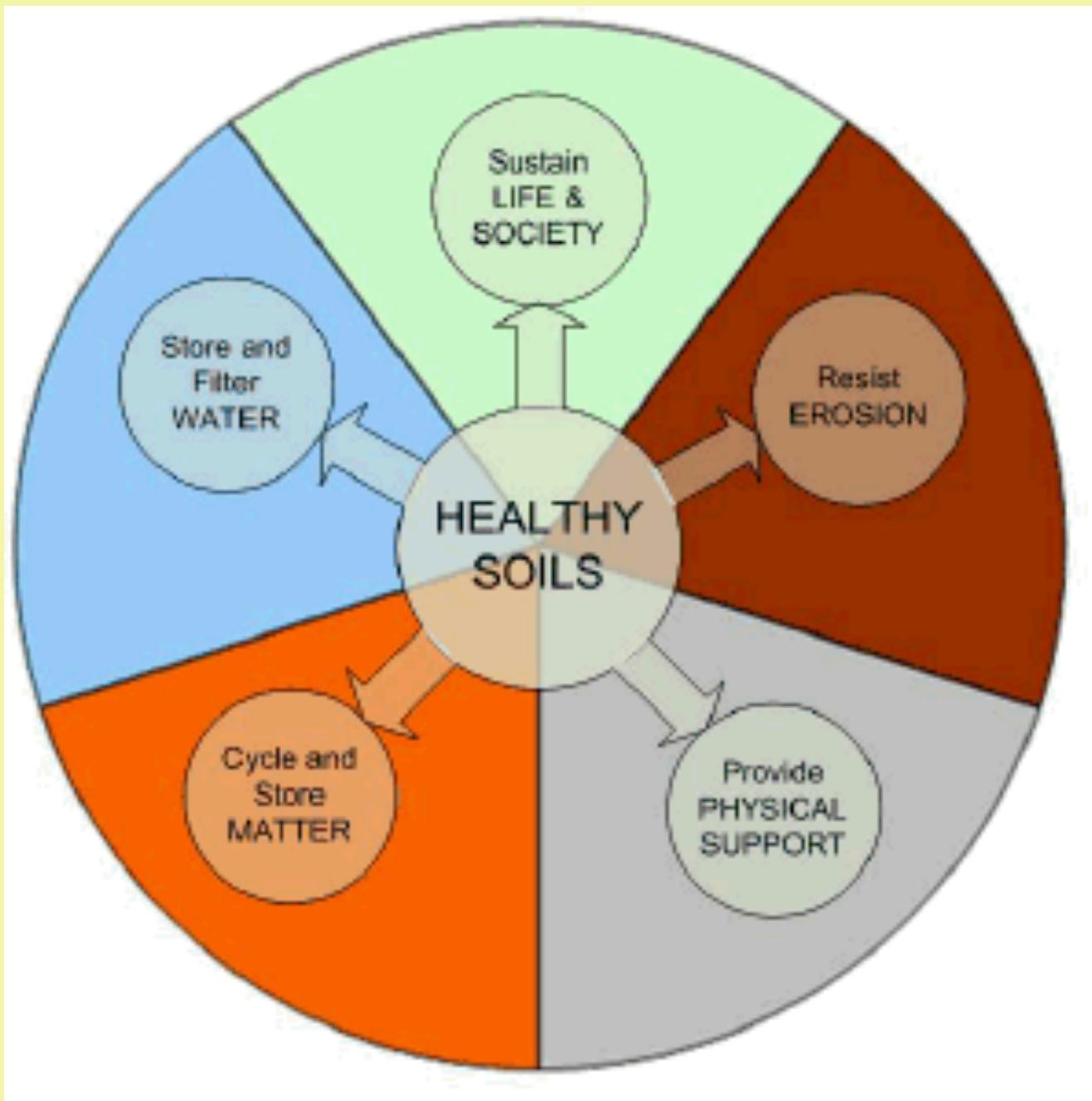


The background of the slide features a faint, light green illustration. On the left side, there is a scorpion, and in the center, there is a plant with large, pointed leaves. The overall color scheme is a gradient of light green.

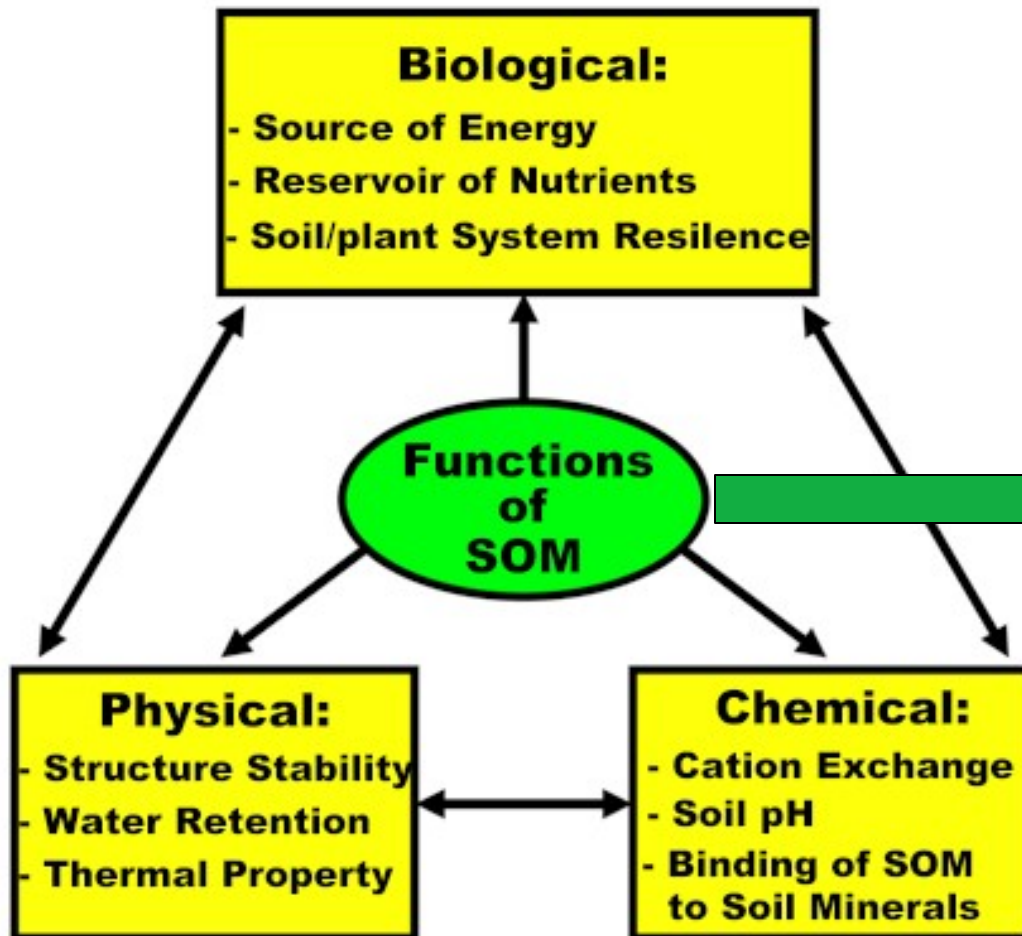
Soil Health and Organic Practices

Ted Radovich and Amjad Ahmad



Soil Health and Local Fertilizers

Why Building Soil Organic Matter is Important?



Source: <http://www.treepower.org/soils/soilorganicmatter.html>



Source: <https://atlantishydroponics.wordpress.com/category/gardening-tips/how-to-identify-plant-problems-and-deficiencies/>



Soil Testing



<http://static.howstuffworks.com/>

**University
laboratory**



Private laboratory





Oahu Urban Garden Center

HOME

VISIT OUGC

EDUCATION

GARDENING

SUPPORT OUGC

ABOUT OUGC

Our Mission ...

To continuously and consistently provide innovative and diverse horticultural information to the gardening public.

Upcoming Events

Second Saturday at the Garden!

Join the O'ahu Master Gardeners and UGC 'Ohana Volunteers at the Pearl City Urban Garden Center for *Second Saturday at the Garden!* Garden demonstrations, UH Master Gardener "Got a Plant Question" booth, tours, UH Seed sales, volunteer plant sales and self garden tours at every event. Visit www.ctahr.hawaii.edu/UHMG to learn more about resources for Home Gardeners!

[Download the event flyer.](#)



VISIT OUGC

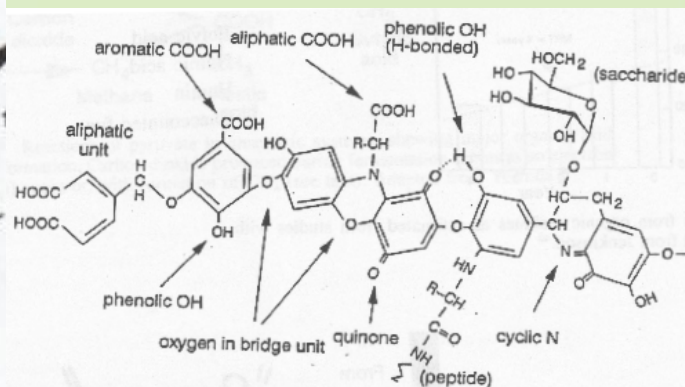
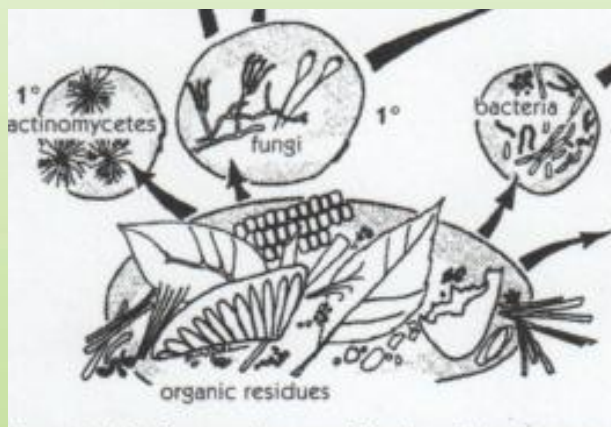
[Location and Directions](#)

[Tours](#)

[Gardens](#)

[Children's Garden](#)

Building Soil Organic Matter



Cover crops



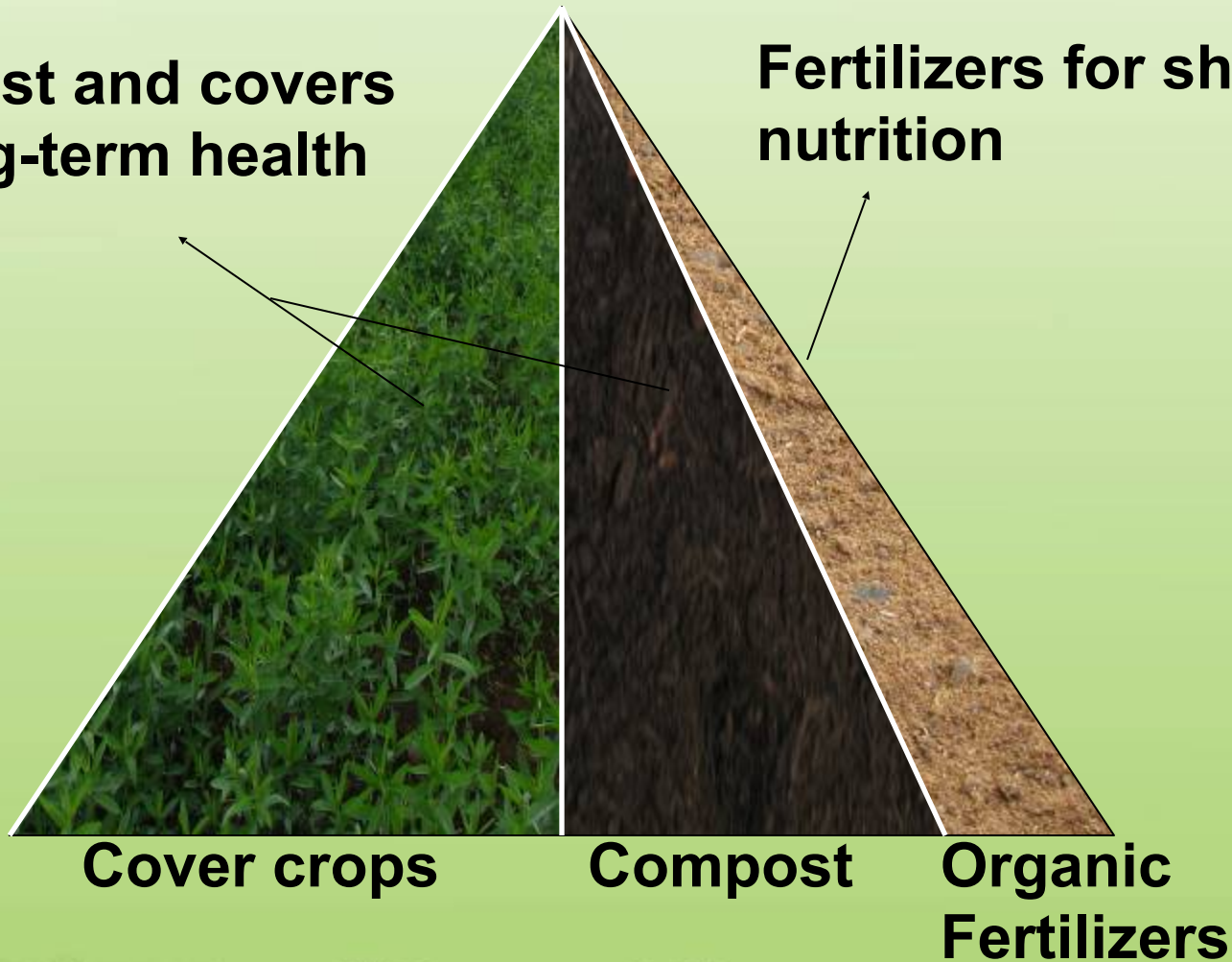
Compost



Soil food pyramid

**Compost and covers
for long-term health**

**Fertilizers for short term
nutrition**





Covercrops

Japanese millet on organic farm- Maui



Protects soil

Suppress weeds

Suppress nematodes

Habitat

Fix nitrogen

Takes up space

Needs water

Seed Costs \$\$

Can host plant pests

















Courtesy: Koon Hui Wang

Intercrop as Living Mulch

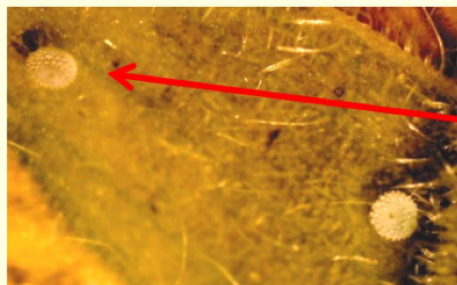
Sunn hemp

- Lycaenidae butterfly is a common pest of sunn hemp. It lays eggs on sunn hemp flower. However, this attracts Trichogramma wasp to come and parasitize Lycaenidae eggs.
- Thus, sunn hemp act indirectly as an insectary plants for this parasitic wasp, Trichogramma.



Wang, K.-H.

Lycaenidae butterfly
on sunn hemp



Eggs of
Lycaenidae being
parasitized by
Trichogramma
inside sunn hemp
flower

(Roshan Manandhar)



Trichogramma
wasps lay eggs
on a corn
earworm egg.

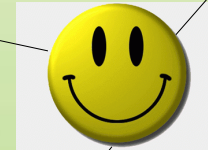
(J.K. Clark UC IPM Project)

Sorghum x Sudangrass



Windbreak in organic papaya Molokai

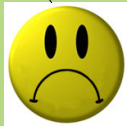
**Suppresses nematodes
& weeds**



Good windbreak

Produces a lot of organic matter

**Poor growth in
winter**



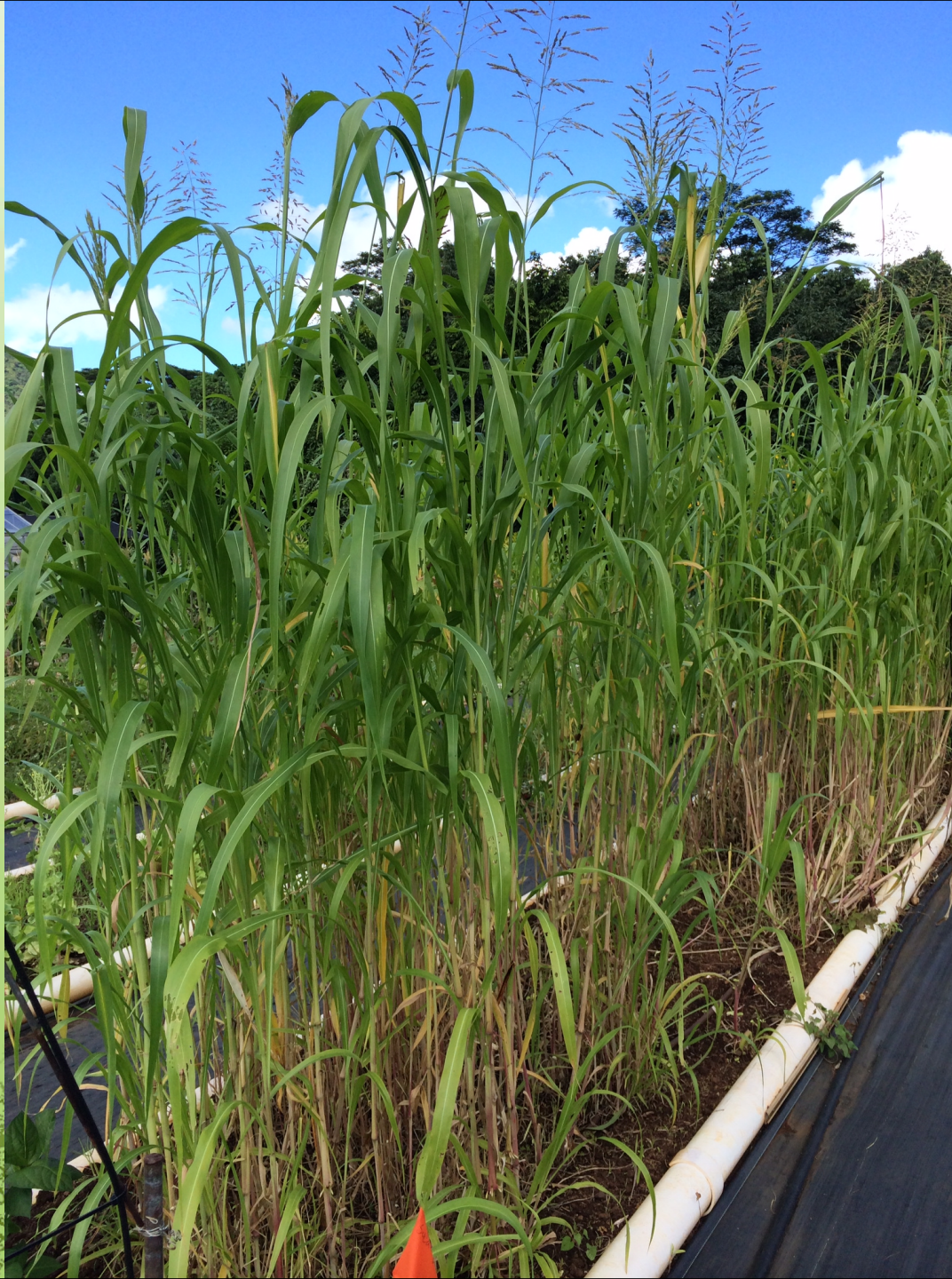
**Nitrogen
requirement**

Biomass production- O'ahu

















Other Cover Crops

<http://www.cilr.uq.edu.au>



Cowpea



Perennial Peanut

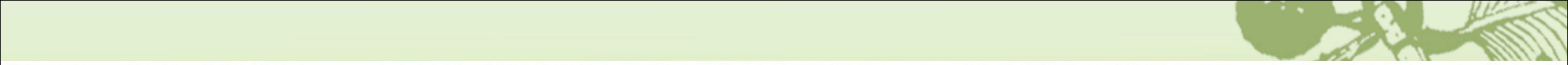


Oats

Slide



Vetch



© Ted Radovich













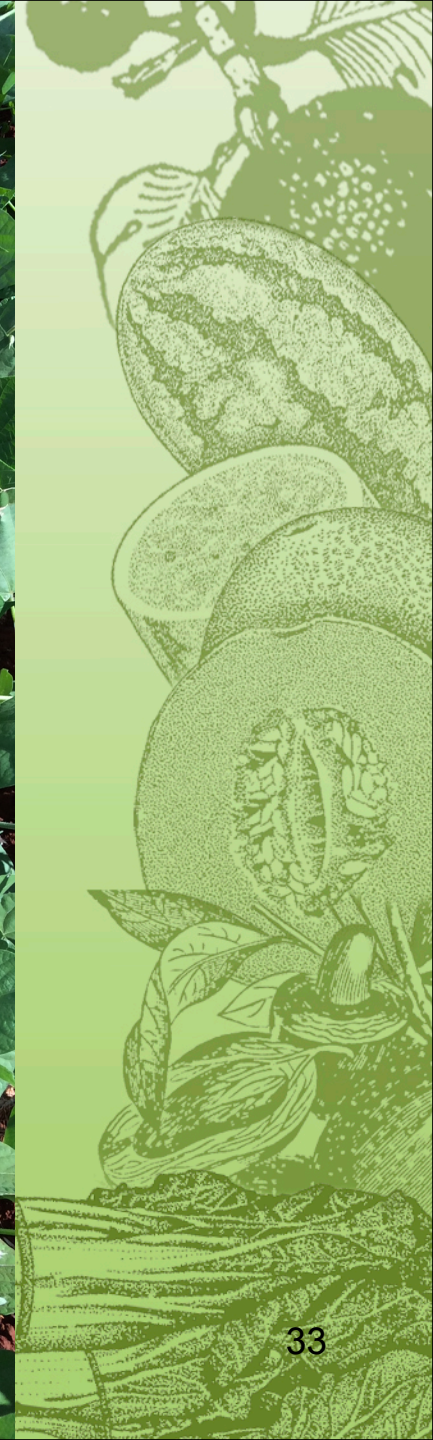




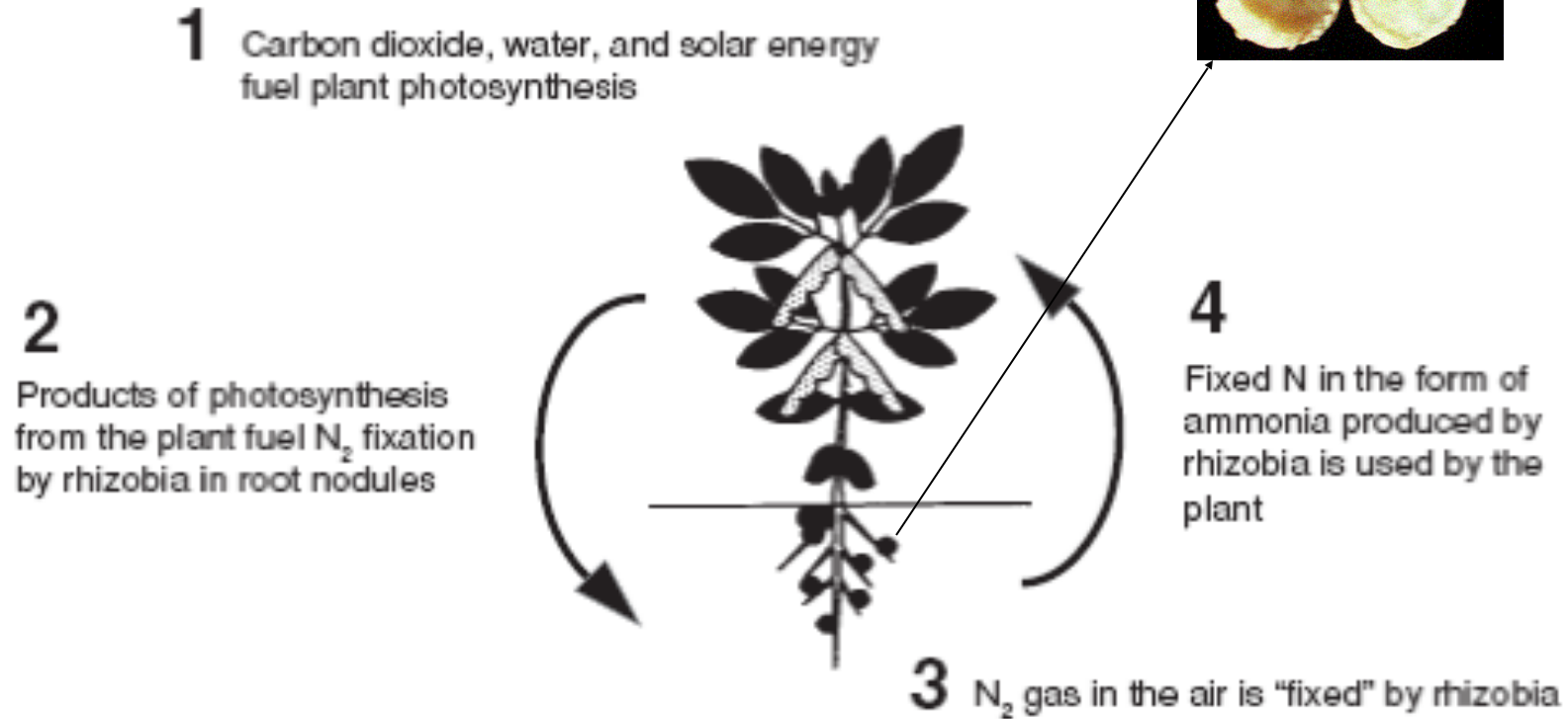


Figure 1. Two-year-old perennial peanut cover established in an O'ahu orchard.

Rhizobia



N fixation by bean plants



<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/pnm13.pdf>



COWPEA



SUNNHEMP





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

Commercial worm composting operation, O'ahu

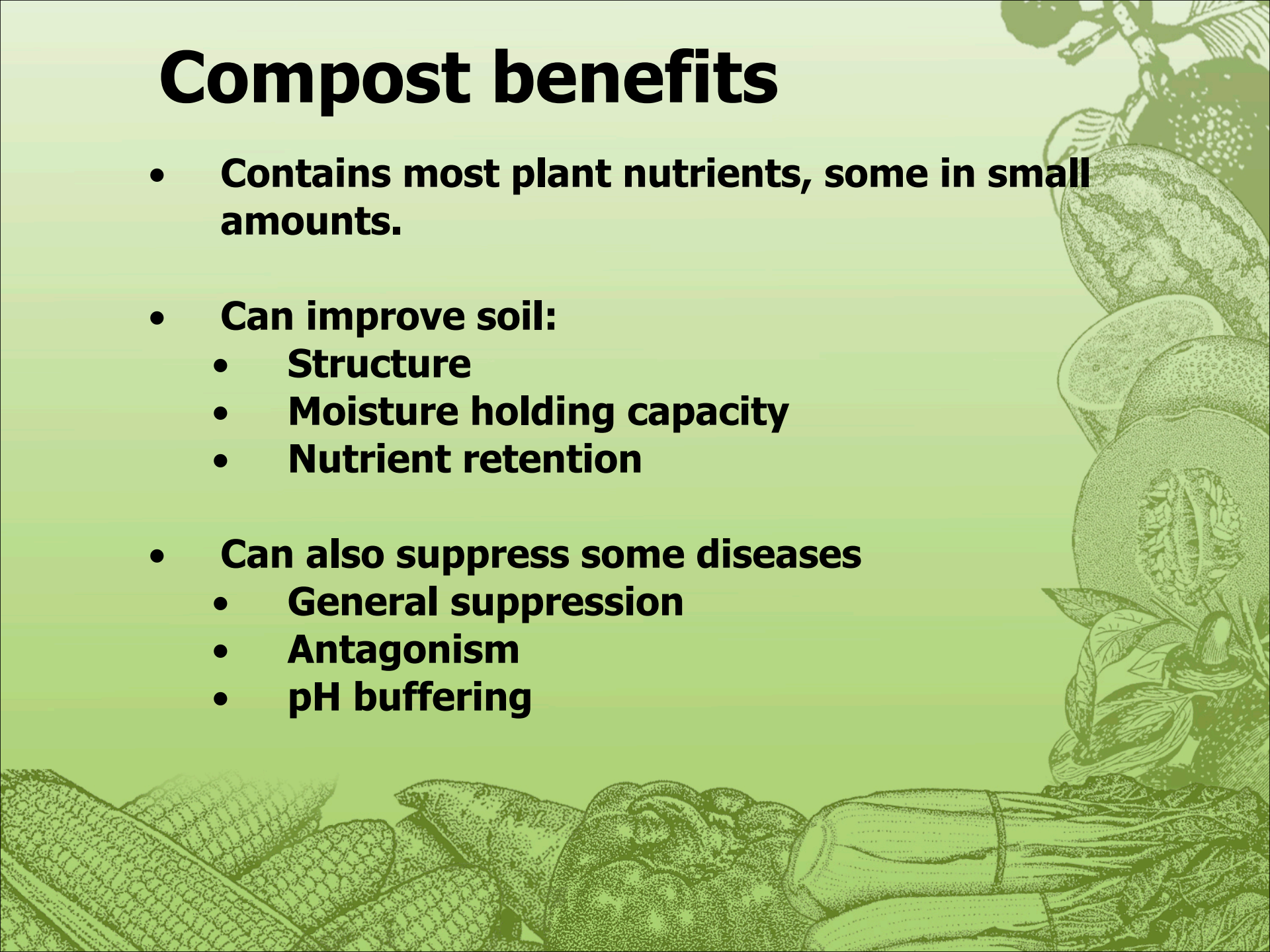


Spreading compost, Molokai
Courtesy: Alton Arakaki



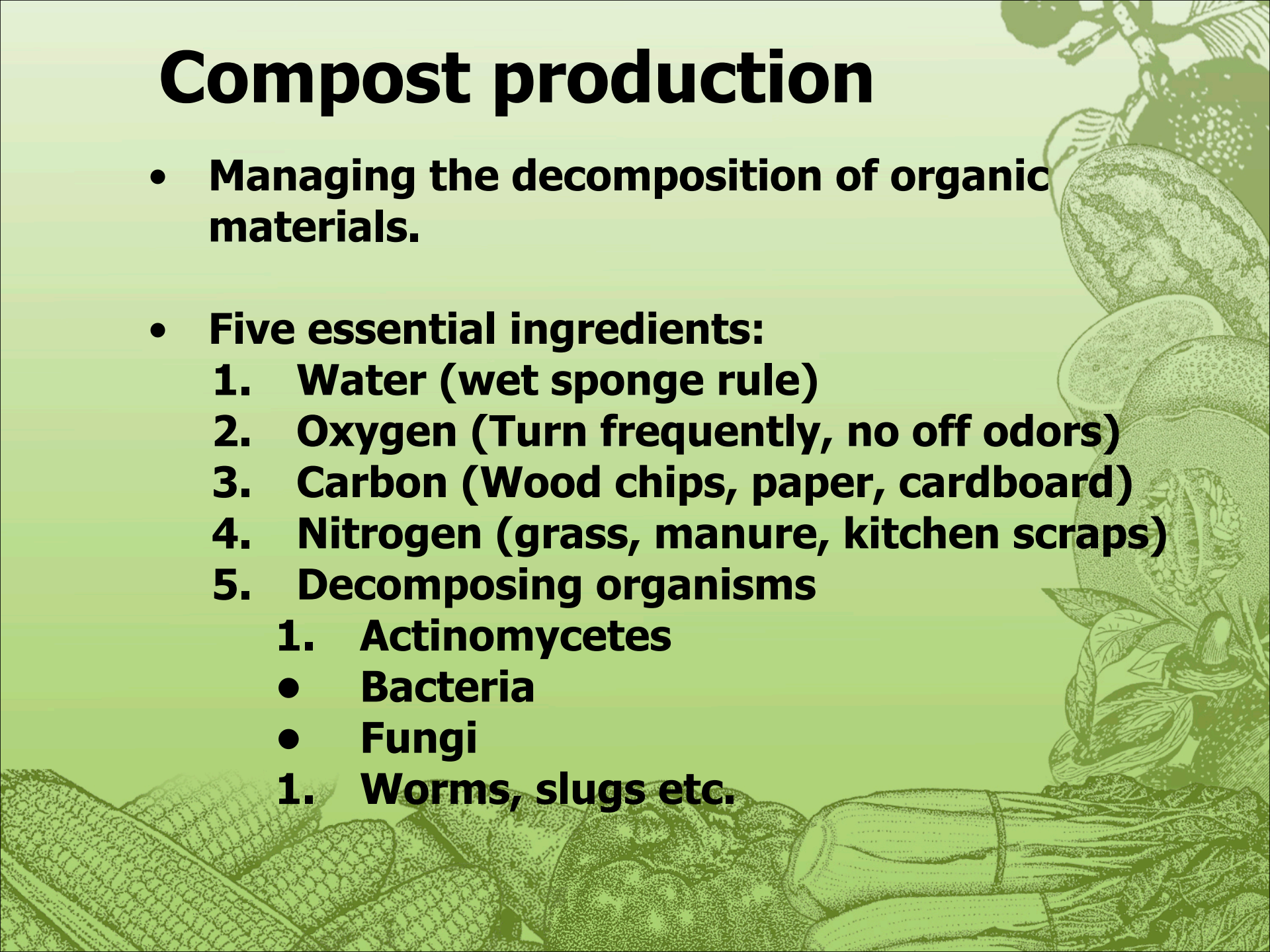
Compost benefits

- **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**
 - **Bacteria**
 - **Fungi**
 1. **Worms, slugs etc.**









	BROWNS				
GREENS	Dry leaves (50:1)	Newsp aper (55:1)	Office Paper (130:1)	Soft Wood chips (225:1)	Cardboar d (380:1)
Chicken Manure (6:1)	72	52	21	22	11
Vegetable waste (11:1)	10	7.5	2.8	3.0	1.6
Food Waste (15:1)	15	10	3.8	4.4	2.2
Packed Grass (15:1)	4.6	3.5	1.3	1.4	0.8
Cattle manure (17:1)	7.0	5.0	1.9	2.1	1.1
Horse Manure (27:1)	2	1.5	0.5	0.6	0.3

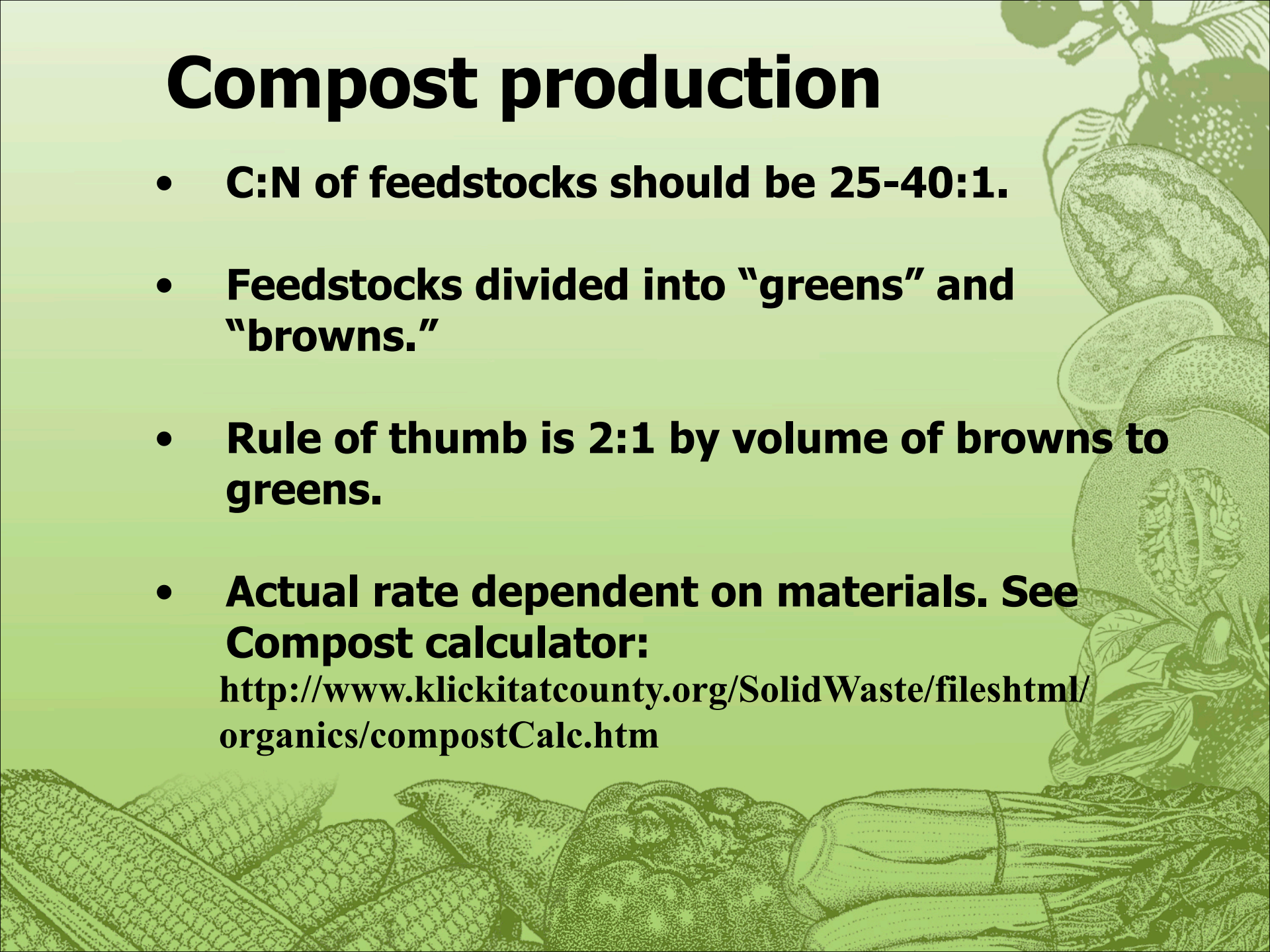
Compost production

- **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 °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>



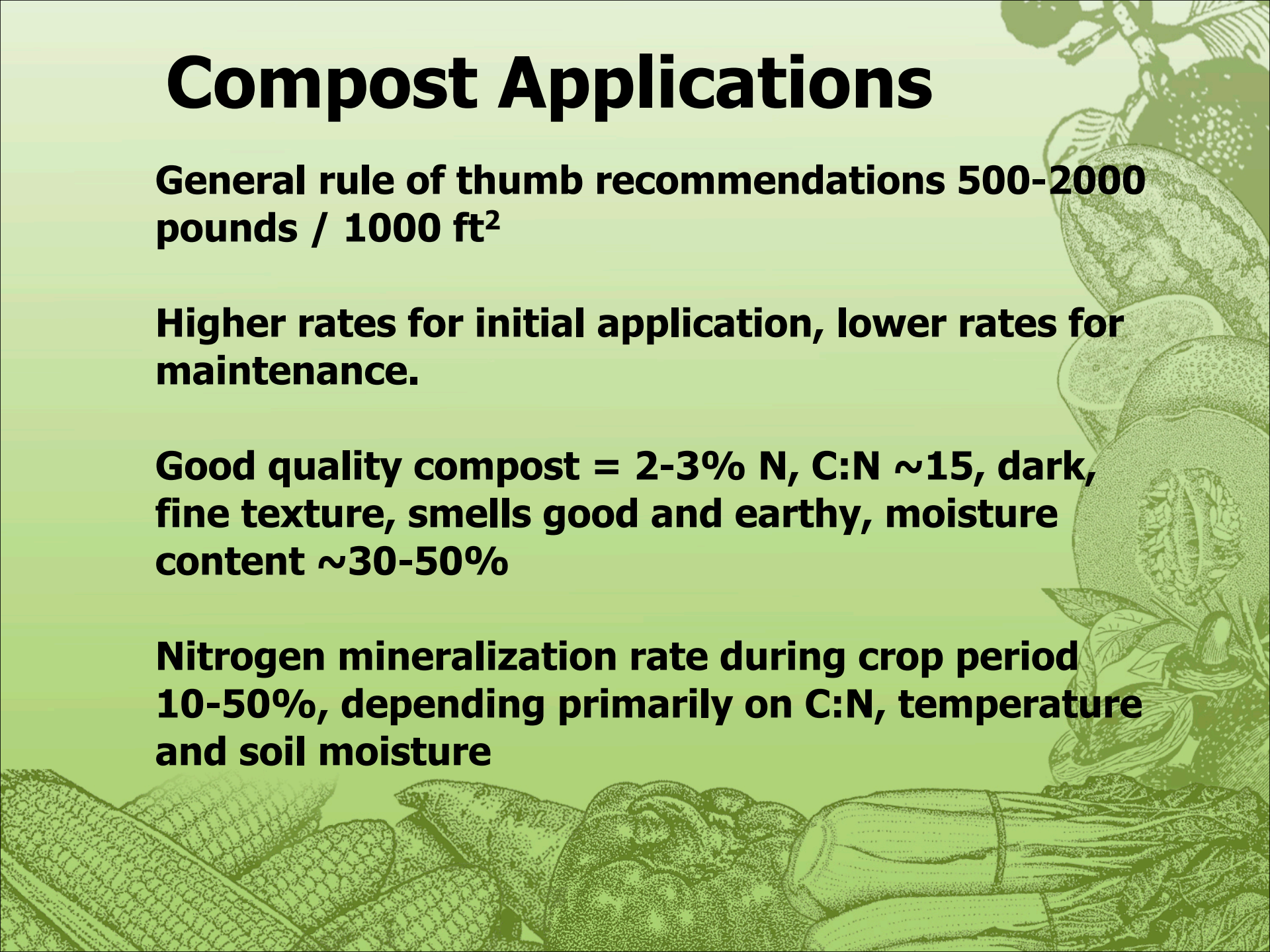
Compost Applications

General rule of thumb recommendations 500-2000 pounds / 1000 ft²

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



Compost



Handcrafted Artisan
Commercial greenwaste

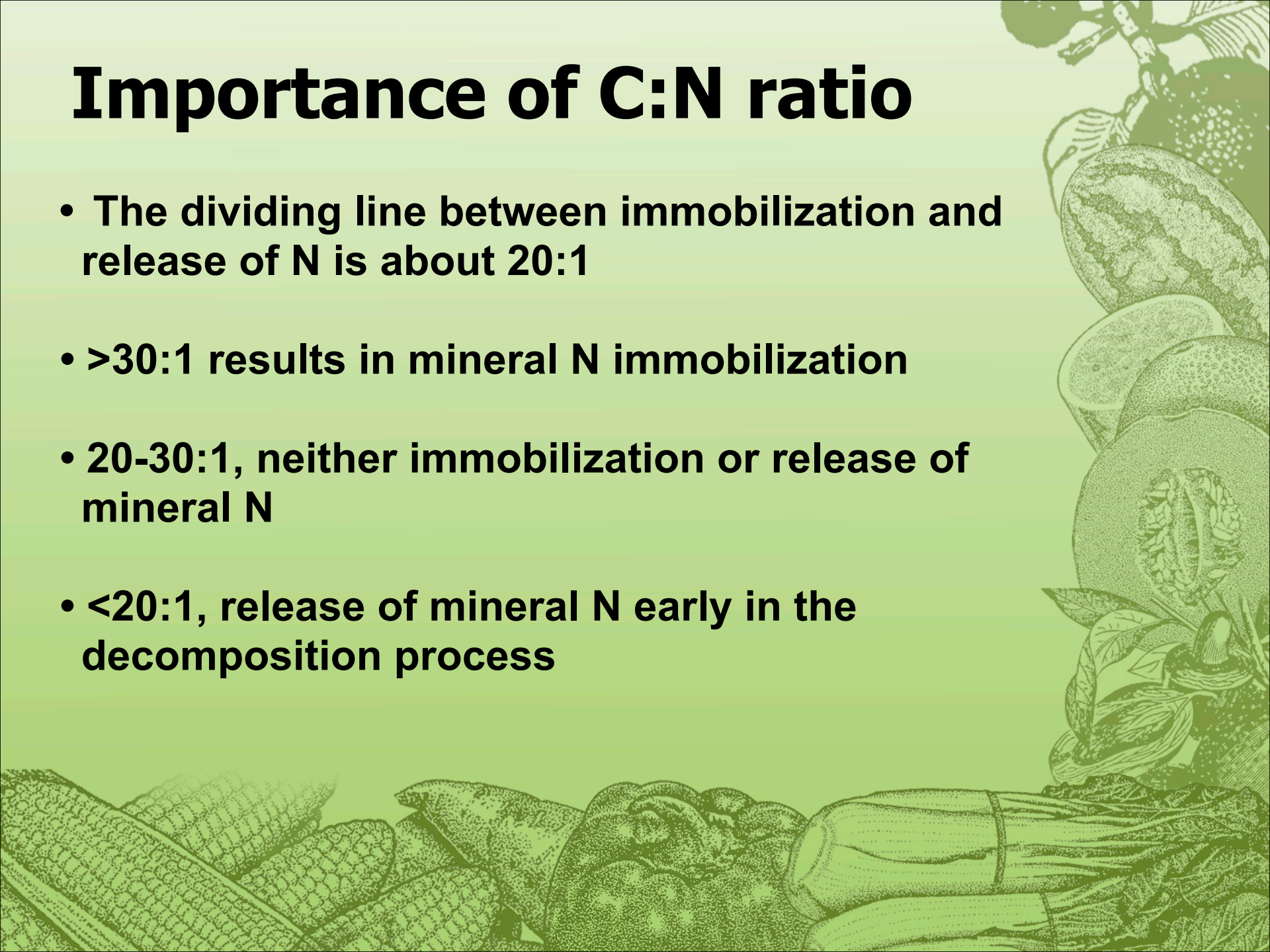


Vermicompost



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

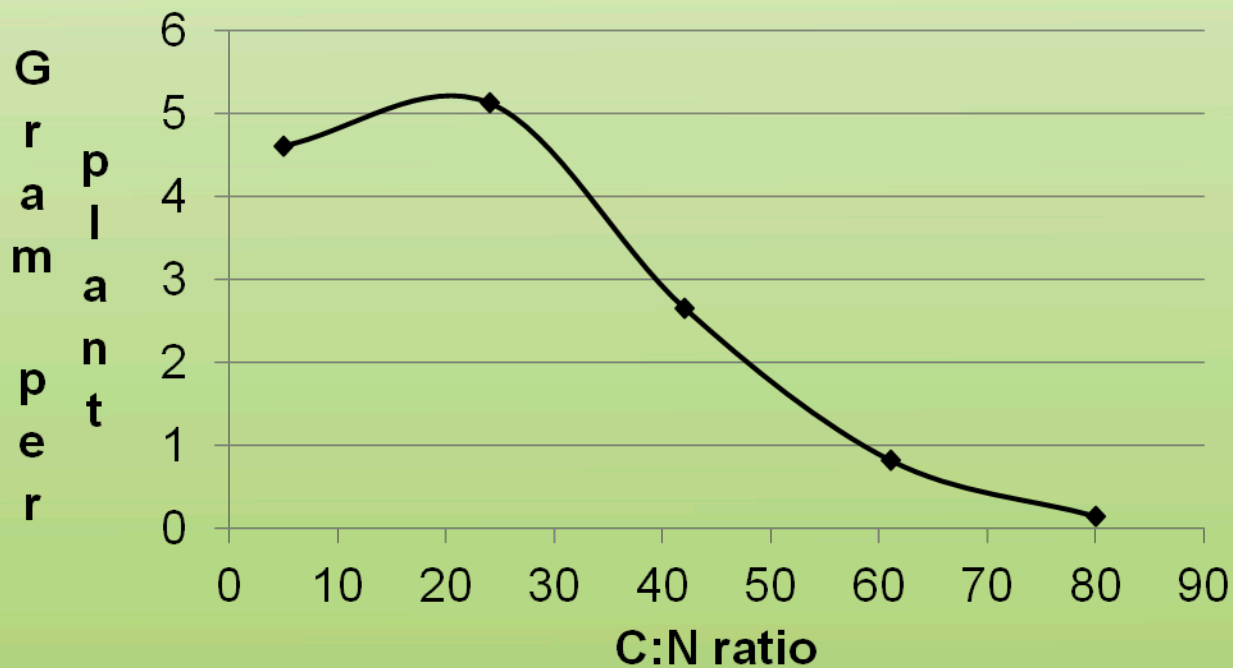


Adjust C:N ratio

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



Carbon to Nitrogen ratio of amendment



Seedlings in 100% compost





Worm species

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









Compost “Tea”

- Uses air and water to extract:

- Nutrients
- Organic acids
- Microbes

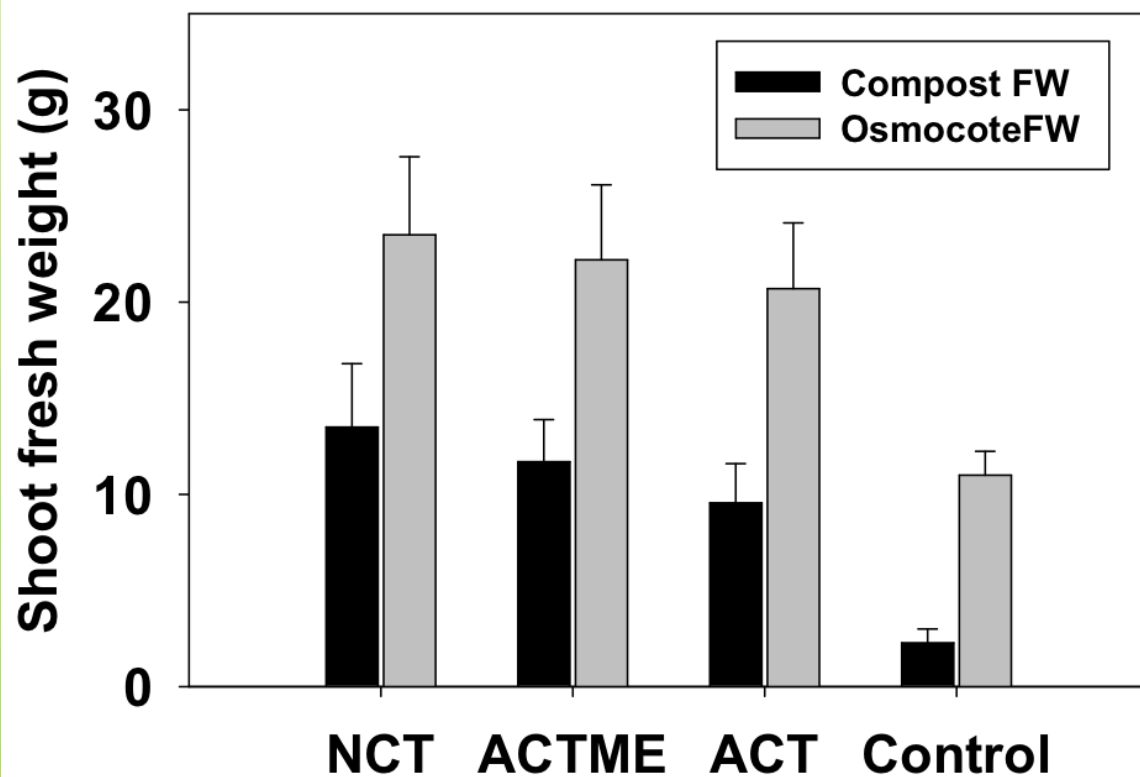
- Ratio of water to compost ranges 10:1-100:1

- Water is not circulated, only air

- 12-24 hrs



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



Variability in tea quality affected plant growth

