



Soil Health and Organic Practices

Invasive Algae

Hanai' Ai (Vol. 5)



Table 1. Nutrient analysis from Maunalua Bay limu species. Values are means of at 4-10 analyses $\pm$ standard error of the mean. Note the significant variability in potassium (K) among species.

Species	-----%						
	N	C	P	K	Ca	Mg	Na
<i>Aravinvillea amadelphia</i>	0.9 ± 0.1	16.7 ± 0.9	0.06 ± 0.001	0.2 ± 0.04	16.9 ± 1.7	1.5 ± 0.1	2.0 ± 0.2
<i>Acanthophora spicifera</i>	1.14 ± 0.17	20.0 ± 0.15	0.04 ± 0.004	4.2 ± 1.9	8.8 ± 1.6	1.5 ± 0.07	3.2 ± 0.1
<i>Gracilaria salicornia</i>	0.58 ± 0.13	15.7 ± 2.6	0.05 ± 0.004	10.4 ± 2.6	6.1 ± 1.8	1.1 ± 0.2	3.0 ± 0.2



Figure 1. Compost is being made from algae along with tree trimmings.



Figure 2. Radish grown on a field amended with algal compost.







Mohihi Keokeo

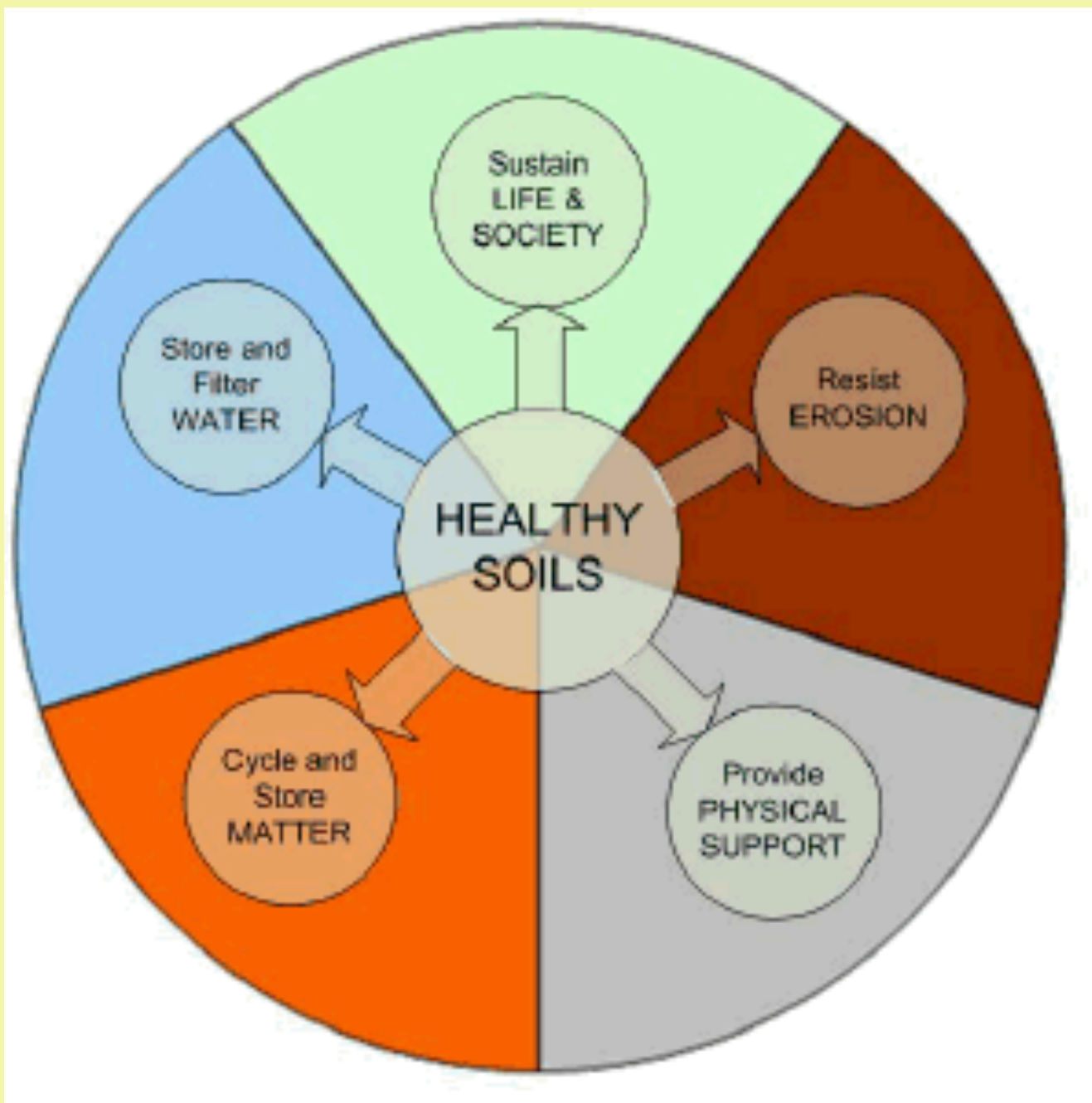


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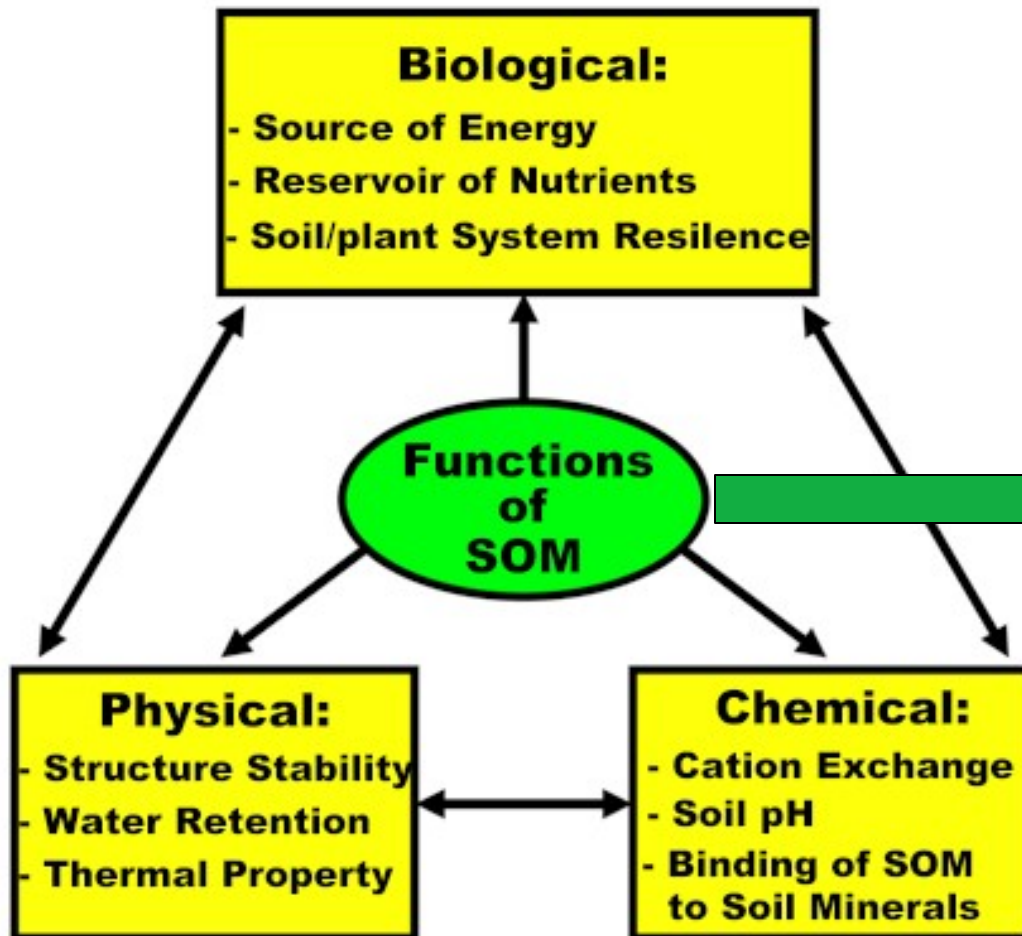
Papa'a Koali





Soil Health and Local Fertilizers

Why Building Soil Organic Matter is Important?



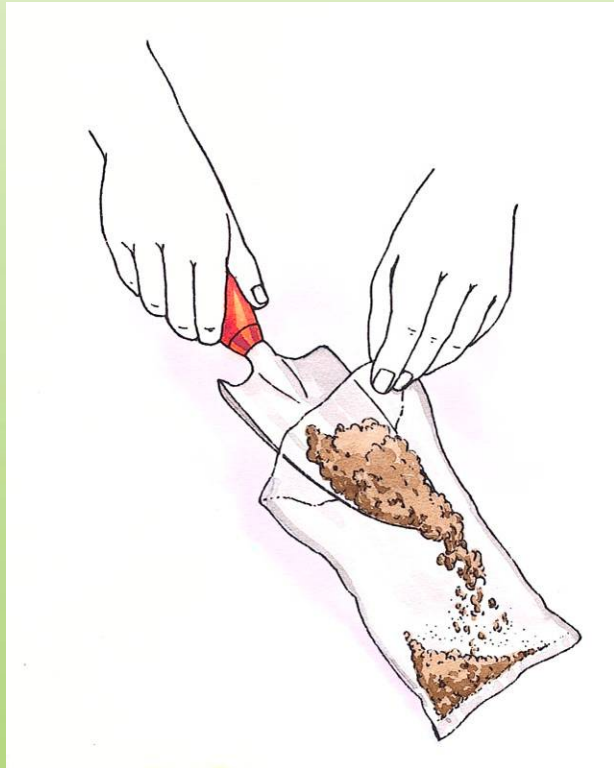
Source: <http://www.treepower.org/soils/soilorganicmatter.html>



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





Get My Location

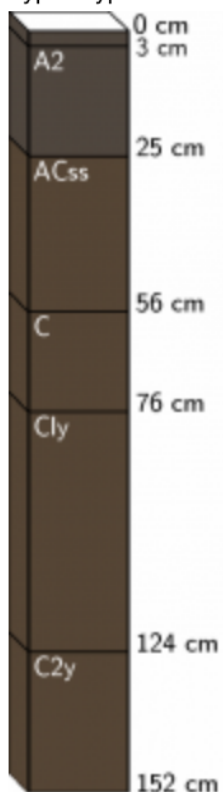
Help!



13m (43ft) from map unit [LvB] boundary | 1 components

Lualualei (100%)

Typic Gypsiteorrerts



alluvial fans / Toeslope

SSURGO Export: 2015-09-

Accuracy: 5 m

request complete



Get My Location

Help!



Soil Taxonomy

Order:	Vertisols
Suborder:	Torrerts [Map of Suborder]
Greatgroup:	Gypsiteorrerts
Subgroup:	Typic Gypsiteorrerts
Family:	Fine, smectitic, isohyperthermic
Soil Series:	Lualualei (Link to OSD)

Data: [\[Lab Data\]](#)

Raw Data [Component](#) [All Horizons](#)

Land Classification

Storie Index	N
Land Capability Class [non-irrigated]	6
Land Capability Class [irrigated]	3
Ecological Site Description	n
Forage Suitability Group	n

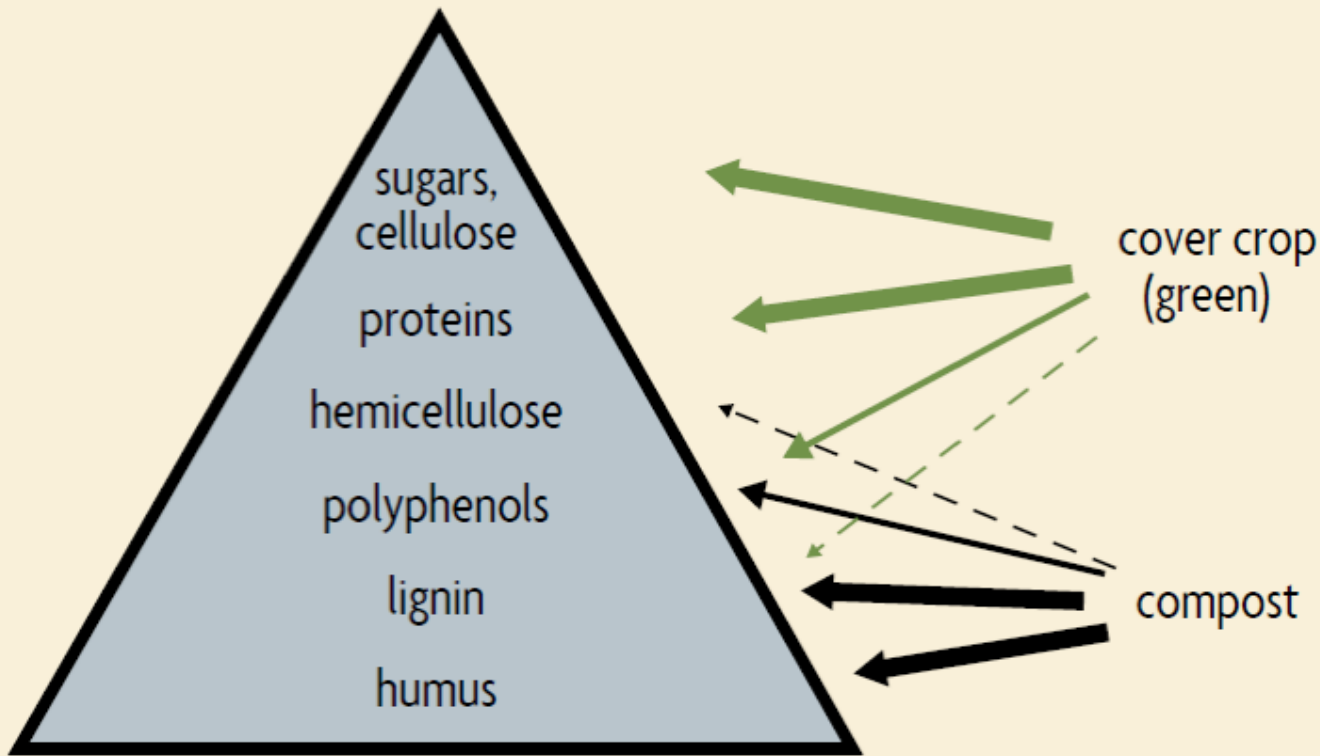
Hydraulic and Erosion Ratings

Wind Erodibility Group	4
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Accuracy: 5 m

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Soil Health



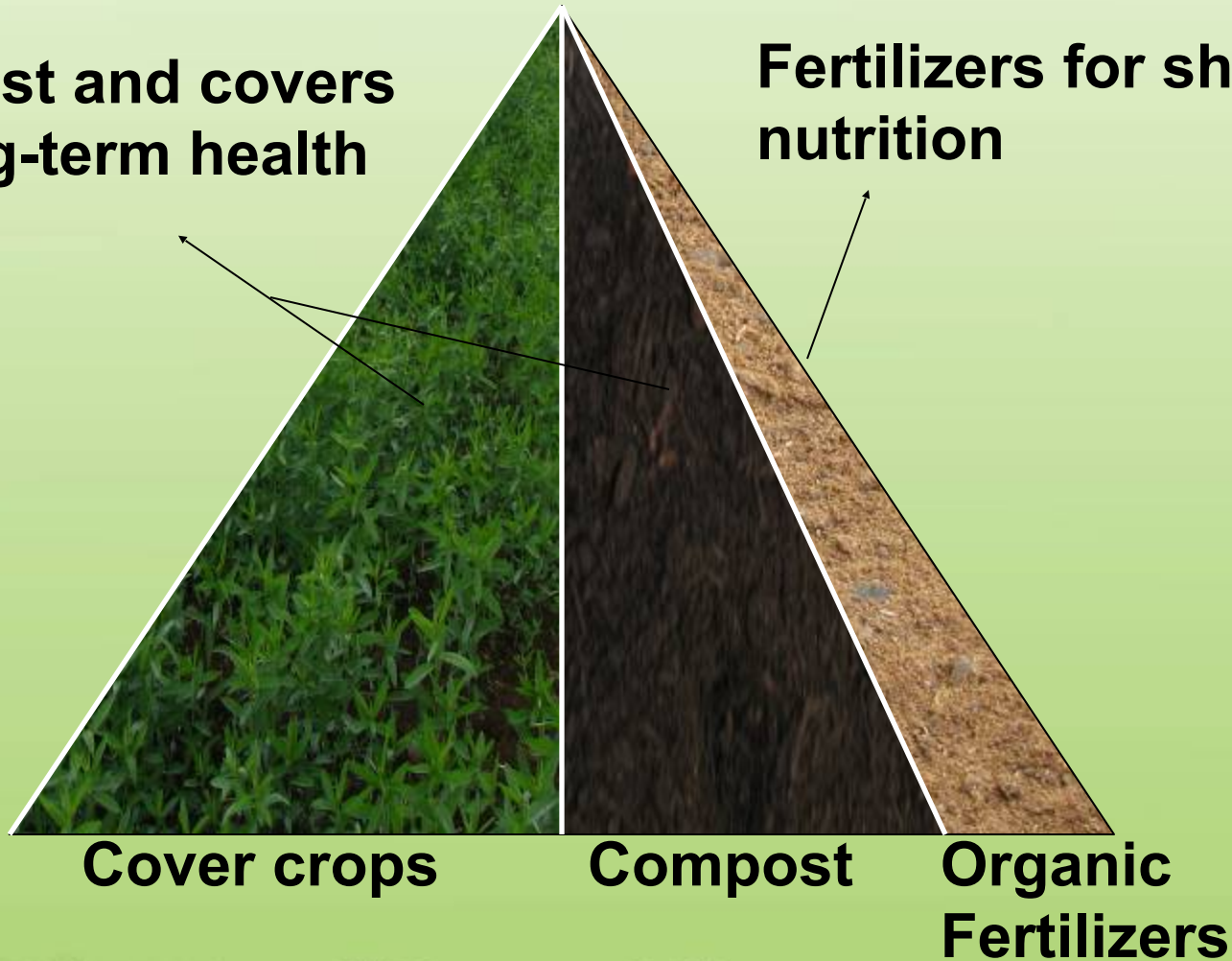
<http://www.sare.org>



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

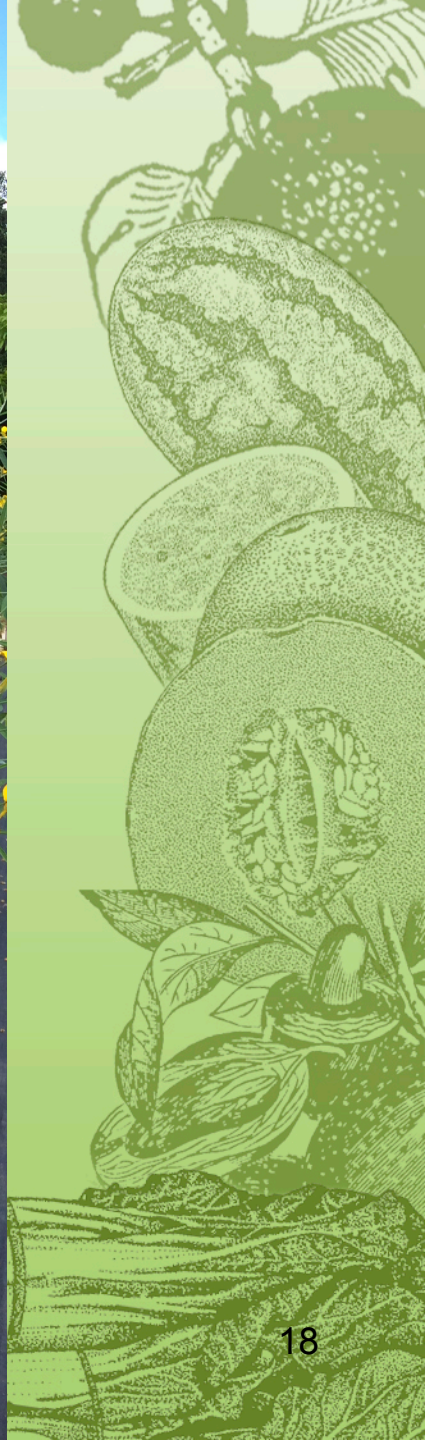
Seed Costs \$\$

Can host plant pests

















Courtesy: Koon Hui Wang

Intercrop as Living Mulch

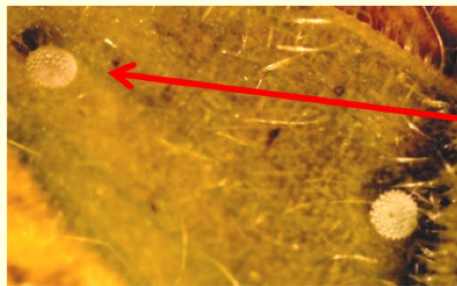
Sunn hemp

- 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.

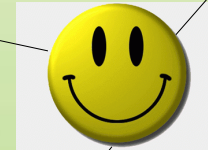
(J.K. Clark UC IPM Project)

Sorghum x Sudangrass



Windbreak in organic papaya Molokai

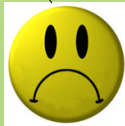
**Suppresses nematodes
& weeds**



Good windbreak

Produces a lot of organic matter

**Poor growth in
winter**



**Nitrogen
requirement**

Biomass production- O'ahu

















© Craig Elenitch

Other Cover Crops

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



Cowpea



Perennial Peanut

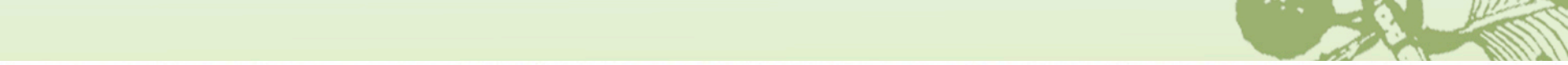


Oats

Slide



Vetch



© Ted Radovich











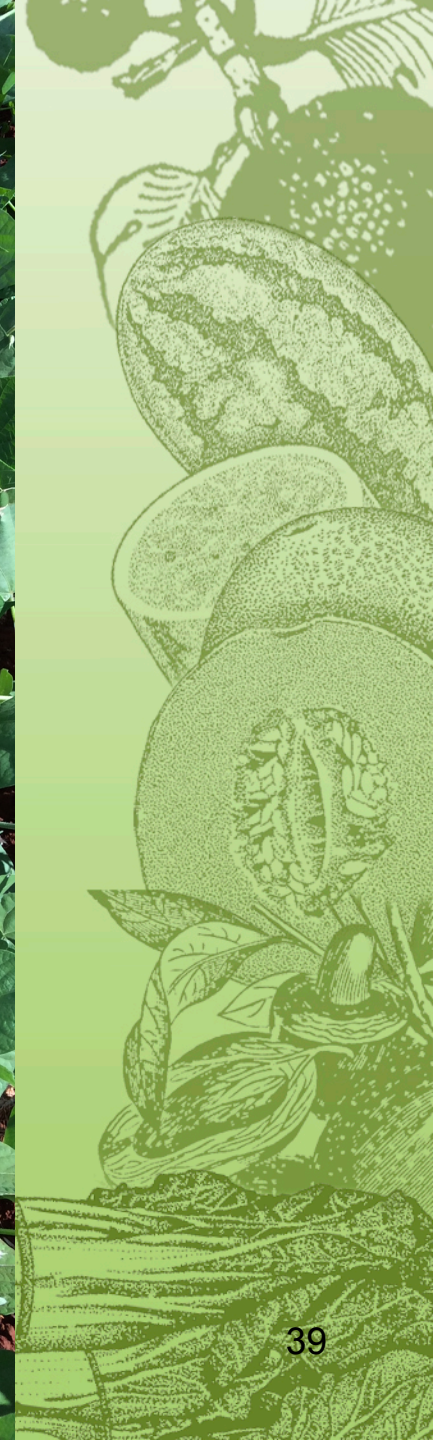




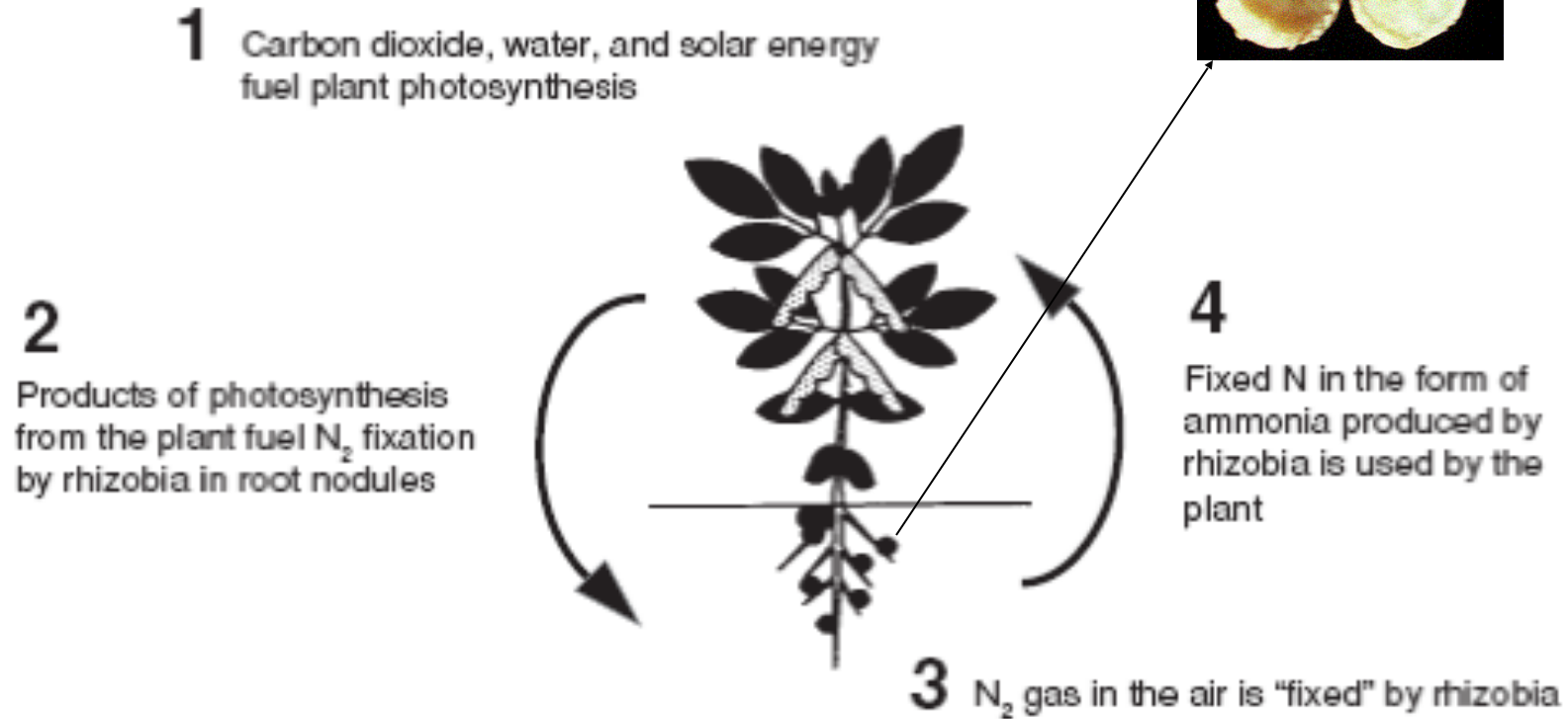


Figure 1. Two-year-old perennial peanut cover established in an O'ahu orchard.

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

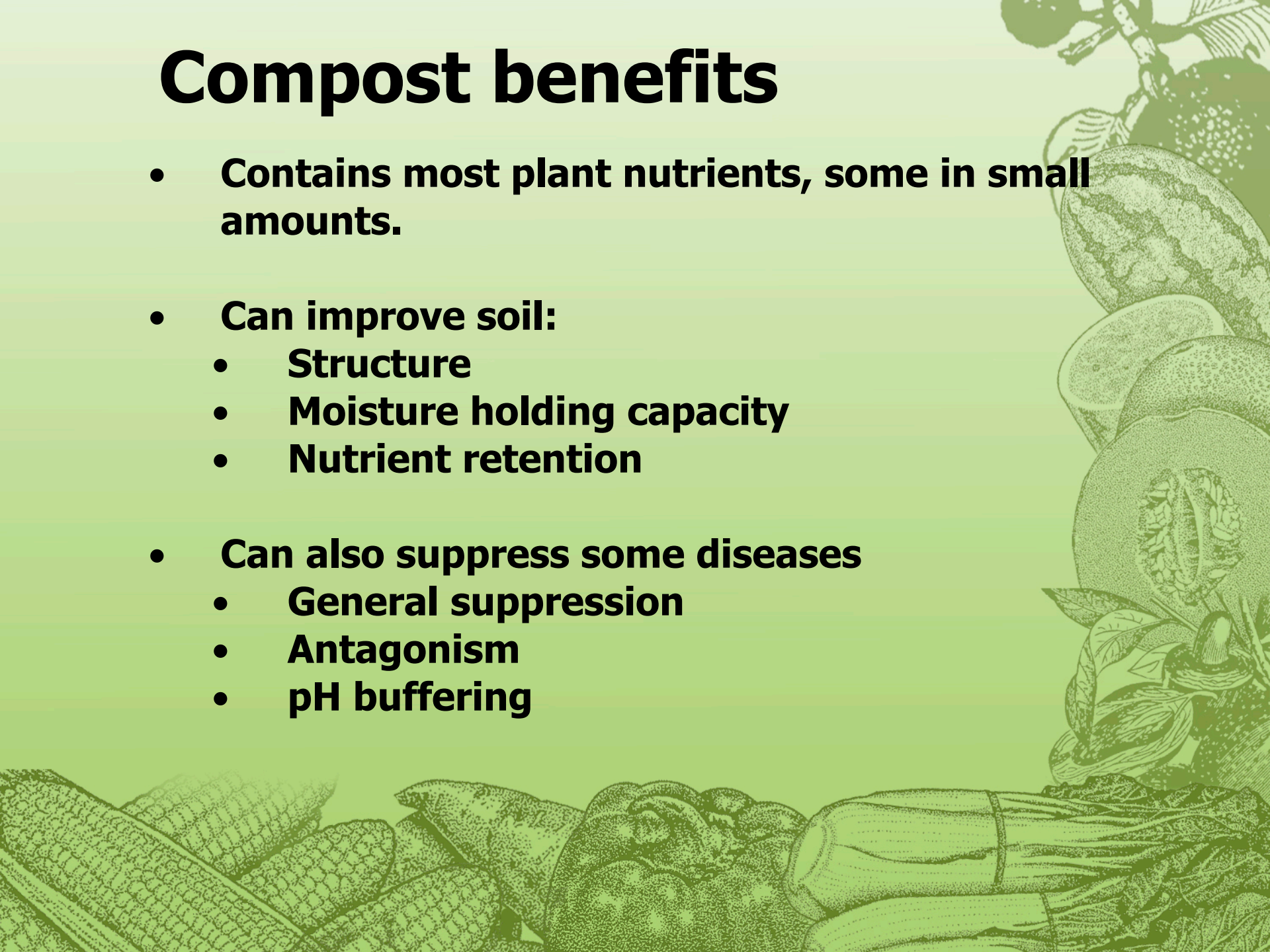
Commercial worm composting operation, O'ahu



Spreading compost, Molokai
Courtesy: Alton Arakaki

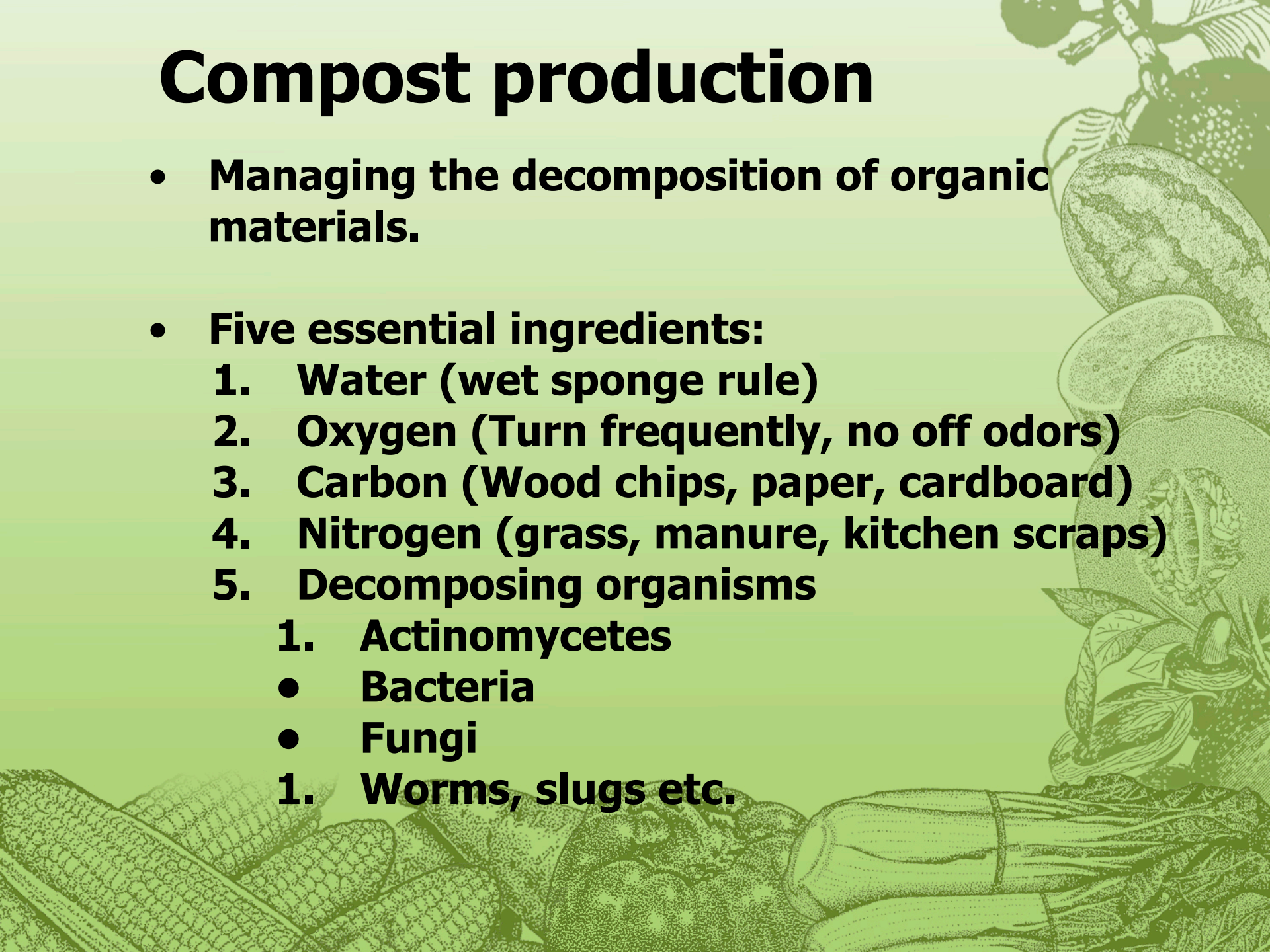
Compost benefits

- **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

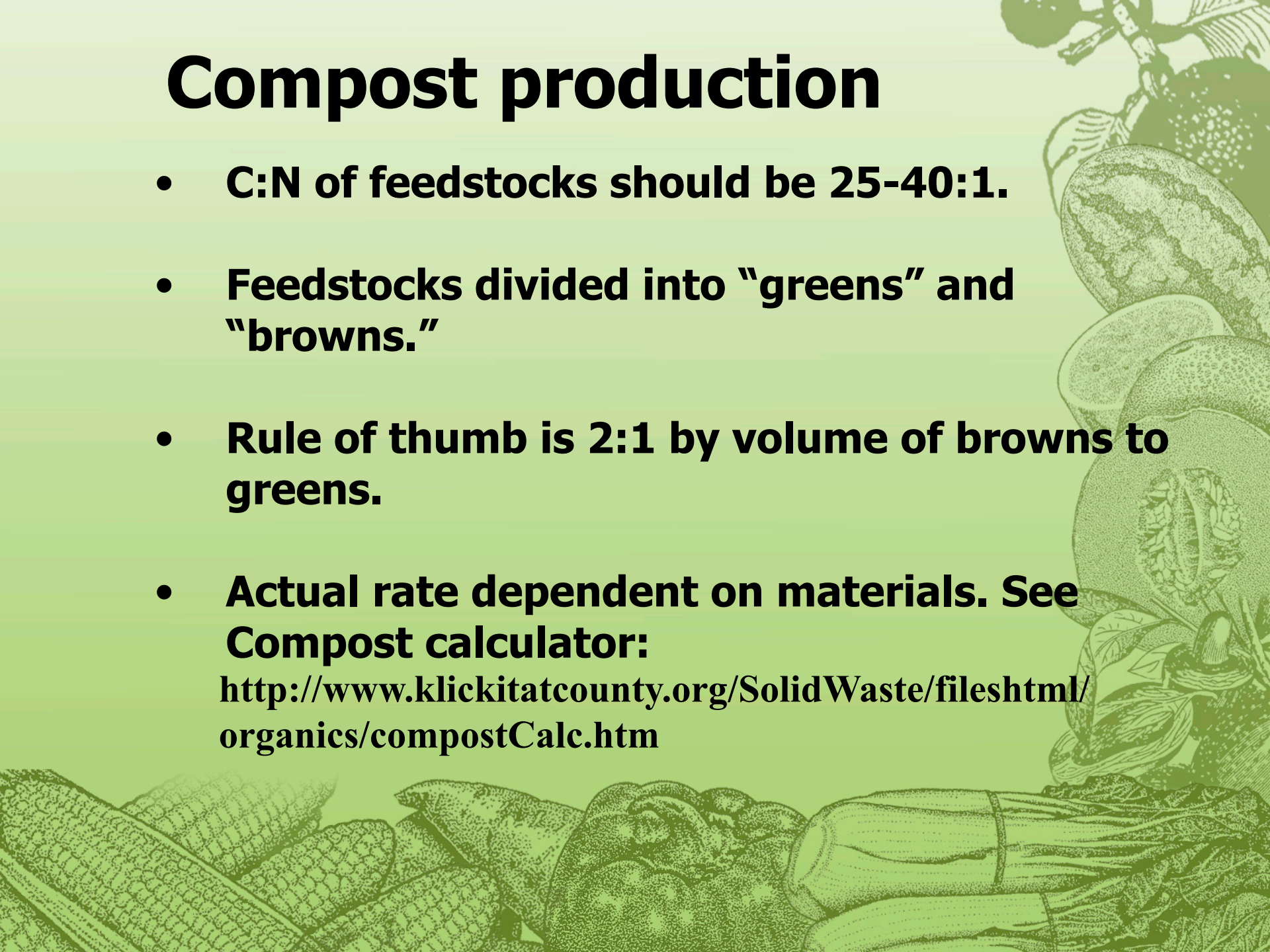
Compost production

- **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>



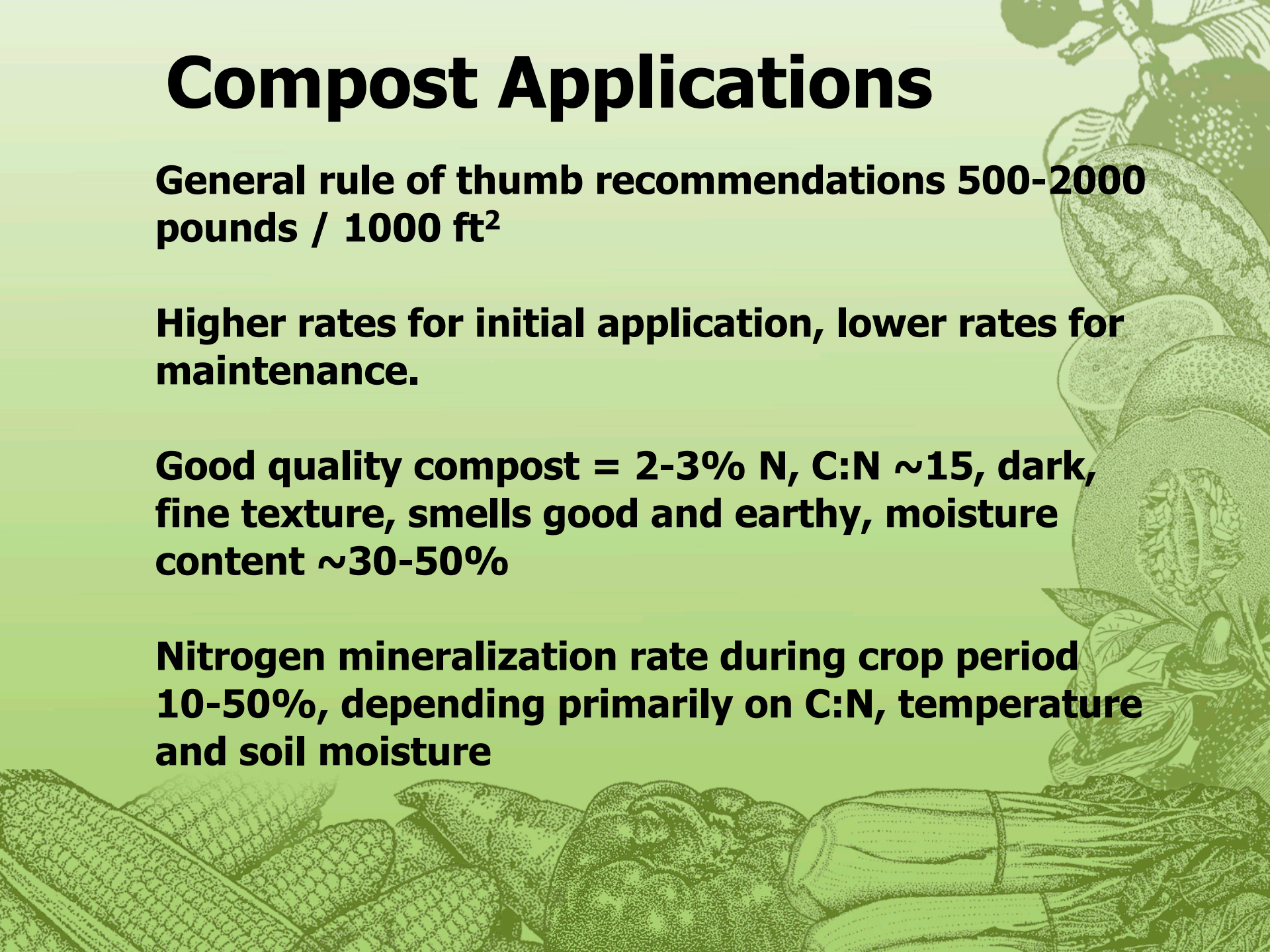
Compost Applications

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



Commercial greenwaste

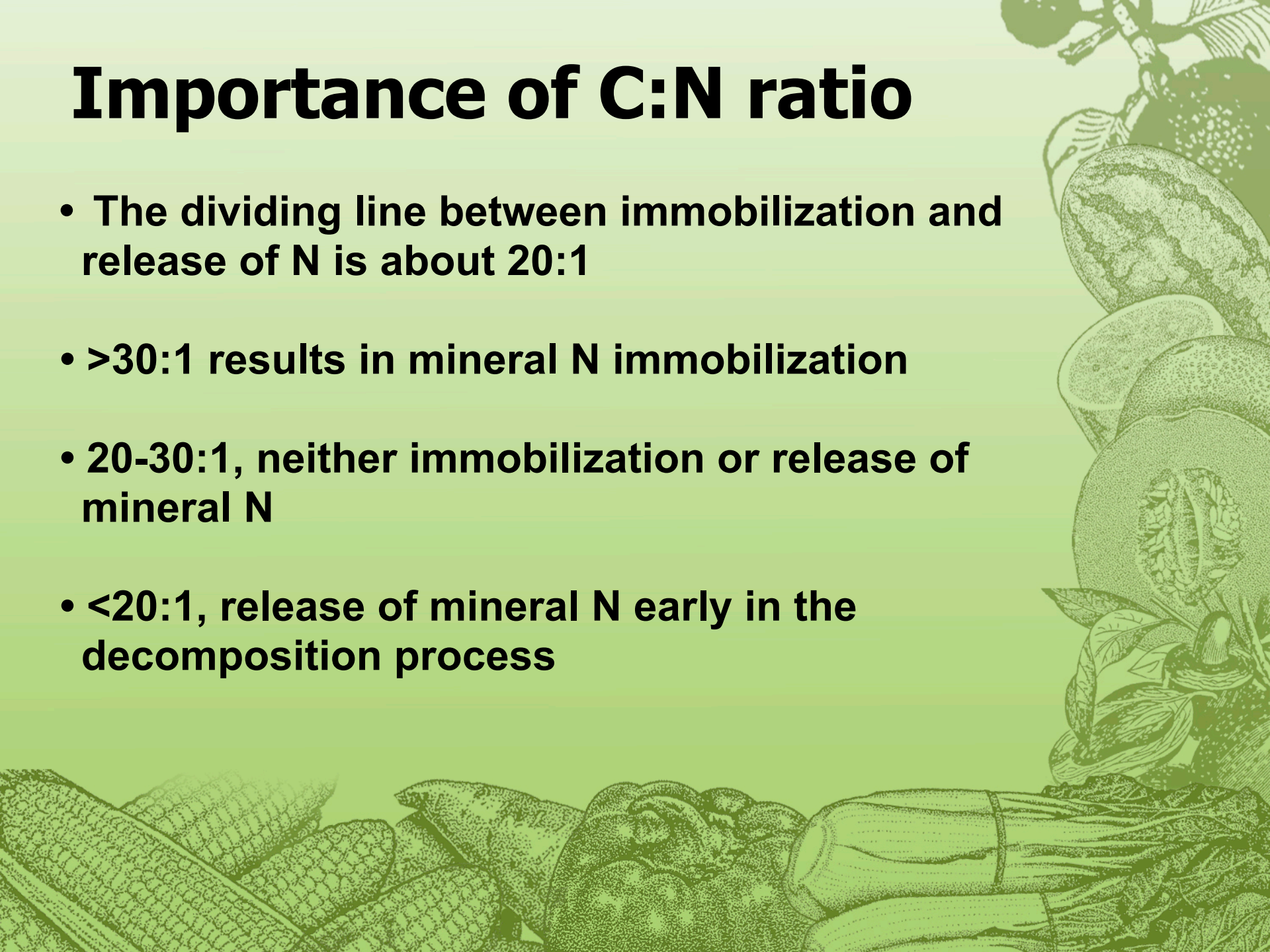


Vermicompost



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

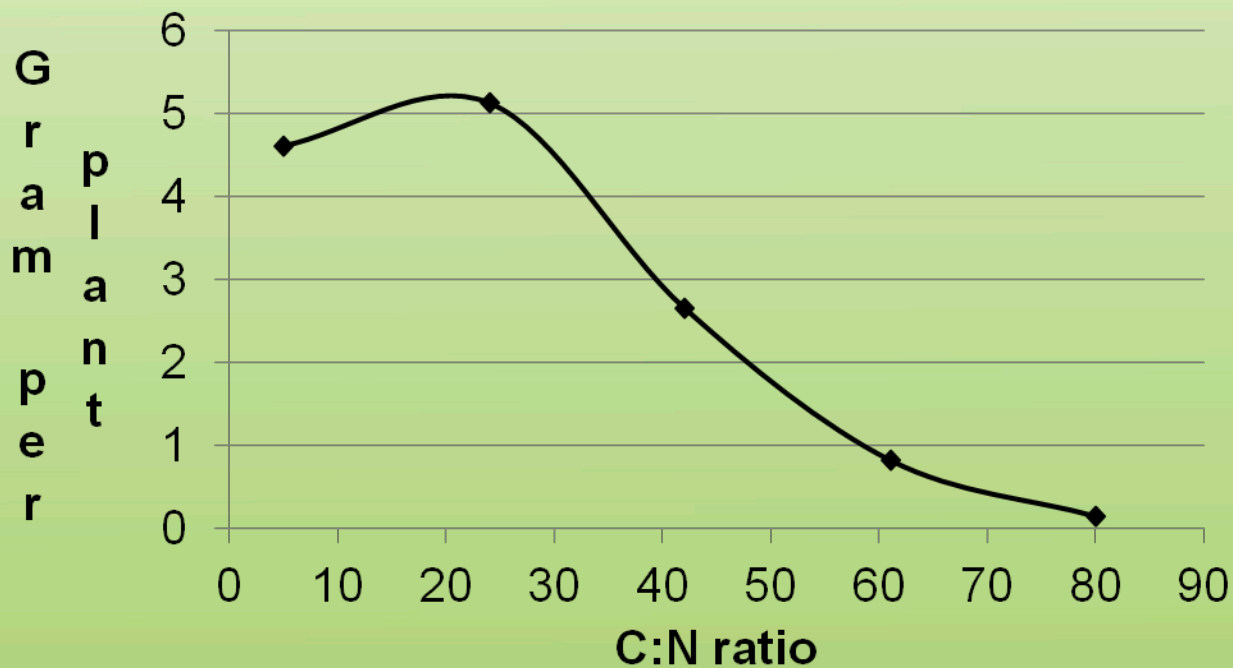


Adjust C:N ratio

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

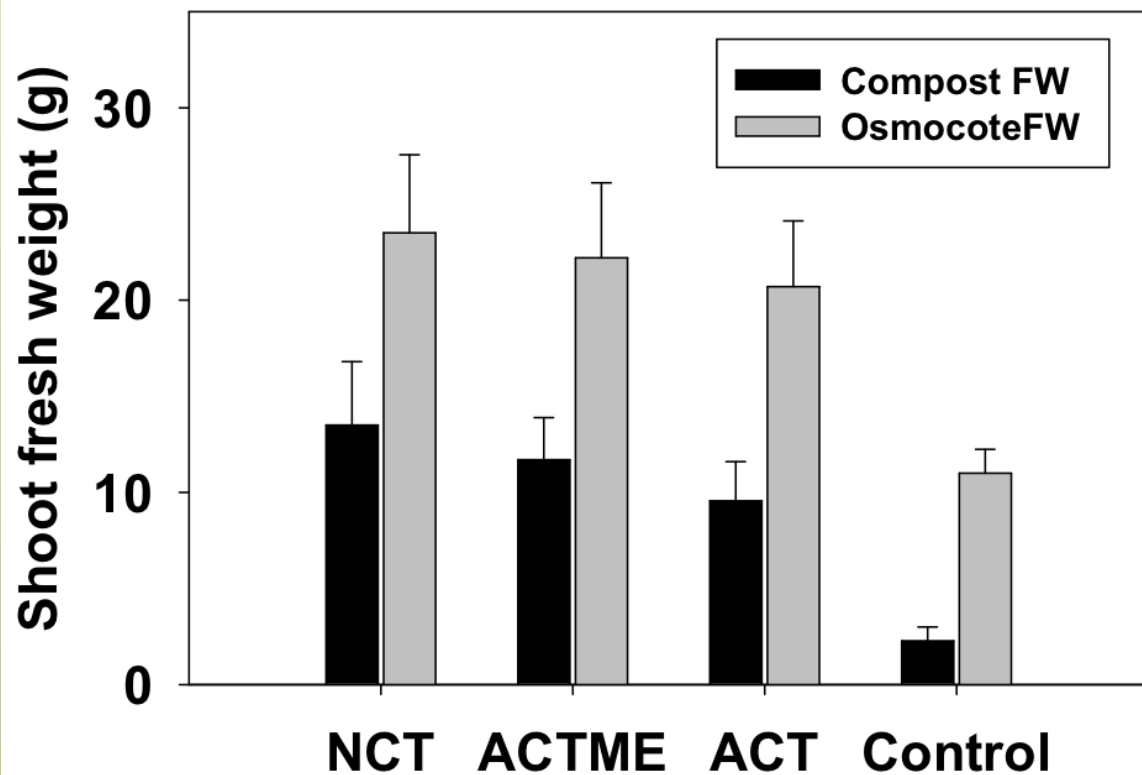
- Ratio of water to compost ranges 10:1-100:1

- Water is not circulated, only air

- 12-24 hrs



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



Variability in tea quality affected plant growth

