Using Compost to Improve Soil

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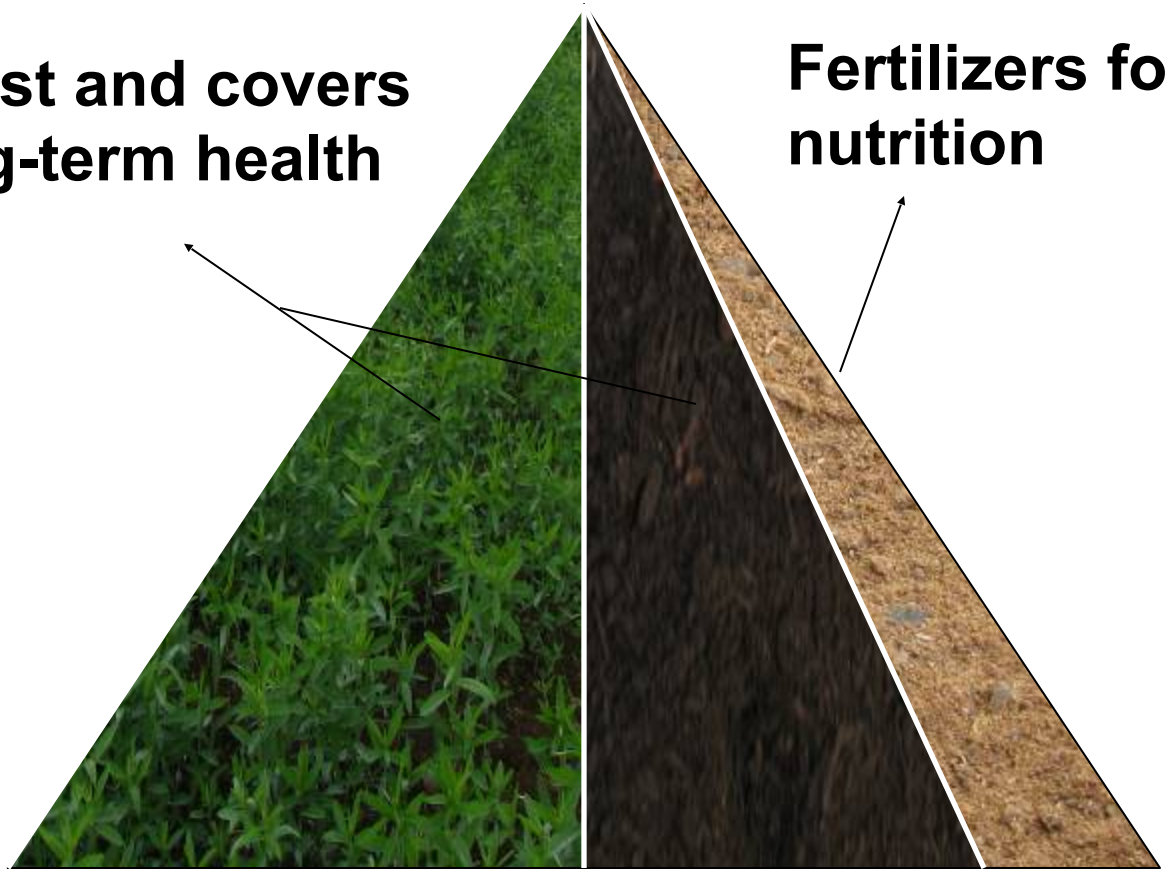
Soil food pyramid



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

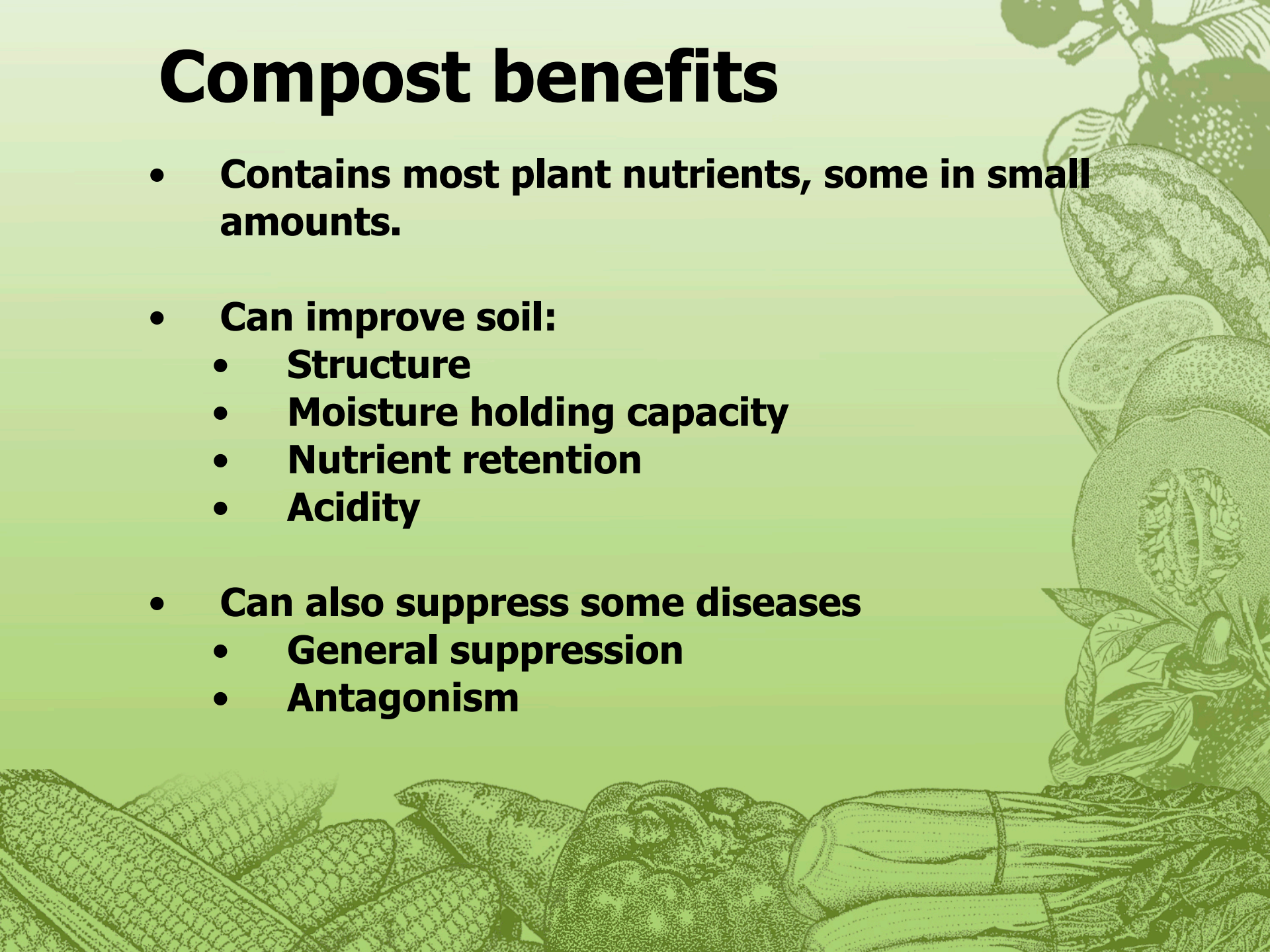
Can be woody and steal nitrogen from plants

Compost benefits

- **Contains most plant nutrients, some in small amounts.**

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

- **Can also suppress some diseases**
  - **General suppression**
  - **Antagonism**



Compost

Thermometer

On-farm compost pile, Maui

Keep moist

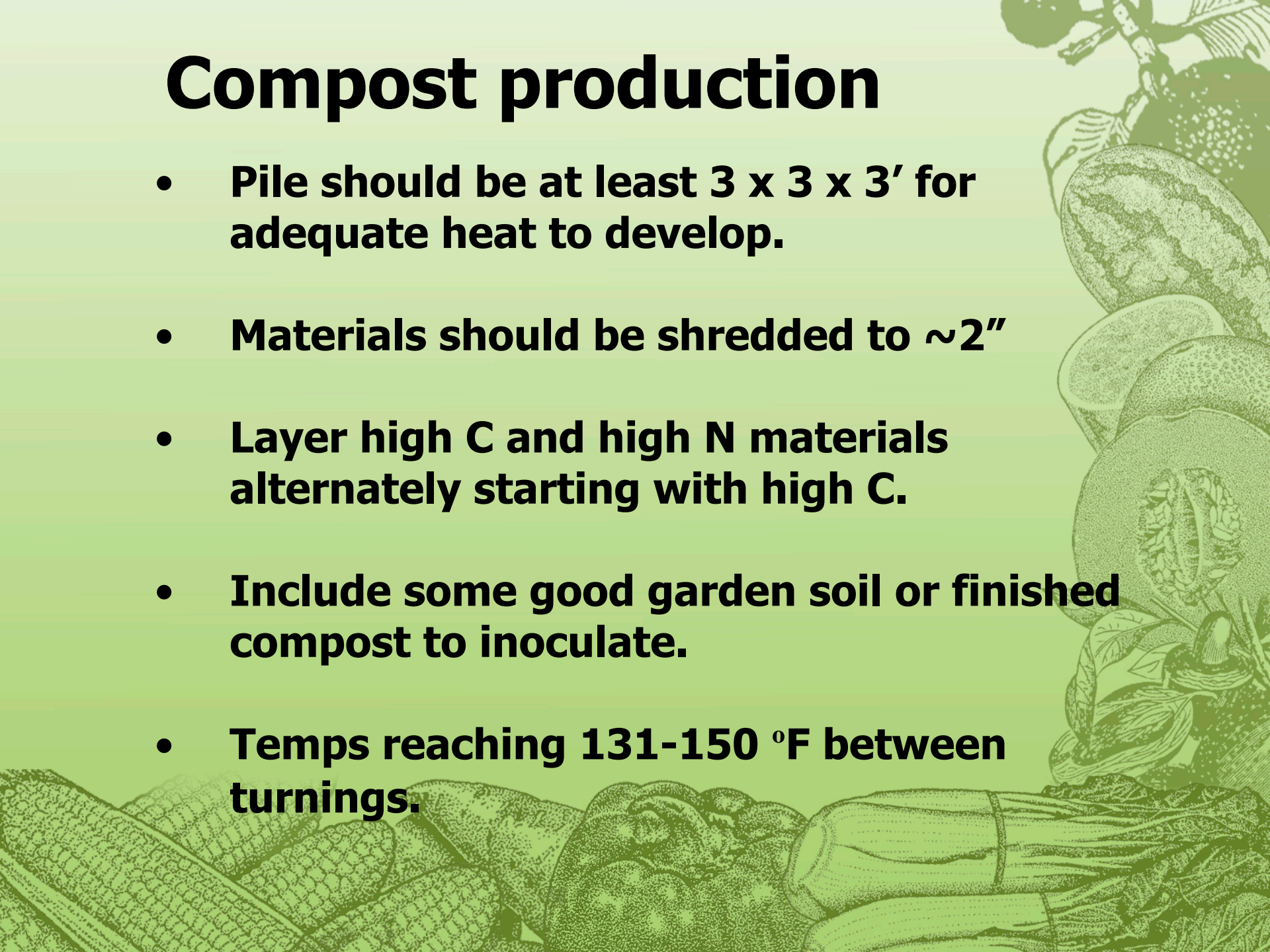
Compost production

- **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.
- 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."**
- **Actual rate dependent on materials. See on-line compost calculators, for example:**

http://www.klickitatcounty.org/SolidWaste/fileshtml/organics/compostCalc.htm

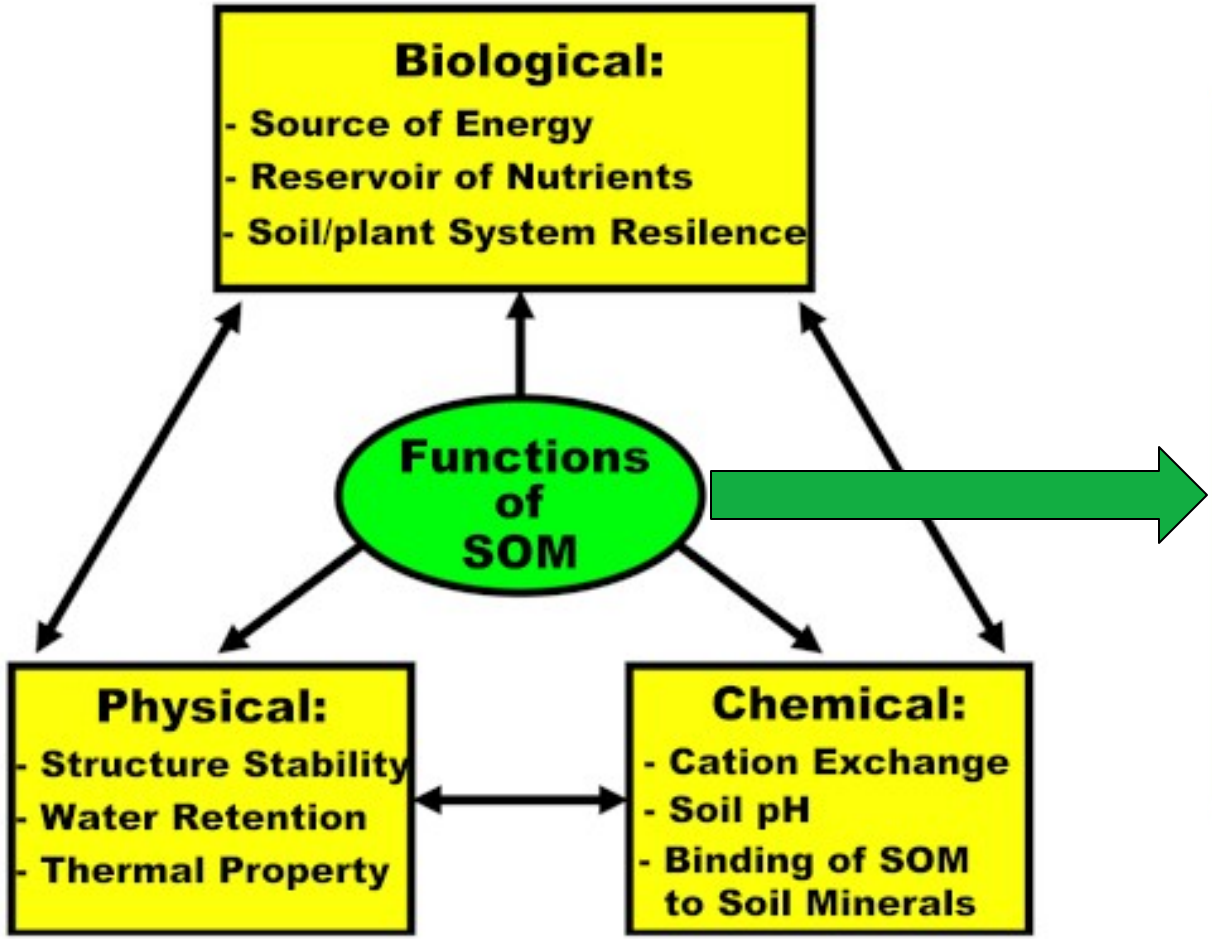
http://compost.css.cornell.edu/CoComposter.xls

http://smallfarms.oregonstate.edu/sites/default/files/WSUcompostcalc.xls

	BROWNS				
GREENS	**Dry leaves (50:1)**	**Newspaper (55:1)**	**Office Paper (130:1)**	**Soft Wood chips (225:1)**	**Cardboard (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**

Soil Health and Local Fertilizers

Why Building Soil Organic Matter is Important?



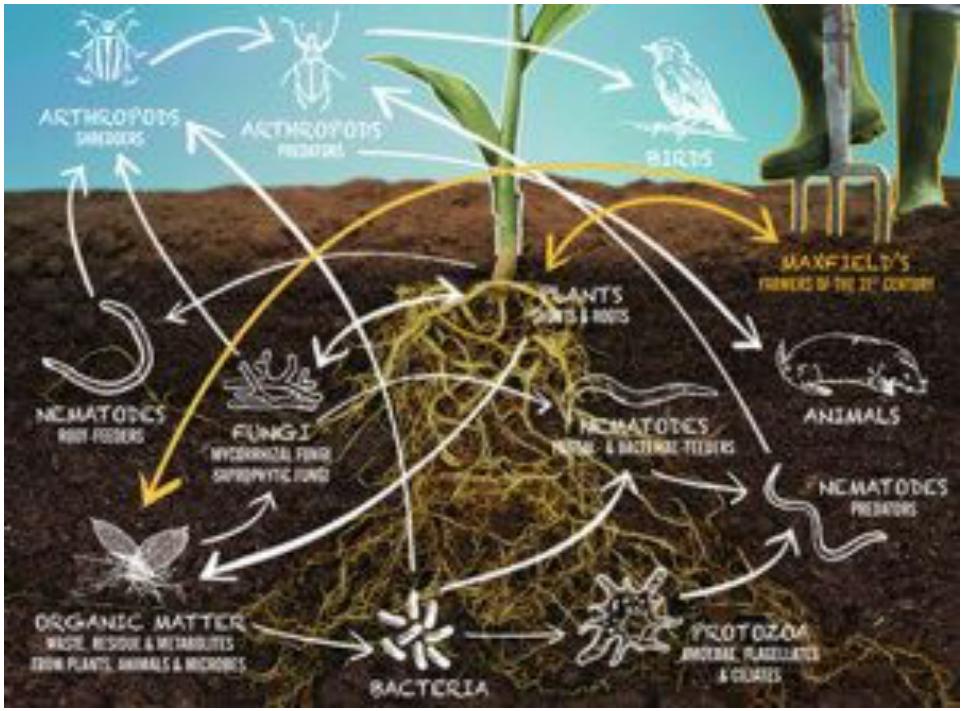
Source: http://www.treepower.org/soils/soilorganicmatter.html

http://www.sare.org

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

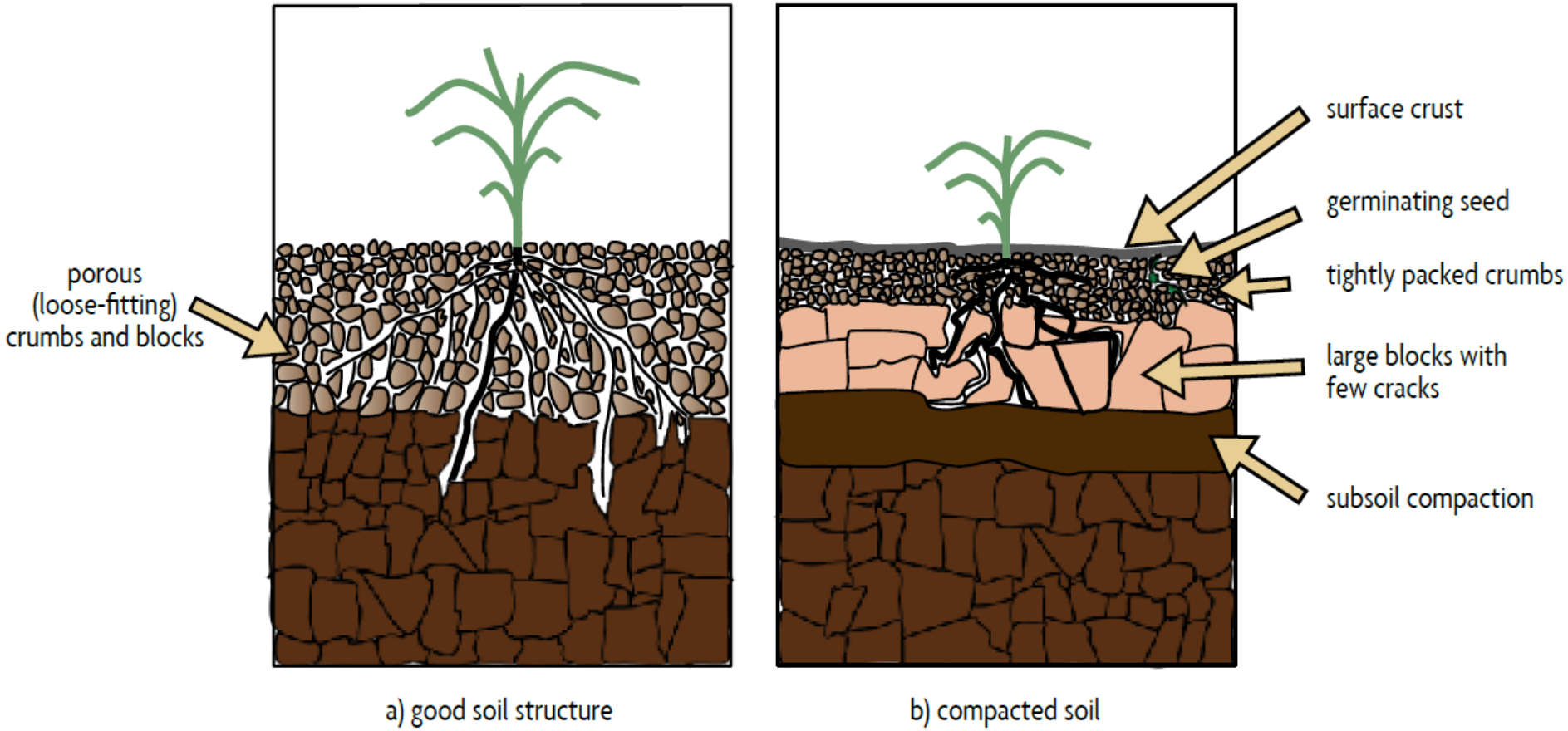
Management affects root health

Conventional **Organic**



http://www.sare.org

Aggregation

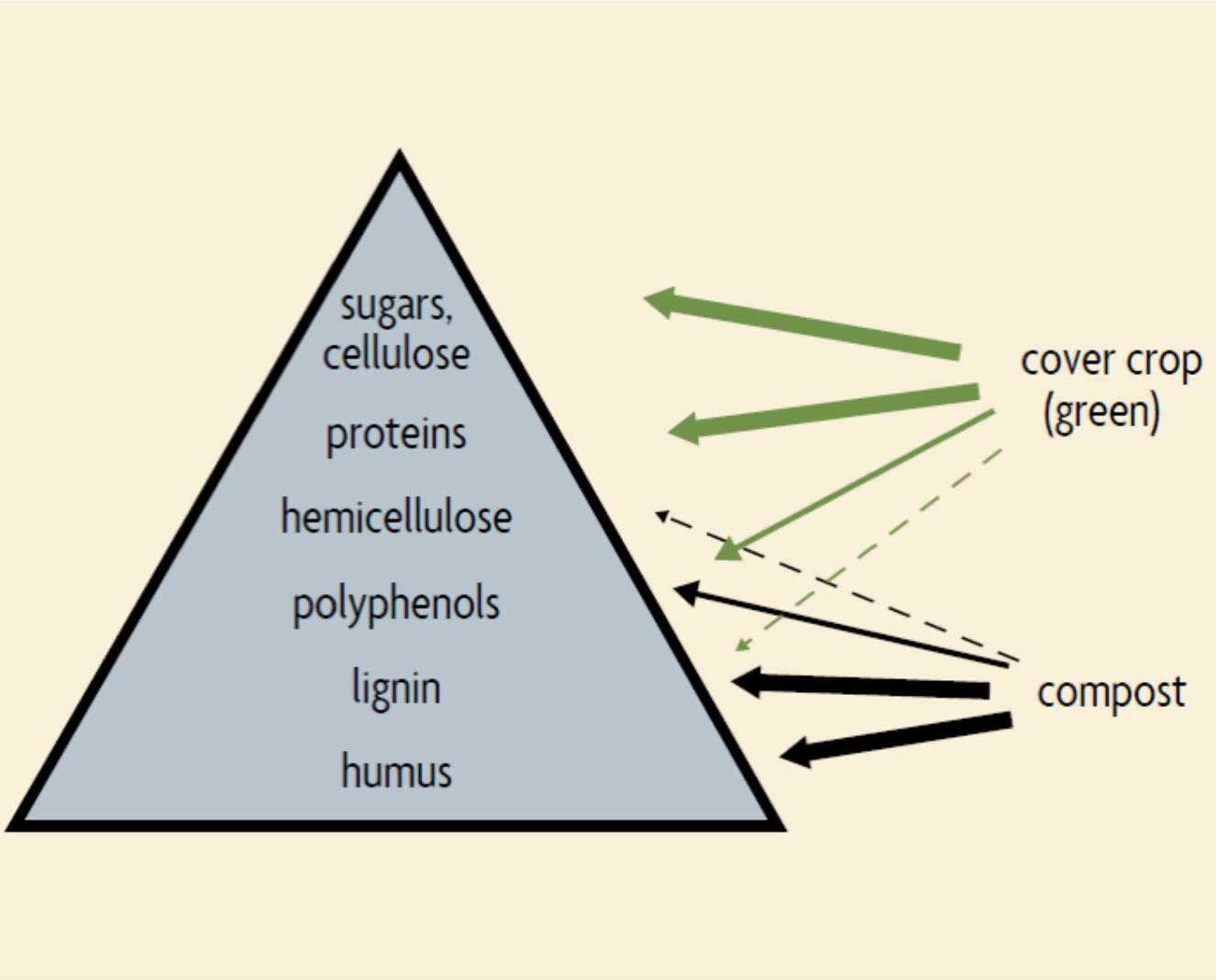


http://www.sare.org

Compaction

http://www.sare.org

Soil Health



http://www.sare.org

Compost

Commercial greenwaste

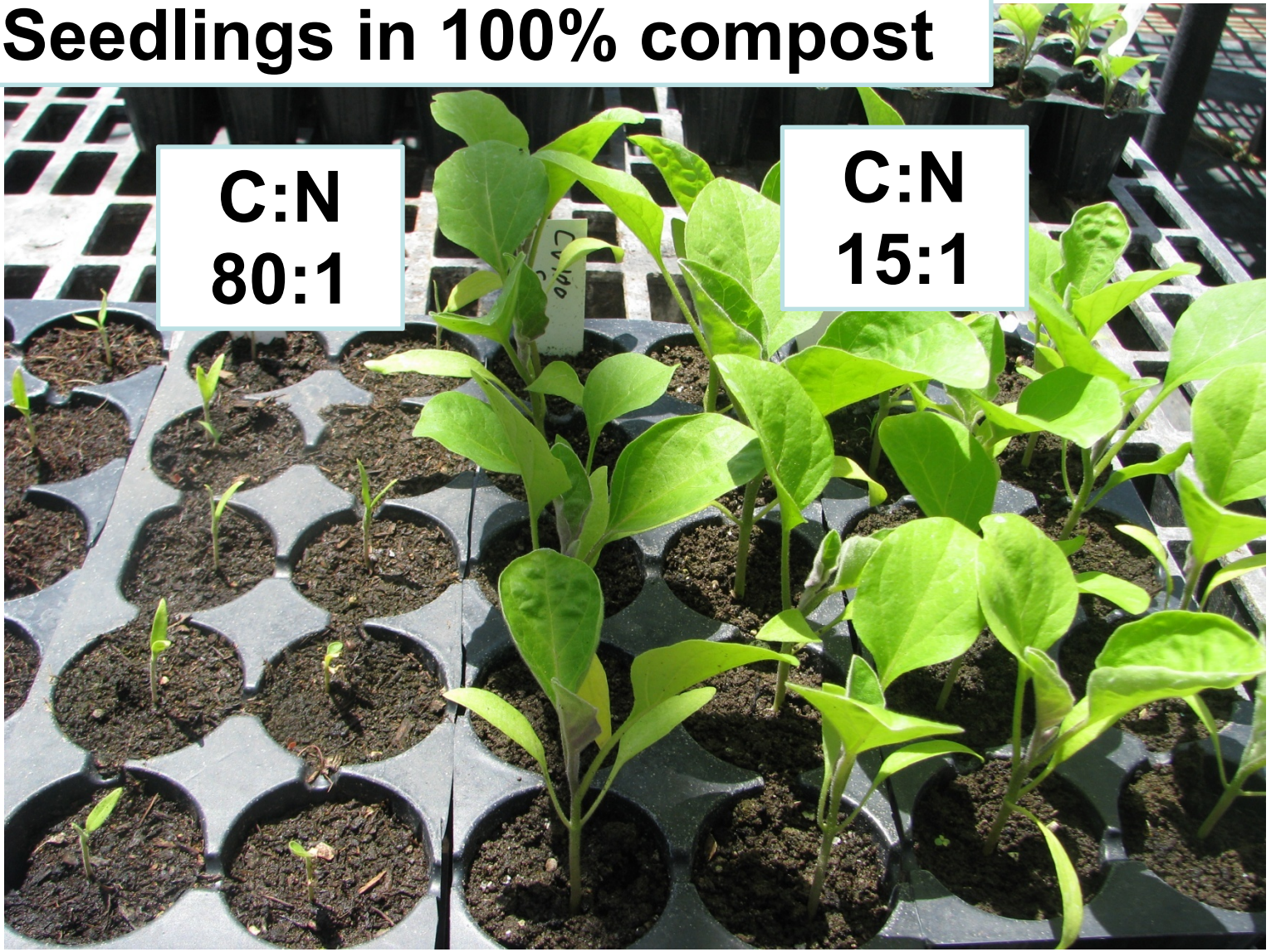
Handcrafted Artisan

Vermicompost

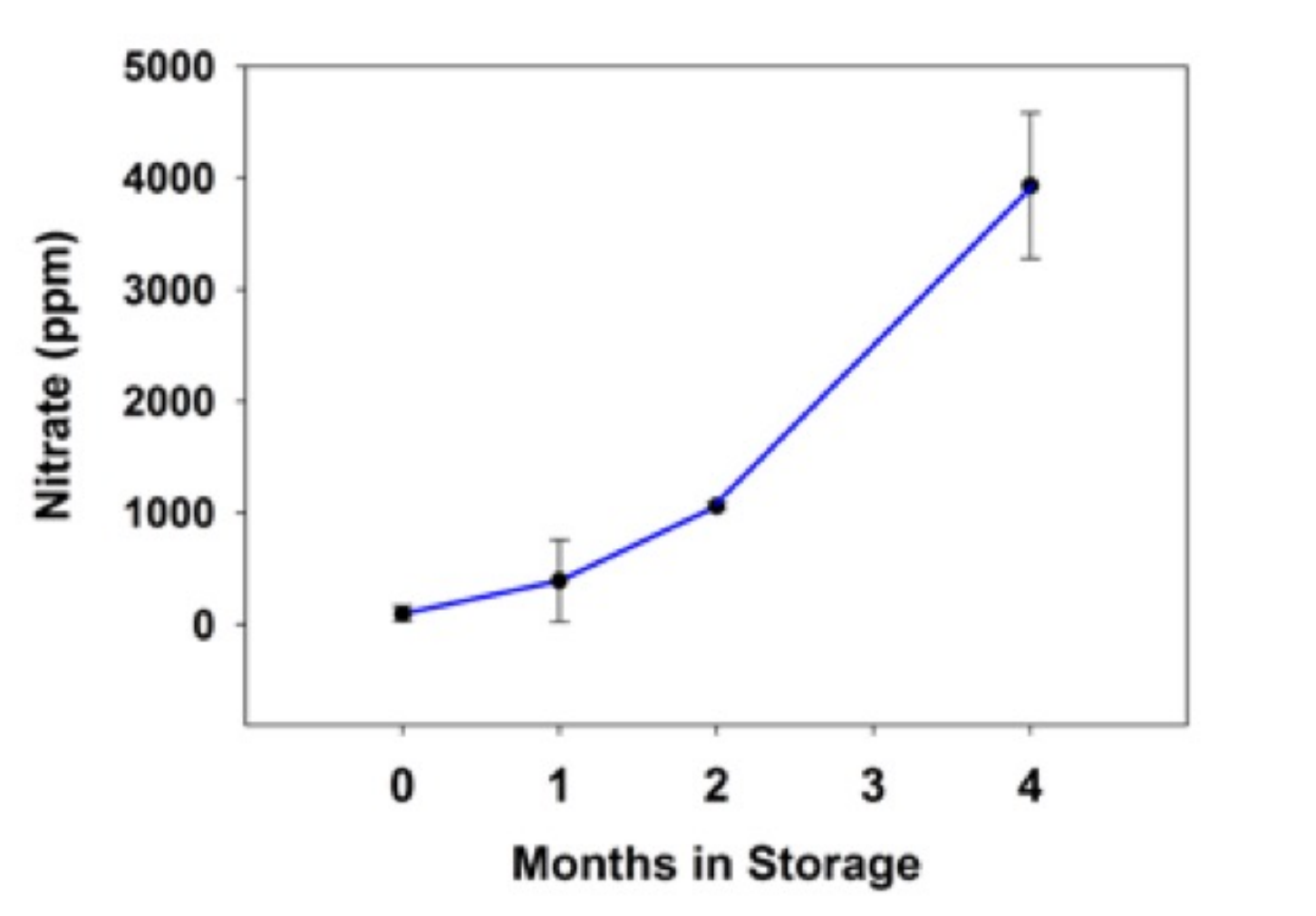
Material	C:N	%N	NO3-
Mulch	110:1	0.42%	3 ppm
Screened OM Compost	17:1	1.6%	5 ppm
Vermicompost	15:1	2.0%	1000 ppm

Carbon to Nitrogen Ratio (C:N)

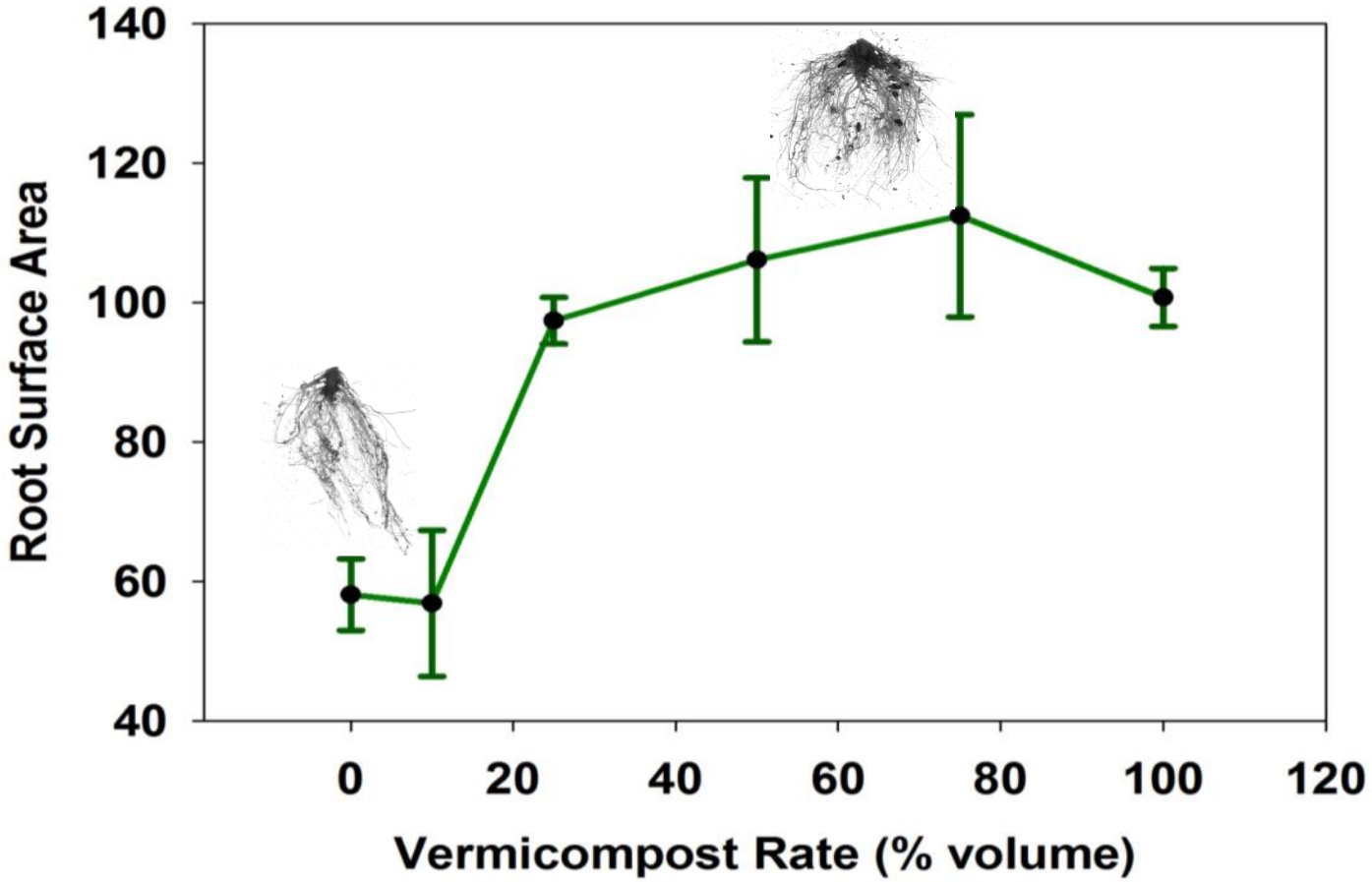
Seedlings in 100% compost



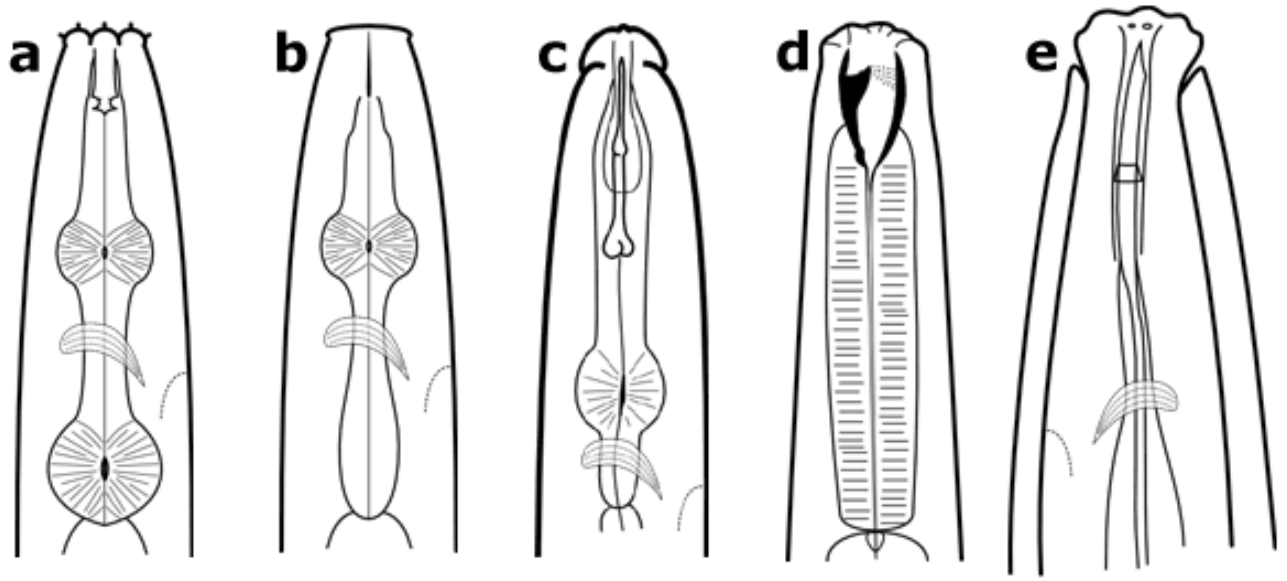
Maturation while covered & kept moist.



Vermicompost effect on tomato roots



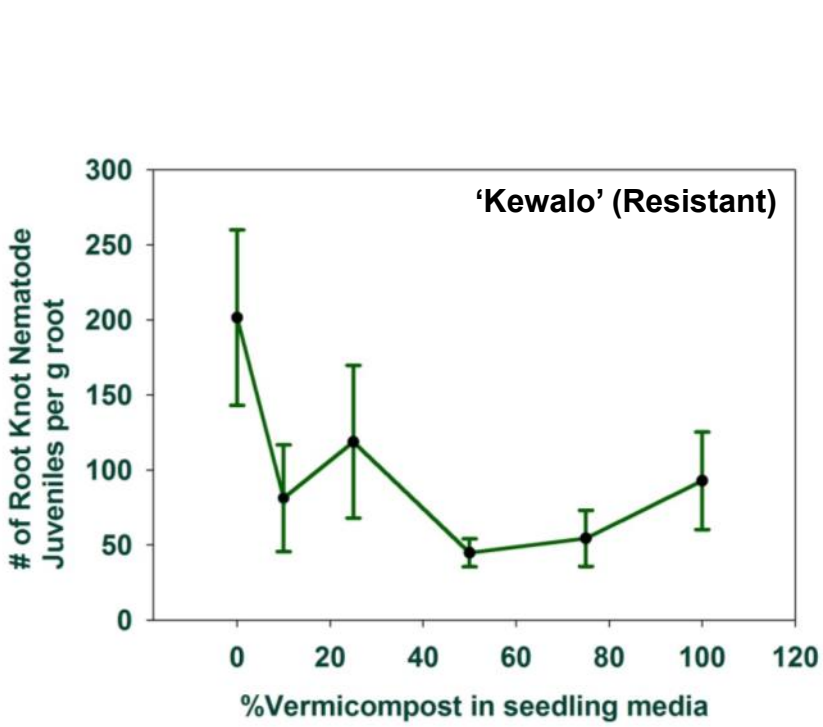
Nematodes as a measure of soil health

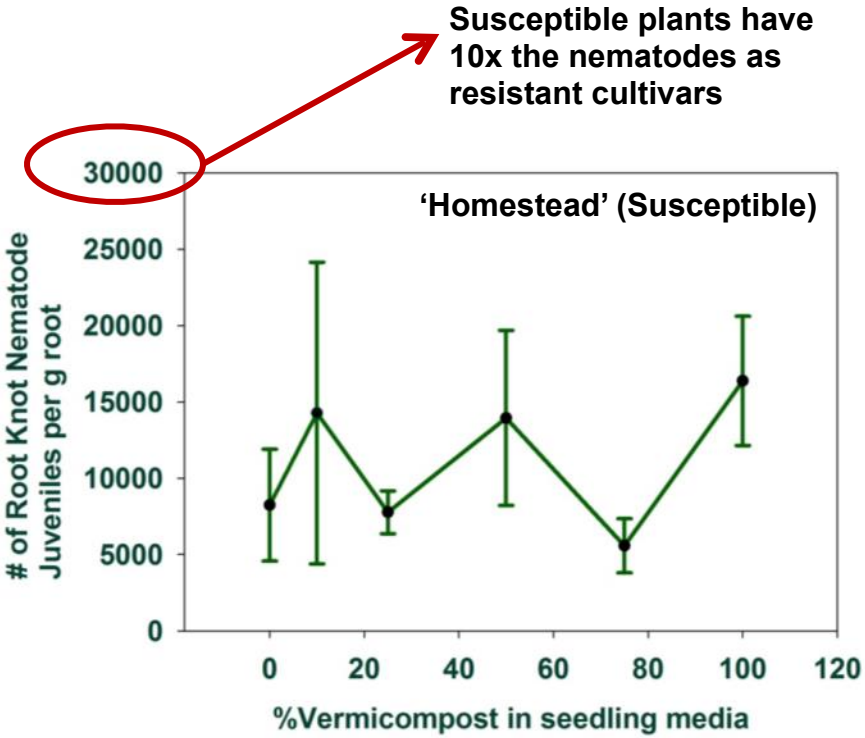


(a) bacterial feeder, (b) fungal feeder, (c) plant feeder, (d) predator, (e) omnivore.
Figure credit: Ed Zaborski, University of Illinois.

Vermicompost influence on *Meloidogyne* spp.

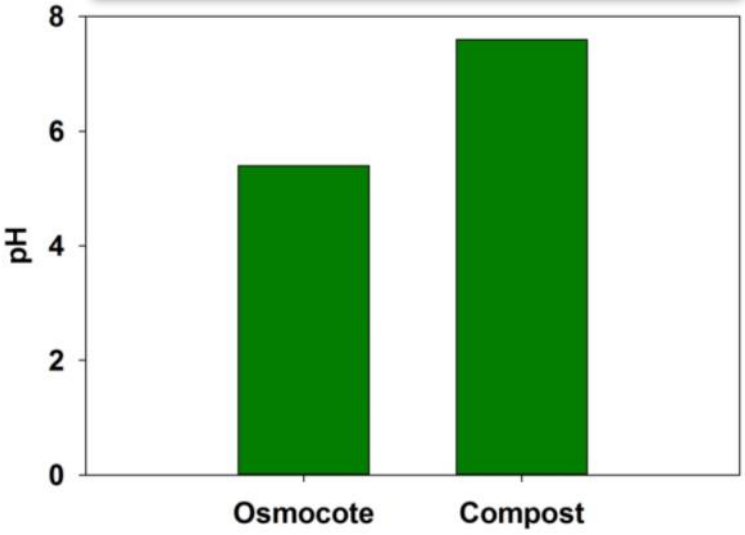
Organic inputs interact with plant genotype

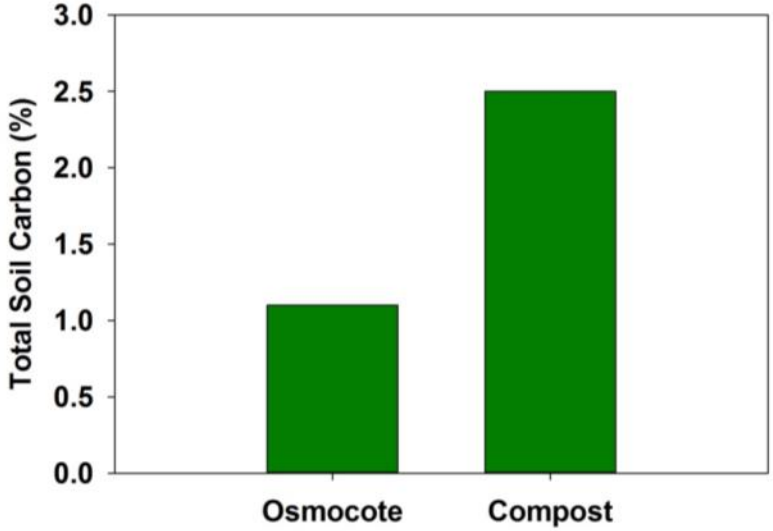




Kermah, Sipes and Radovich, unpublished data

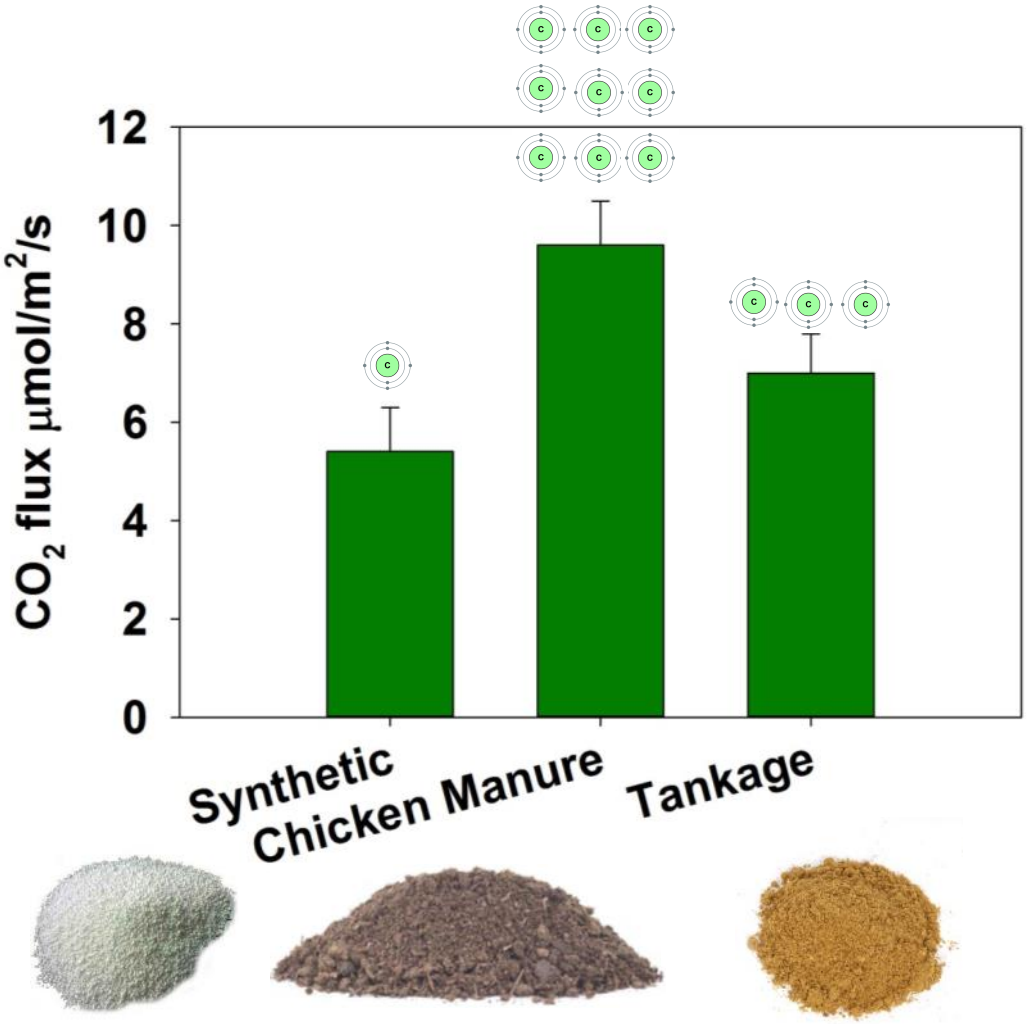
Organic fertilizers can improve soil chemical quality in poor soils





Compost Science & Utilization (2011) 19: 279-292

Soil Biological Activity by Fertilizer Type



150 kg N/ha

HORTSCIENCE 47(3):395–402. 2012.

Not all fertilizers are equal

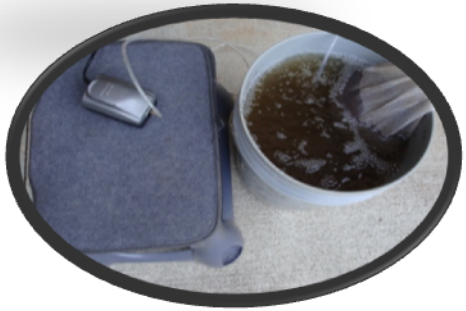
150 kg N/ha

Synthetic	Composted	Tankage
16-16-16	Chicken manure	Meat and Bone
16% N	3% N	~10% N
<7% C	~25% C	~45% C
938 kg/ha	5,000 kg/ha	1,500 kg/ha
66 kg carbon	1,250 kg carbon	675 kg carbon

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**



Microbial population in vermicompost tea.

Extraction Method	Active Bacteria (log_{10} cells mL^{-1})	Active Bacteria ($\mu g\ mL^{-1}$)	Length of Active fungi ($cm\ mL^{-1}$)	Active Fungi ($\mu g\ mL^{-1}$)
ACT	7.5 a	6.0 b	31.9 a	0.7 a
ACT ME	7.8 a	21.8 a	29.2 a	0.6 a
NCT	7.6 a	5.7 b	29.5 a	0.6 a
MNS	0.0 b	0.0 c	0.0 b	0 b
Control	0.0 b	0.0 c	0.0 b	0 b

Means (N=3) followed by the same letter are not significantly different ($p<0.05$). NCT=Non-aerated vermicompost tea, ACTME=Aerated vermicompost tea with microbial enhancer, ACT=Aerated vermicompost tea, MNS=Mineral Nutrient Solution, Control=water.

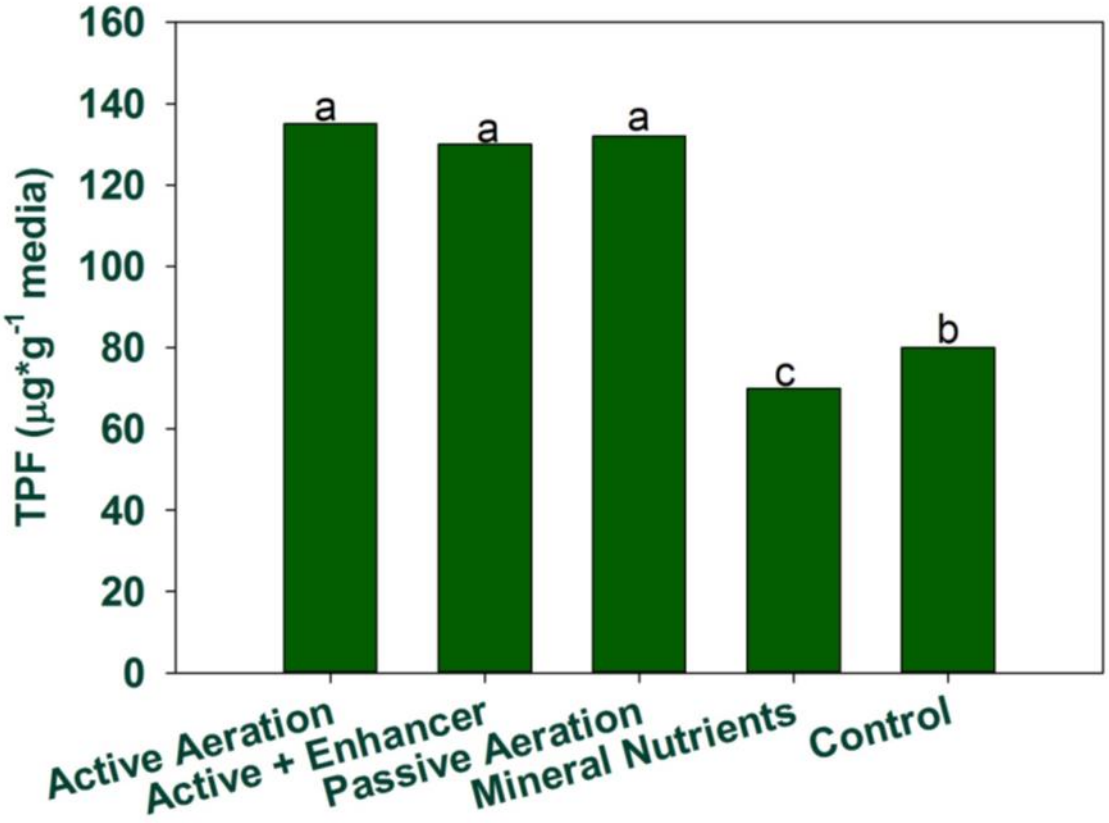
HORTSCIENCE 47(12):1722–1728. 2012.

Variability in tea quality affected plant growth

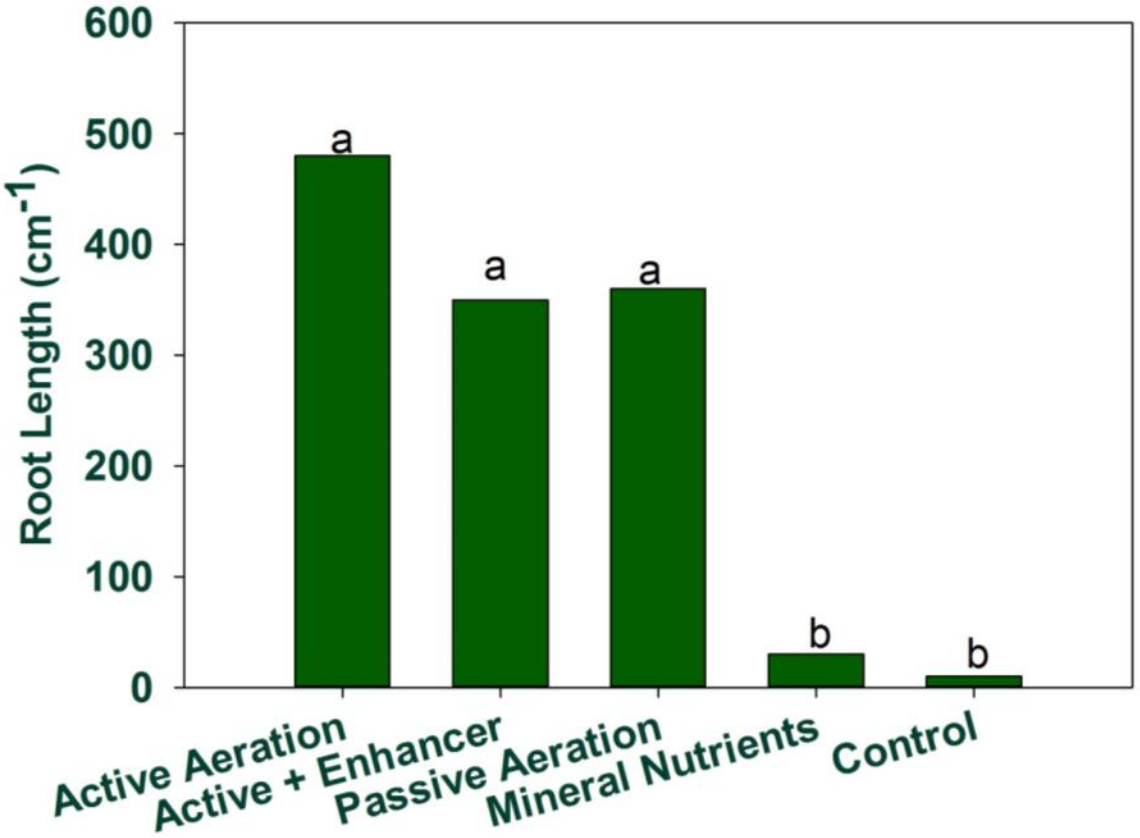
Scientia Horticulturae 148 (2012) 138–146


Live Like This

Chicken Manure vermicompost extracts affect biological activity

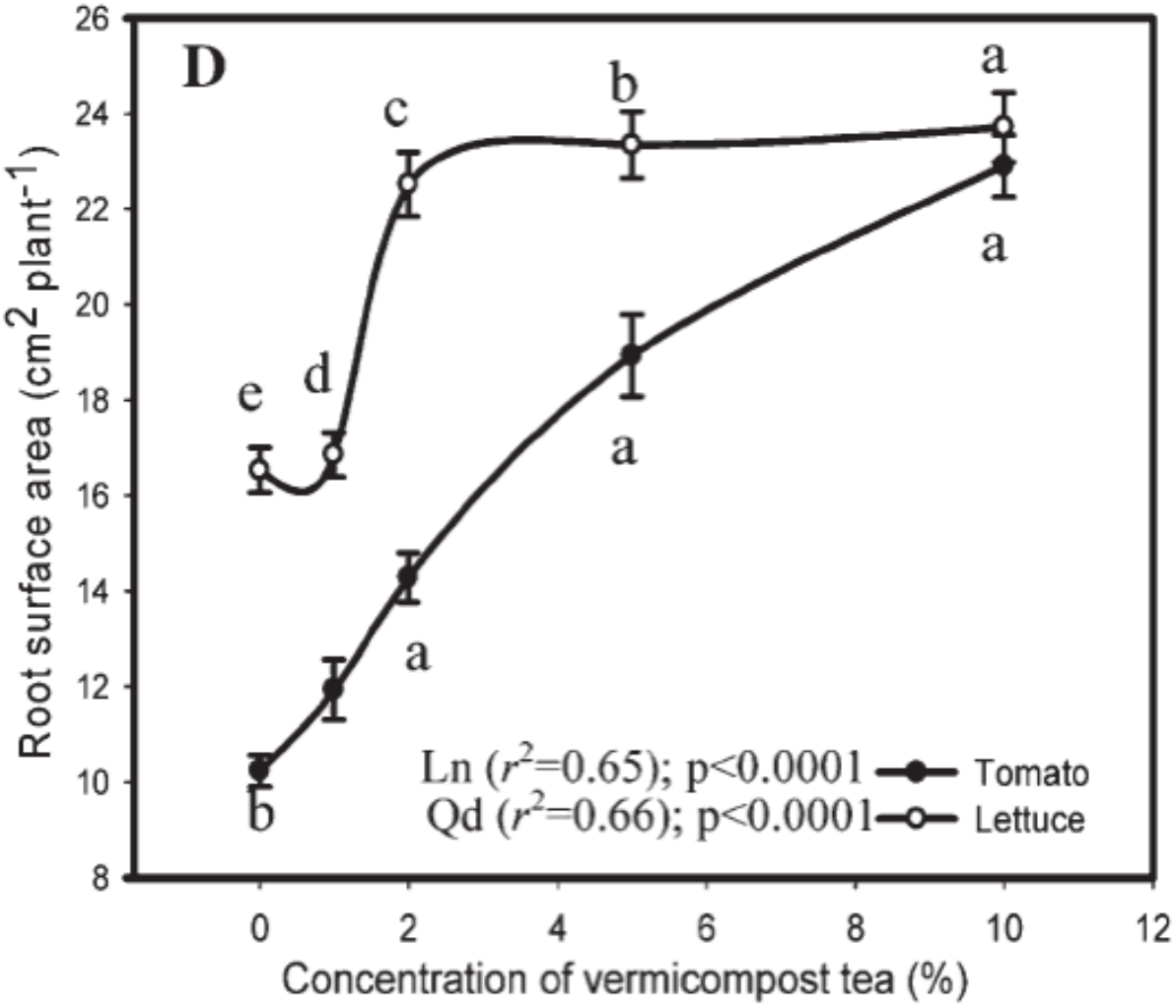


Compost extracts affect root growth



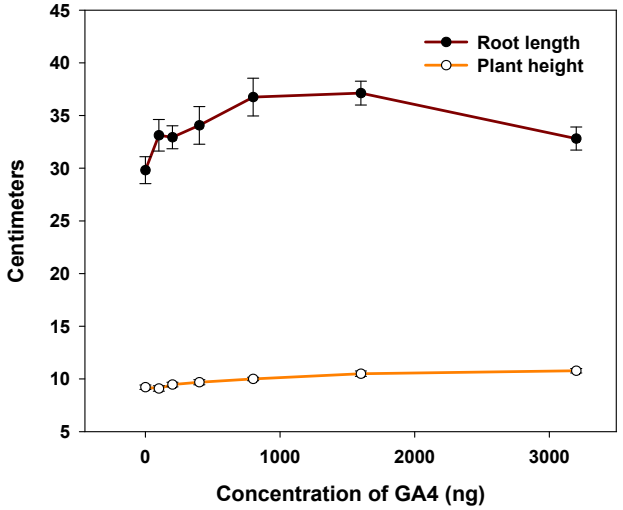
Compost Science & Utilization (2011) 19: 279-292

Compost tea effects seedling roots

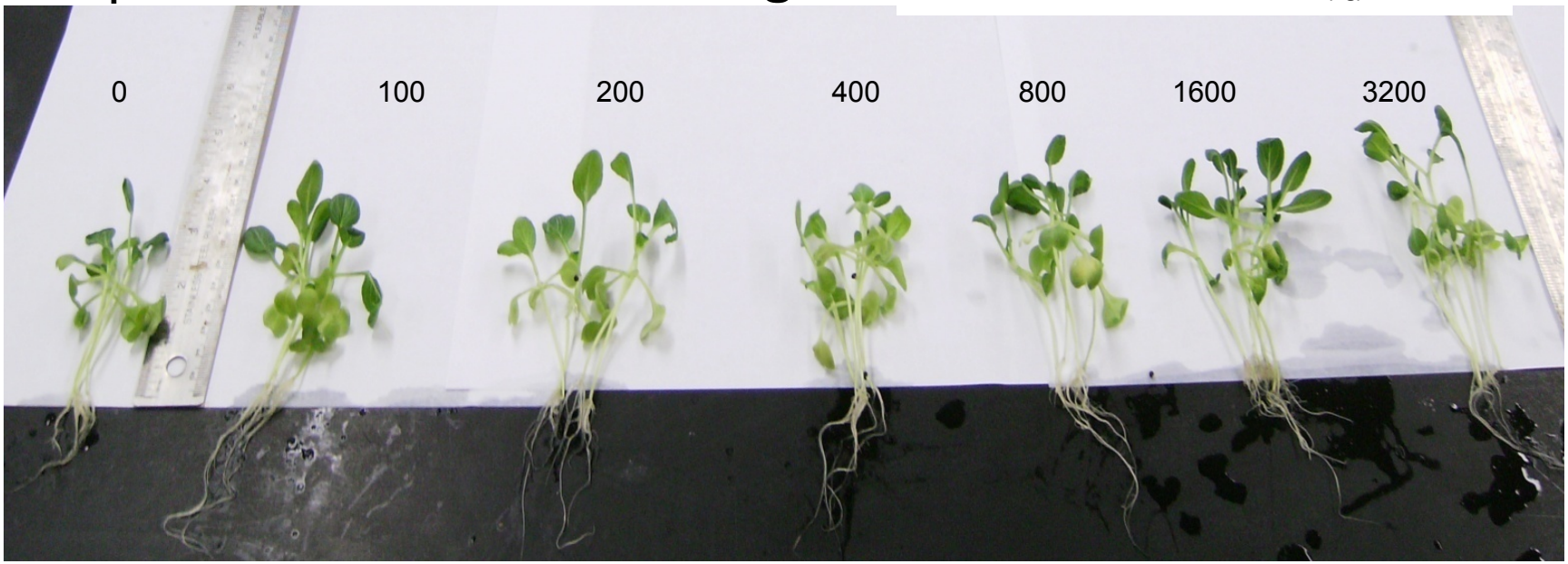


HORTSCIENCE 47(12):1722–1728. 2012.

Fresh weight = 7.76 + 2.6 X GA_4 + 0.13 X Nitrate

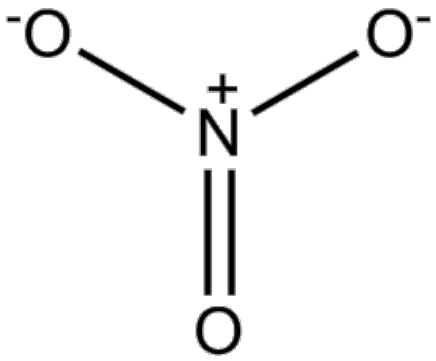


GA_4 concentration: 0-3200 ng L^{-1}

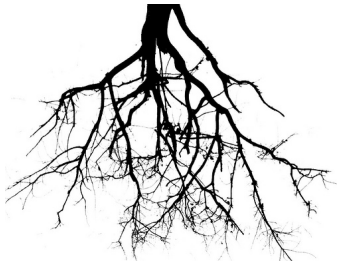


How does it work?

Nutrients

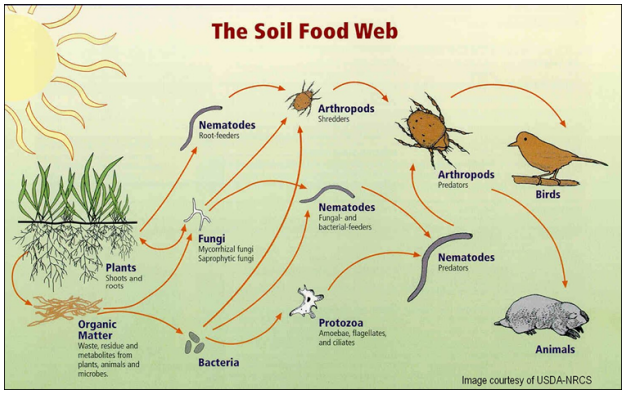


Stimulated Root growth (GA_4)



https://c2.staticflickr.com/

Enhance Biological Activity



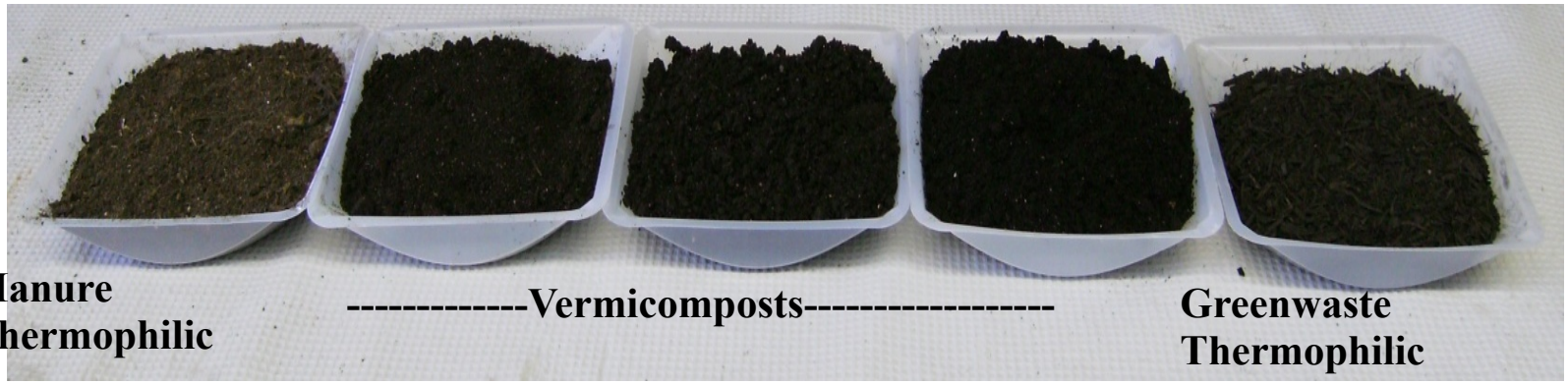
Summary

Compost tea improves plant nutrient status:

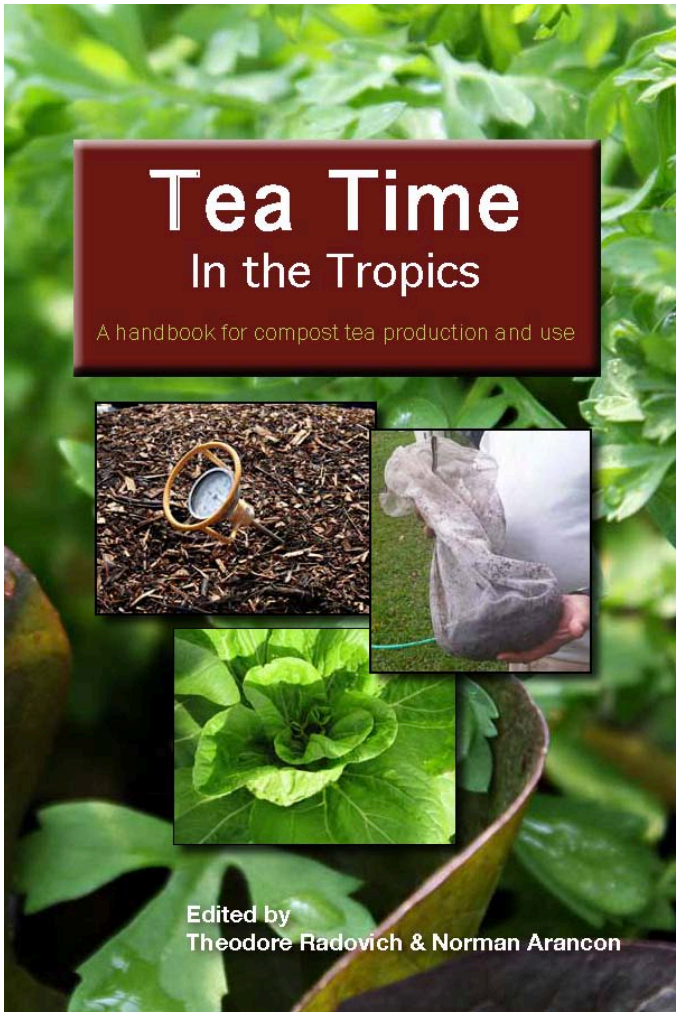
1. **Mineral nutrients**
2. **Stimulated root growth.**
3. **Improved soil biological activity**

Recommendations to Growers:

1. **Compost quality matters.**
2. **More mature better. >300 ppm nitrate.**
3. **>1% compost.**
4. **Aeration recommended, not additives.**
5. **Inject into drip.**



Guiding new adoptors



http://www.ctahr.hawaii.edu/RadovichT/lab-local_resources.html#compost

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