

Soil Structure & Building Robust Soil Systems

Webinar Series

July 15, 2020 3:30pm

Professional Standards Learning Code: 1230





Arizona Department of Education (ADE)

This training was sponsored by the Arizona Department of Education (ADE) Health and Nutrition Services Division (HNS).

Intended Audience

This training is intended for **School Food Authorities (SFAs)** operating the **National School Lunch Program (NSLP)** and the school garden leaders and teachers that support them.

Professional Standards

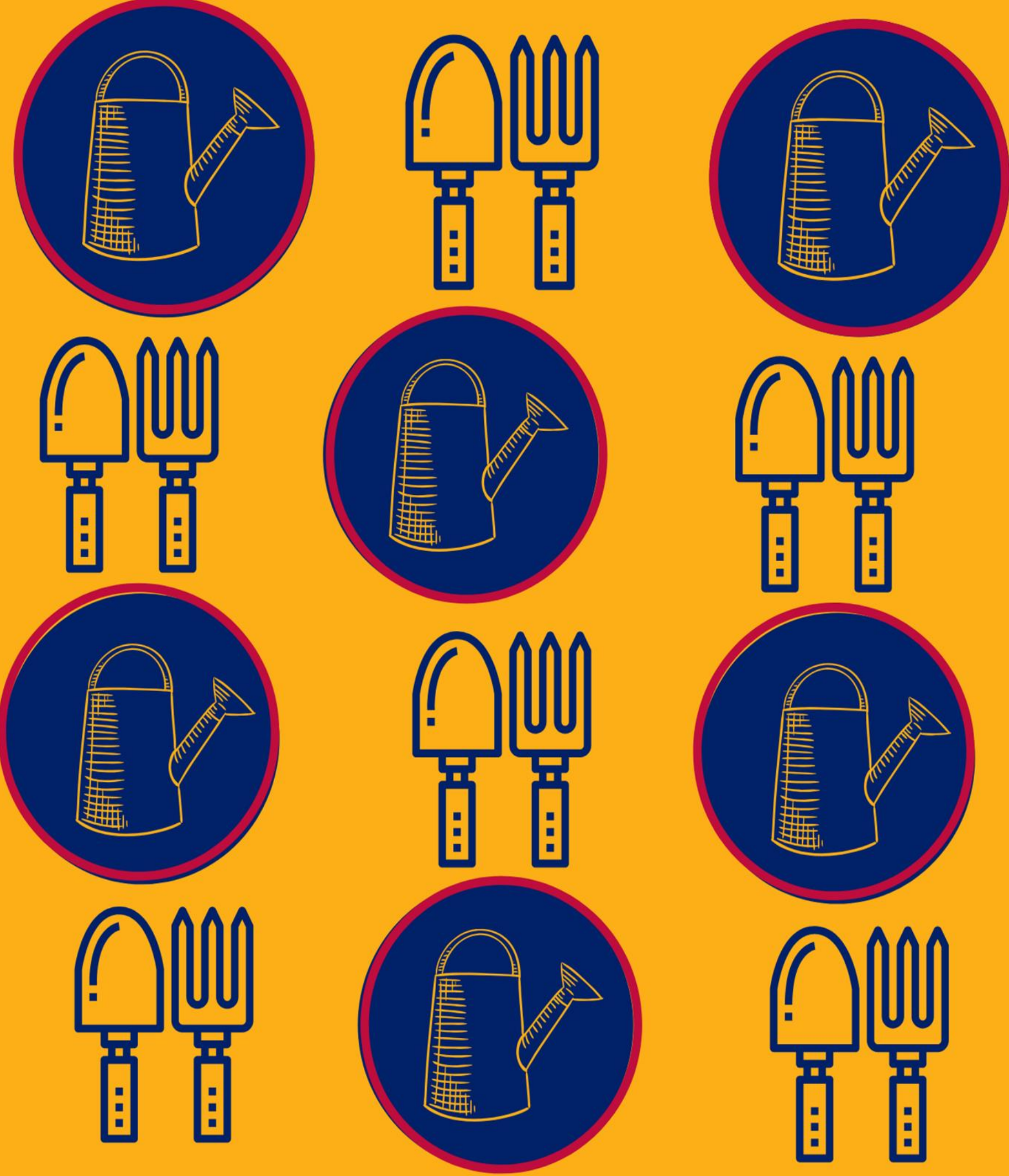
Information to include when documenting this training for Professional Standards:

Training Title: Soil Structure & Building Robust Soil Systems

Key Area: 1000- Nutrition

Learning Codes: 1230

Length: 1 hour



39%

In February 2020 past attendees of the Arizona School Garden Sustainability series of 2019, responded wanting to learn more about soil structure and building robust soil systems.



Emily Rockey

Green Industry Professional

Tank's Green Stuff / Mission Garden

Thank you for joining me today!

Bio: Emily Rockey studied Plant Sciences at the University of Arizona then worked at public gardens (Longwood Gardens, Walt Disney World, and Tucson Botanical Gardens).

Emily “dug deeper” into soil at Tank Green Stuff in Tucson, expanding their selection of organic soil materials and cultivating relationships in the community around the company's composting operation.

Now, Emily brings her passion for plants, soil, sustainability, and community together with her work at Mission Garden as the Garden Supervisor, maintaining 4 acres of organic fruits and vegetables.

Overview

What is Soil?

- How to Determine Soil Type
- Soil Testing
- Soil & Plant Biology Basic

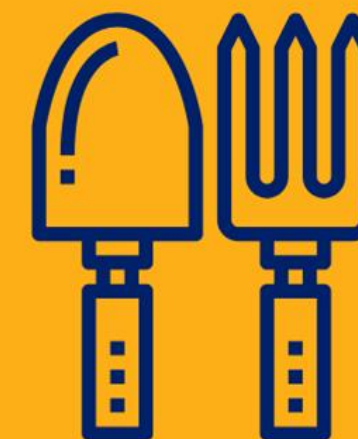
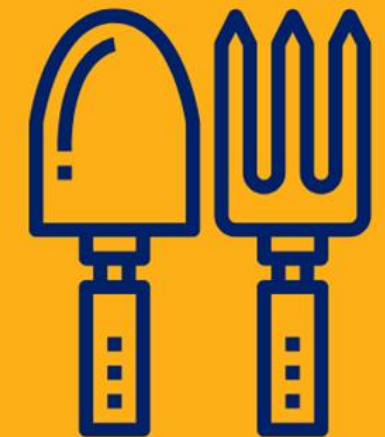
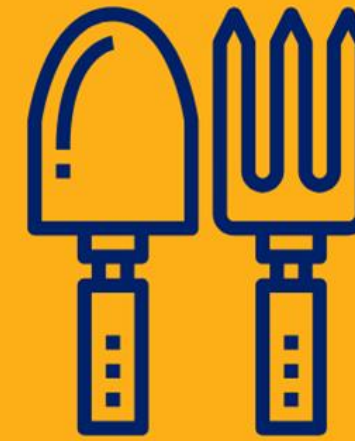
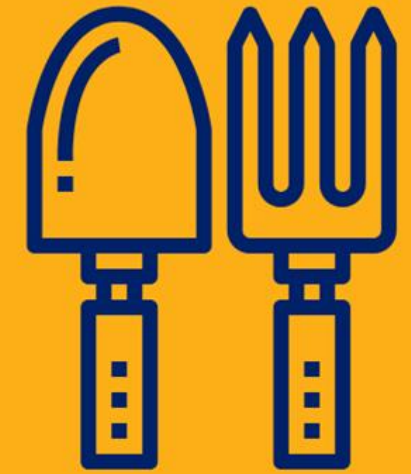
Role of Organic Matter

- Compost – what, why, how, and where
- Bed Preparation & Good Foundations
- Mulch Selection
- Soil Amendments

Signs of Soil Health & Need for Support

- Building Healthy Soil: It Takes Time.

Resources for Soil Health



What is soil?



1. Physical 2. Chemical 3. Biological

Texture: Sand, Silt, Clay

Porosity: Air & Water (40-60%)

Minerals & Nutrients – 12 Essential

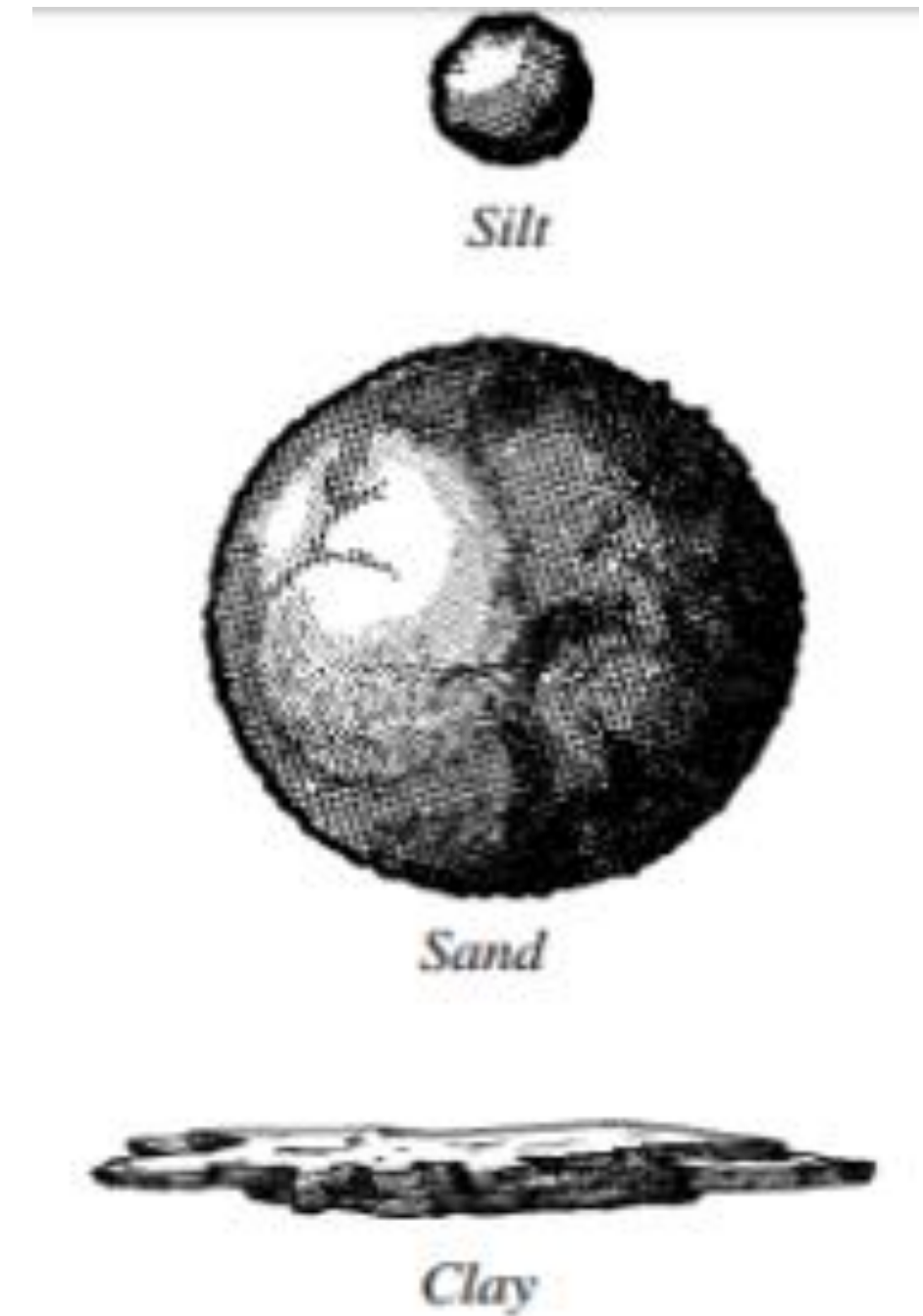
Organic Matter (Compost, Mulch, Manure)

Most soils: 2-10%. Native desert soil?

Less than 1% (why?)

Does that mean it's "bad soil"?

Beneficial Microbes: Bacteria, Fungi (mycorrhizae)



Breakfast Soil

Balanced Soil: Many Shapes, Sizes, Pores



Breakfast Soil

Ample drainage, air spaces, porosity, water interspaces.



Breakfast Soil

Un-Balanced, Compacted Soil: No Shapes/Sizes, Tiny Pores



Breakfast Soil

**Un-Balanced, Compacted Soil: No Shapes/Sizes, Tiny Pores
Easily Waterlogged, No Drainage, Standing Water...**



Breakfast Soil

Working/Tilling Wet Soil: Destroys Aggregates and Porosity



Soil Testing

Test Your Soil – Jar Test (16 oz. jar, fill halfway with rootzone soil, few drops soap. Shake!)

Wait 24 hours. Sand: bottom, Silt: middle, Clay: Top

Calculate Percentages.

Take Out the Guesswork – Lab Test Your Soil

Use in-state labs- usually more local experience, and regional knowledge.

IAS Labs, Phoenix – Soil, Water, & Plant Tissue

Adding or altering one thing in the soil will likely affect another (or many others)

The lab can interpret results and guide you on amendments.

A note on EC / Salts- water thoroughly to avoid salt build up. Flush soil routinely.



IAS Laboratories
SOIL • PLANT • WATER • & MORE

HOME TESTING SERVICES • HOW TO SAMPLE • ABOUT IAS IAS LABS NEWS CONTACT CHAIN OF CUSTODY

CALL US
602.273.7248

Homeowners

We take the guessing out of plant health and save you time and money.

COMPLETE SOIL TEST - \$75

COMPLETE PLANT TISSUE / PETIOLE - \$88

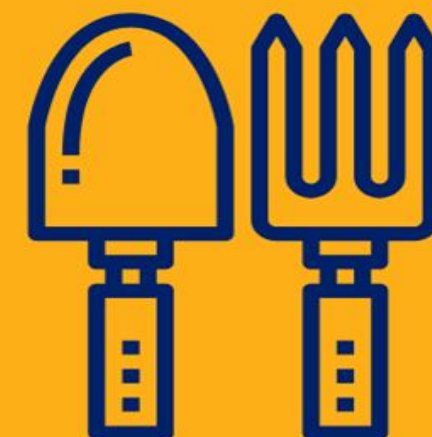
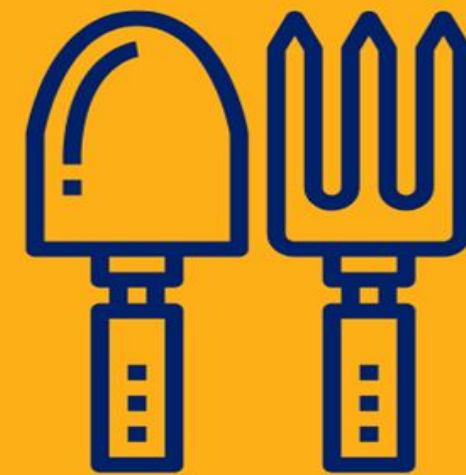
WATER QUALITY TEST - \$88

COMPLETE SOIL TEST

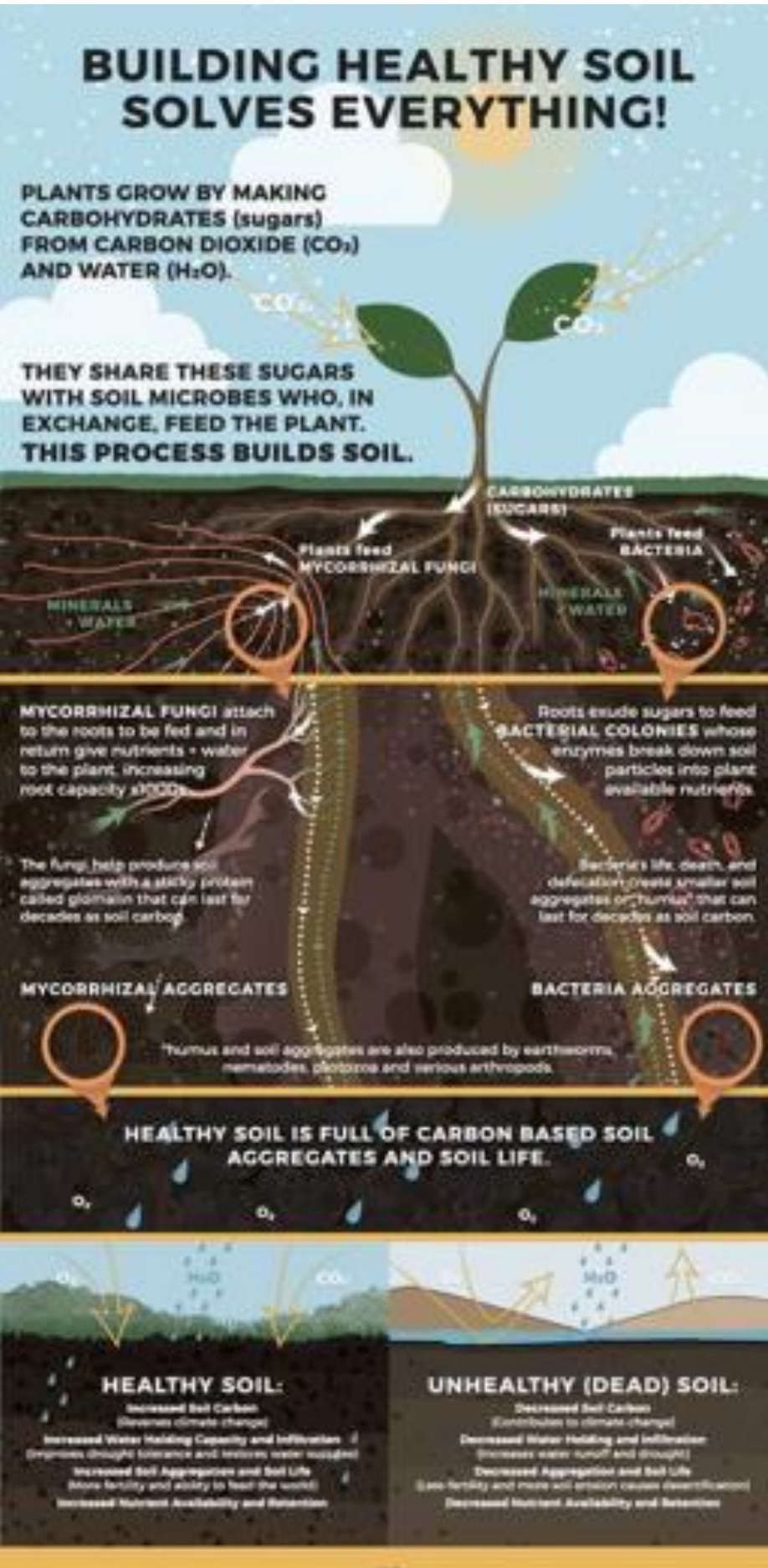
WITH AMENDMENT RECS, \$75

Nitrate-nitrogen, magnesium, phosphate-phosphorus, potassium, pH, calcium, copper, zinc, manganese, iron, boron, sulfate-sulfur, sodium percentage, salinity, and free lime

Role of Organic Matter.



What's all the fuss about microbes?



- ✓ Microbes make compost, improve soil
“Spoon-feed” plants!
- ✓ Microbes are “mini-composters” = nutrients for plants (think: earthworms)
- ✓ During hot composting, microbes create heat to destroy pathogens and degrade contaminants
- ✓ Stimulate humus development (*Hue-Muss*) = Dark organic matter
This is what “good soil” feels like!
- ✓ Microbes' work enhances soil structure for plant health



Key Takeaway:
Healthy, live, diverse soil microbes are key to a successful garden.

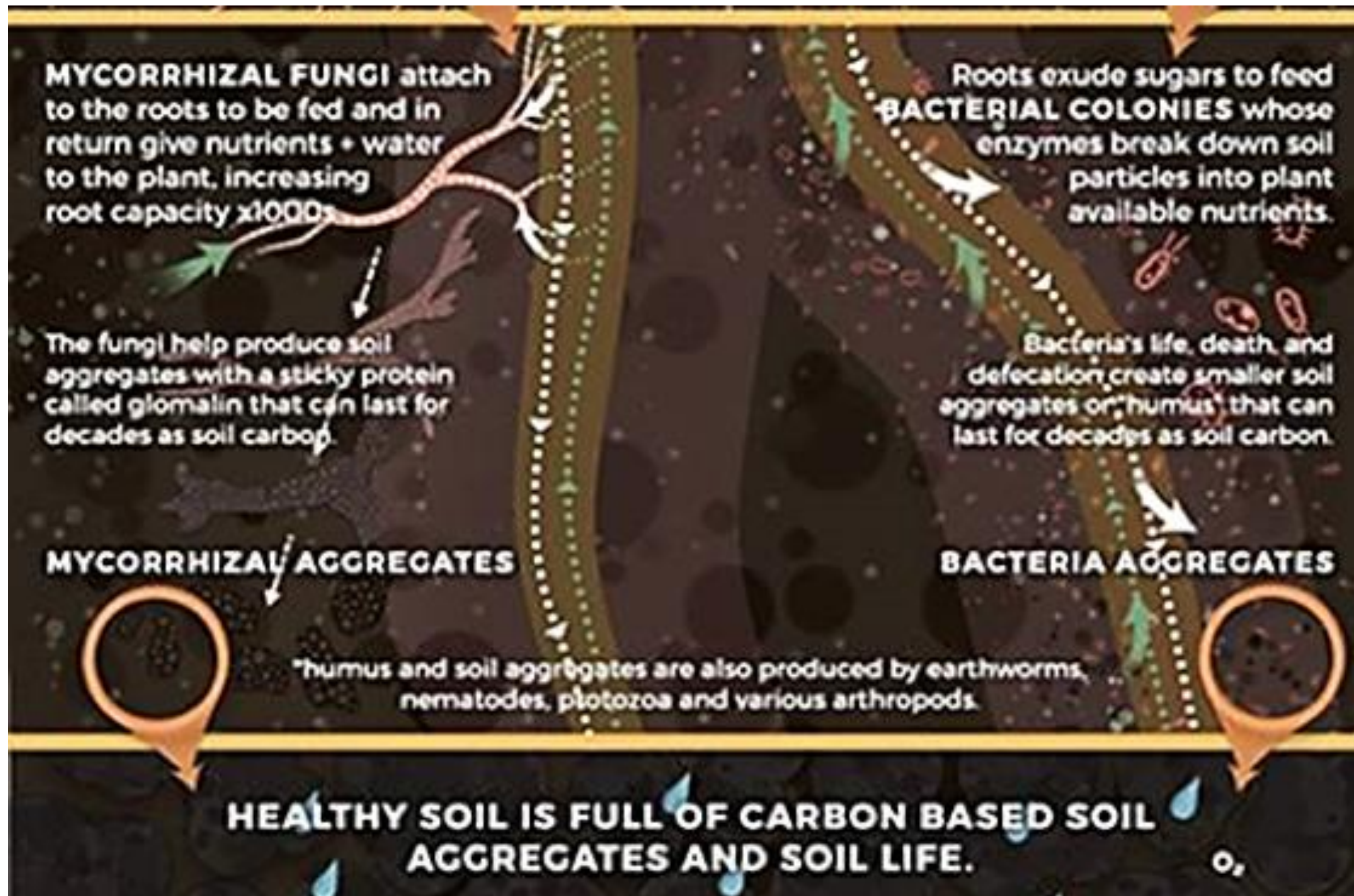
Building Healthy Soil:

1. Plants Photosynthesize=make carbohydrates (sugars/energy).
2. Soil Microbes EAT plant sugars (called “exudates”)



Building Healthy Soil:

3. Microbes give decomposed nutrients back to plant.
4. Microbes create humus (OM) = builds healthy soil



Why Compost?

Keep *organics* out of landfill,
recycle a valuable resource.

Compost: Useful for All Gardens

- Trees & Shrubs
- Vegetables & Flowers, Cactus
- Seeding
- Lawns & Grass

Compost: A Major Multitasker

- ✓ Improves soil structure
- ✓ Reduces water use
- ✓ Provides essential nutrients
- ✓ Reduces erosion & stabilizes pH
- ✓ Binds heavy metals
- ✓ Kills pathogens and weed seeds with heat.
- ✓ Supports soil microbes



Composting Basics

- Plant Debris = “Browns” (C)
- Animal Manure, Green Trimmings, Fruits/Veg = “Greens” (N)
- Food, water, and oxygen = healthy population of microorganisms
- Microbes digest the raw material and produce fertile compost with plant-available nutrients
- Heat produced by microorganisms kills pathogens (>131 F), kills weed seeds, and breaks down contaminants



To Compost, or to Buy Compost?

Recipe:

~16 weeks required to make compost from scratch. Initially may need to buy compost. Start a very basic, static pile.

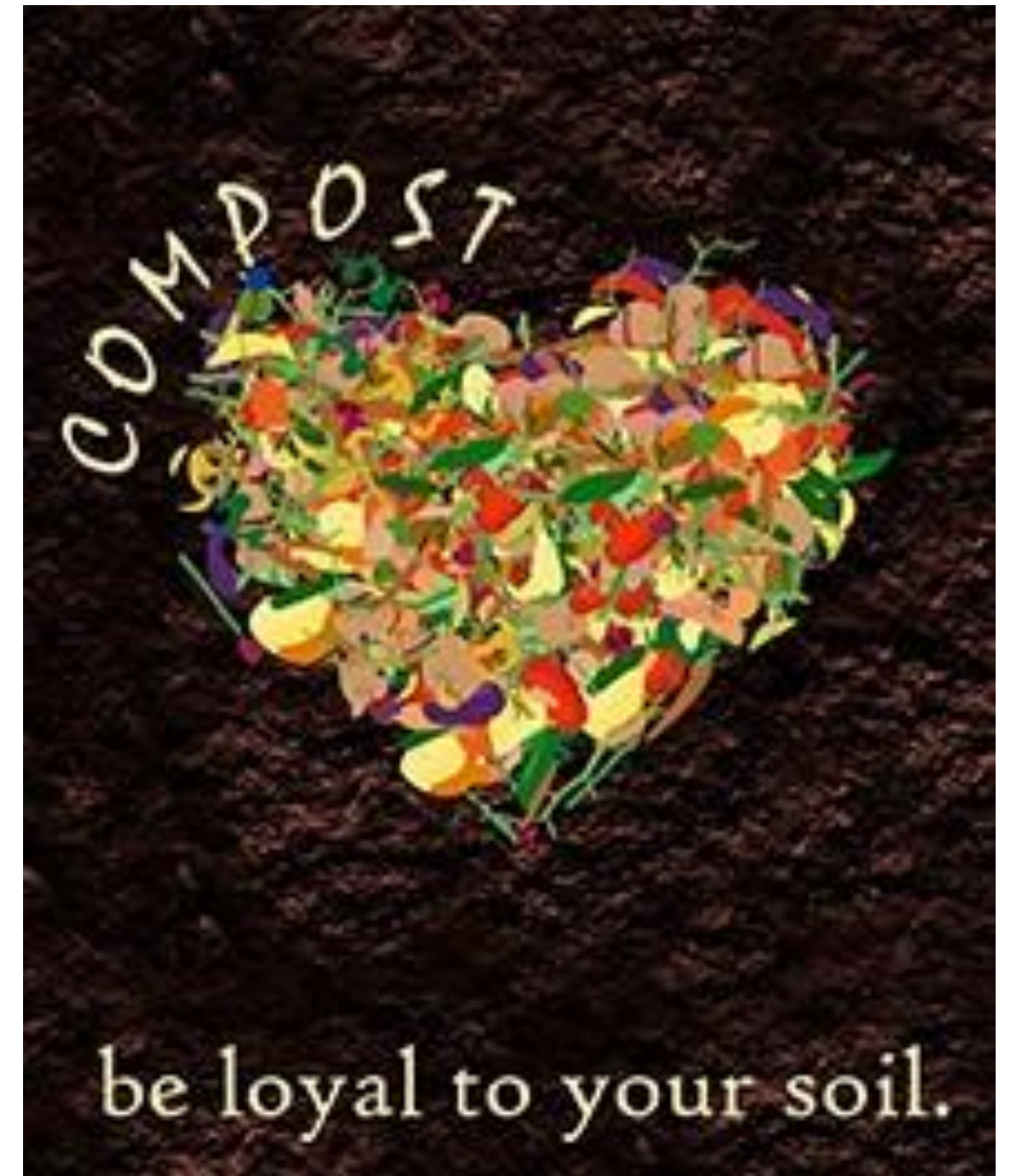
From Where?

<https://www.compostingcouncil.org/page/participants#AZ>

Questions to Ask:

- Request the Test! Best to buy from a US Composting Council STA (Seal of Testing Assurance) Program Member
- Fully composted? (Stability / Maturity)
- Inputs / Feedstocks: avoid animal inputs where you don't know the source (organic dairy or chicken manure?) be aware of hay-fed

TIP: Remember, if manure is used and not completely composted, compost will likely contain weed-seeds.



Look in Resources: For more about the “bigger picture” on compost and soil,, check this out on YouTube



What Kind of Organic Matter Do I Add?

Nitrogen: The nutrient that plants need most.

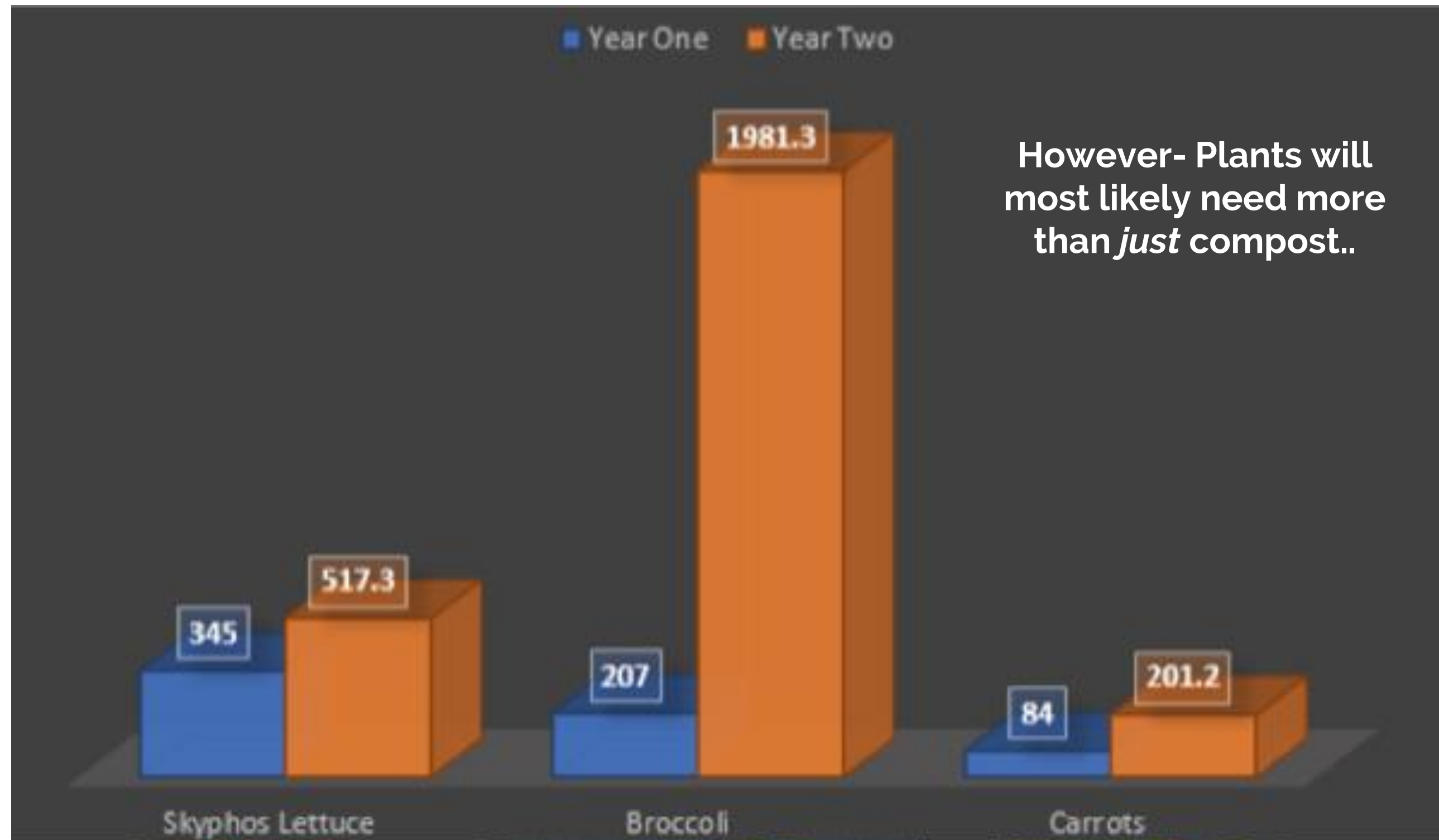
Bacteria needs Nitrogen, too in order to decompose Carbon in organic matter.

Thus, Nitrogen is temporarily unavailable as microbes decompose organic matter (and is not available to the plant). Consider → Carbon : Nitrogen Ratios (C : N)



High Carbon # = Less Nitrogen Available NOW.
(Inverse Relationship)

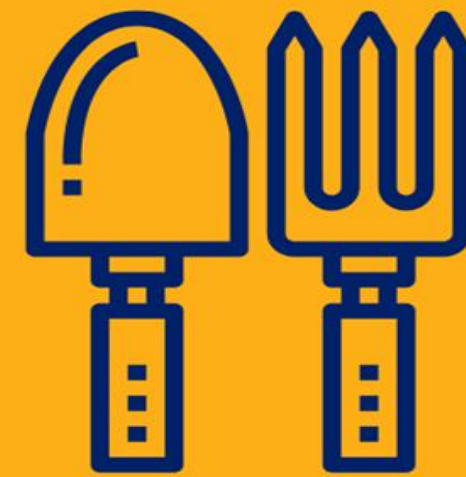
VEGETABLE YIELD AFTER COMPOST APPLICATIONS, YEAR 1 - YEAR 2



However- Plants will most likely need more than *just* compost..



Signs of Soil Health & Need for Support



You can see the difference
with *fully* composted compost:



Bed Prep!

How much soil / compost / mulch needed?
(by volume)

- 1: Measure Plot in Square Feet (LxW)
- 2: How Deep? (if inches, convert to feet)
(Add compost: ~1-3", seasonally)
3. Multiply. Answer in: Cubic Feet (ft³)
4. Convert (divide by 27). Answer in Cubic Yards.
27 cubic feet = 1 cubic yard

Important: Prep early! Allow Time to Rest (Soil Microbes Need Time)



Please Keep In Mind

Building **Good Soil**

Requires...



Soil Hydration

Recipe for fully hydrated soil:

1. Add water *as you mix* in compost and/or soil.
2. Allow a little time to rest
3. Not unlike mixing water into flour!
4. If needed, use an organic surfactant (Yucca)

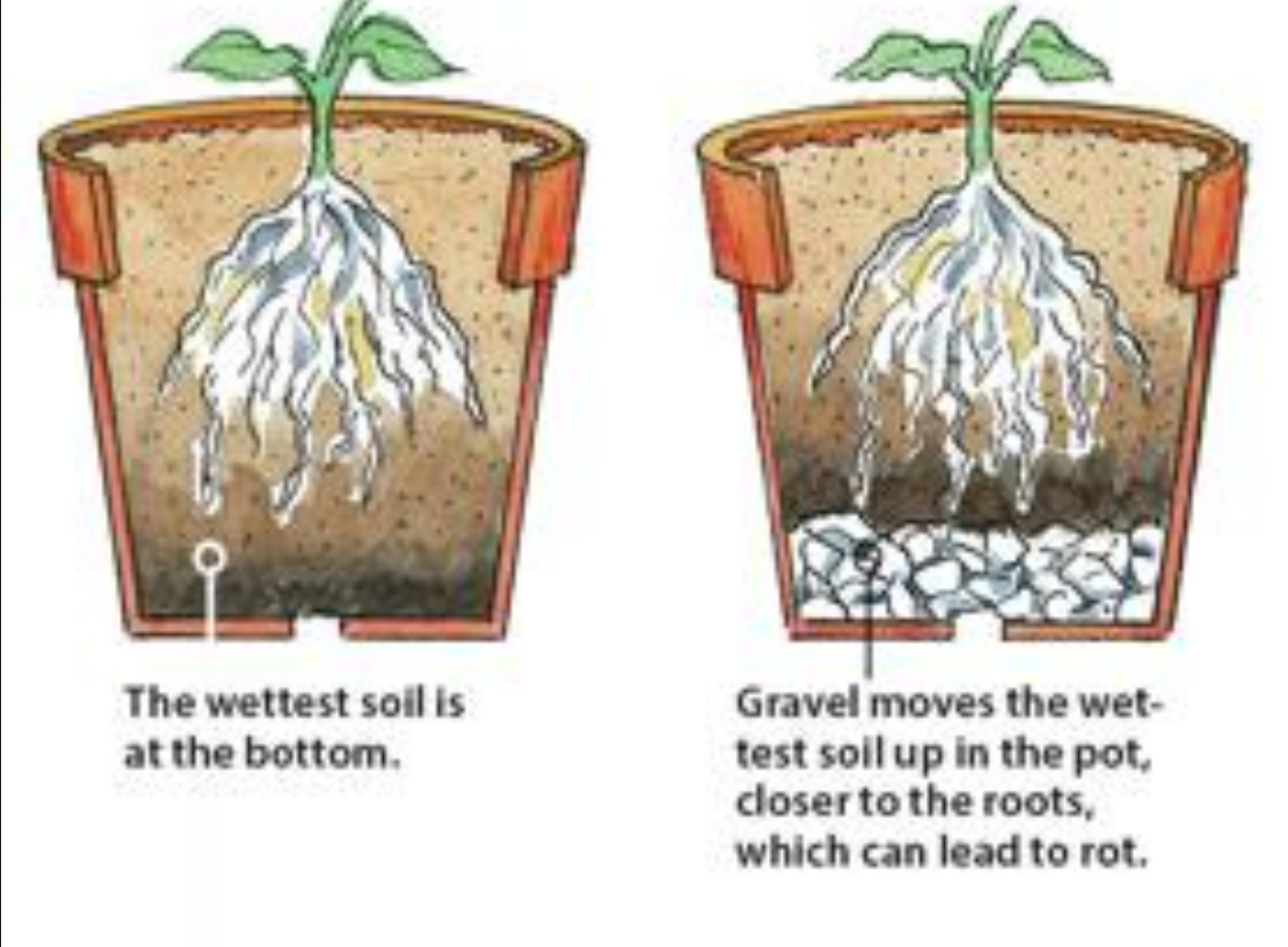
Video on Hydration: [YouTube](#)



Water Movement

TIP: Don't put gravel in bottom of pots!

- It's counter-productive, unless trying to reduce the volume of the pot/container
- Try an upturned plastic pot, or bag with packing peanuts.
- Otherwise, shard of pottery or screen cloth over hole.



hubpages.com



todayshomeowner.com

pcmg-texas.org

Mulch Much Please!

Fine Composted Mulch

Mulching around veggies and bedding plants:

- Gives a beautiful aesthetic, delineates beds/paths
- Cools the soil
- Saves water
- Harbors beneficial microbes
- Suppresses weeds
- Follow Nature's way



TIP: Match your mulch for the plants you are looking to protect. Example: Trees and shrubs vs fruits and flowers.



Wood Chip Mulches

1. Beautiful but Functional!
2. Use for Perennials/Trees/Shrubs, not for veggie/flower beds.
3. Mulch conserves water, reduces evaporation.
4. Shades + cools soil and roots in summer, insulates in winter. At least 10-30F!
5. Eventually decomposes: builds organic matter in the soil. Wood chips last in extreme conditions
6. Mimics nature's processes.
7. Wood is good for beneficial fungi especially for perennials



Fertilize to Replace...

Lost Nutrients

- Growing Plants: Leaves, fruit, flowers.
- Leached (washed) through soil profile.

Choose Organic Inputs to Build Soil,
Feed often, gently (balanced organic
fertilizer)

- Promote Beneficial Life in Soil,
- And Grow Healthier food for kids!



Organic Coco-Coir

Peat-based Mix

Does not work
well in dry
climates



Coconut Coir

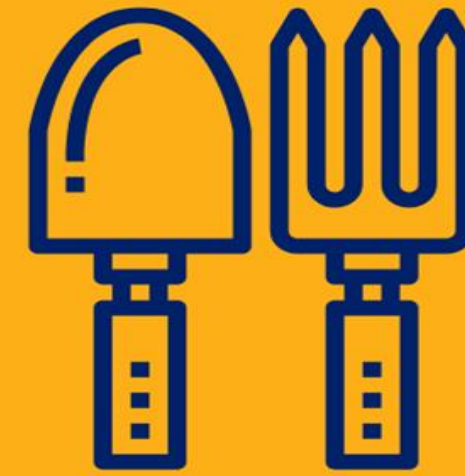
- ✓ Holds water
- ✓ Increases air
- ✓ Renewable
- ✓ Long-lasting:
4-5 years+



Review

- 1 | Soil Classifications & Bed Prep**
Test your soil (jar & lab). Calculate compost needs, and install several weeks in advance.
- 2 | Compost**
Make or buy quality, fully-composted compost. STA-Program
- 3 | Microbes are your friends.**
Feed them, don't harm them, and they will repay you manyfold.
- 4 | Mulch Selection & Amendments**
Fine/composted mulch in beds, wood chips on trees and shrubs.
- 5 | Remember...It Takes Time.**
Apply organic matter, cover the soil, and you will find success!

Resources



Emily's Recommended Resources & Books

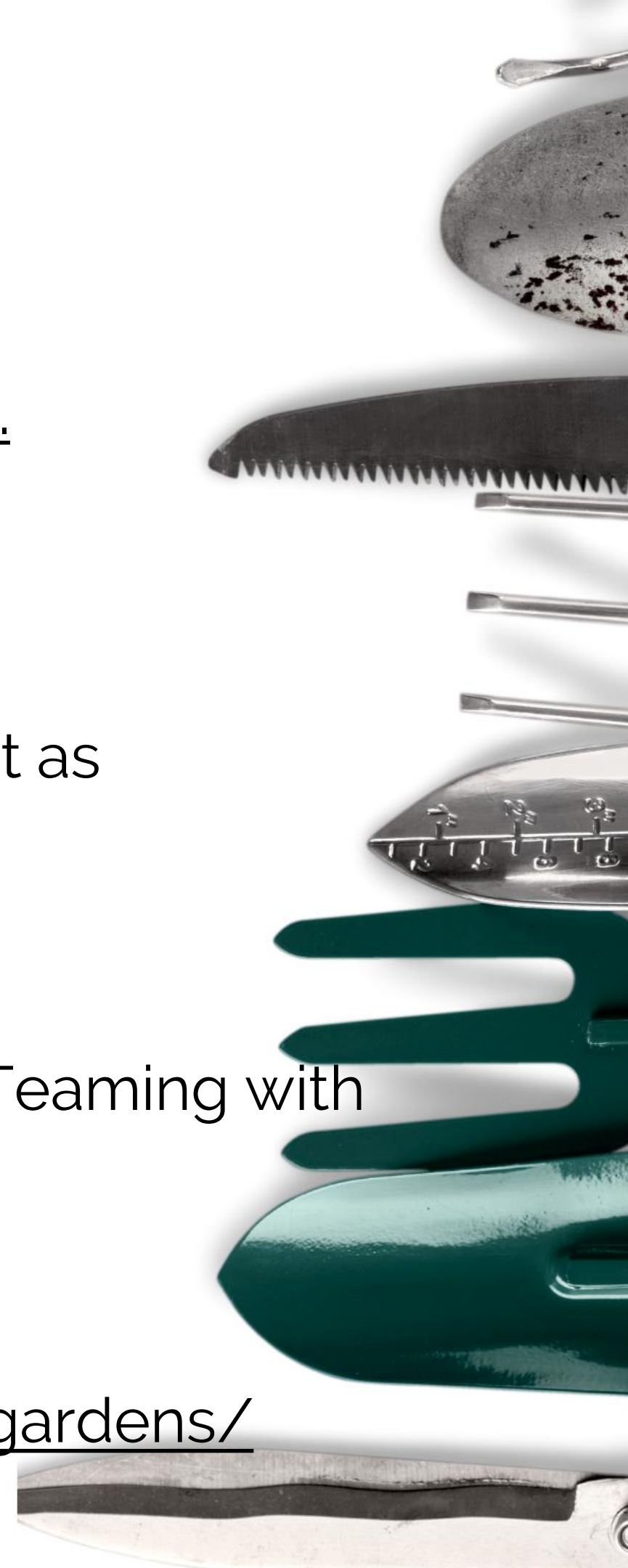
Resources:

- Click here for Emily's Favorite Resources on Soil, Composting, Etc.
- US Composting Council - for composting and compost sources
- UA Cooperative Extension Master Gardener Webpage(s)

TIP: Find a local garden partner or organizations to help troubleshoot as questions come up over the school year!

Books:

- Jeff Lowenfels - Teaming with Microbes / Teaming with Fungi / Teaming with Nutrients
- Soil Biology Primer (Ingham)
- Let It Rot! The Gardener's Guide to Composting
- Annie's Grants for Gardens: <https://www.annies.com/grants-for-gardens/> (application period opens July



Emily's Recommended Resources & Books

Soil Structure & Building Robust Soil Systems



Favorite Resources on Soil, Composting, Gardening, & More from "The Dirt Girl" Emily Rockey

Soil and Composting

Teaming with -- Series:

- Teaming with Microbes: The Organic Gardener's Guide to the Soil Food Web.
- Teaming with Nutrients: The Organic Gardener's Guide to Optimizing Plant Nutrition.
- Teaming with Fungi: The Organic Gardener's Guide to Mycorrhizae (Science for Gardeners)

Soil Biology Primer (Ingham)

The Rodale Book of Composting

Let It Rot! The Gardener's Guide to Composting

Websites

Interpreting Compost Analyses:

<https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/em9217.pdf>

Home Composting (UA Extension Service):

<https://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1632-2014.pdf>

A Guide for Making Recommendations for Garden Soils:

[https://cals.arizona.edu/yavapai/publications/yavcobulletins/A Guide for Making Recommendations for Garden Soils.pdf](https://cals.arizona.edu/yavapai/publications/yavcobulletins/A%20Guide%20for%20Making%20Recommendations%20for%20Garden%20Soils.pdf)



Thank you for joining me!

Emily Rockey
Garden Manager
Mission Garden
erockey1@gmail.com



For more information on school gardens email
ArizonaFarmtoSchool@azed.gov or visit
<https://www.azed.gov/hns/azf2s/>



Congratulations!

You have completed the **School Garden Webinar Series - Soil Structure & Building Robust Soil Systems**

To request a certificate, please go to the next slide.

In order to count this training toward your Professional Standards training hours, the training content must align with your job duties.

Information to include when documenting this training for Professional Standards:

- Training Title: Recorded Webinar: School Garden Webinar Series - Soil Structure & Building Robust Soil Systems
- Learning Codes: 1000– Nutrition
- Key Area: 1230
- Length: 1 hour

Please Note: Attendees must document the amount of training hours indicated regardless of the amount of time it takes to complete it.



Congratulations!

Requesting a training certificate

Please click on the link below to complete a brief survey about this webinar. Once the survey is complete, you will be able to print your certificate of completion from Survey Monkey. **This will not appear in your Event Management System (EMS) Account.*

<https://www.surveymonkey.com/r/RecordedWebinarOnlineSurvey>

The information below is for your reference when completing the survey:

- Training Title: Recorded Webinar: School Garden Webinar Series - Soil Structure & Building Robust Soil Systems
- Professional Standards Learning Codes: 1230

