

What can the Reclamation Industry Learn from Organic Farmers?

Caitlin Youngquist, Ph.D.



Context

Observations and experiences working with ranchers and farmers in Wyoming and beyond who are committed to using organic / biological / regenerative practices

- Primarily rely on high carbon amendments for mineral nutrients
- Approach farming and ranching with a “soil centric” perspective – always trying to stimulate the biology

Practices based on what works on the farm and what people share at field days, YouTube, etc.

Goal

Grow more plants more quickly in a high stress environment with limited inputs

4 ECOSYSTEM

PROCESSES

Energy Flow



Water Cycle

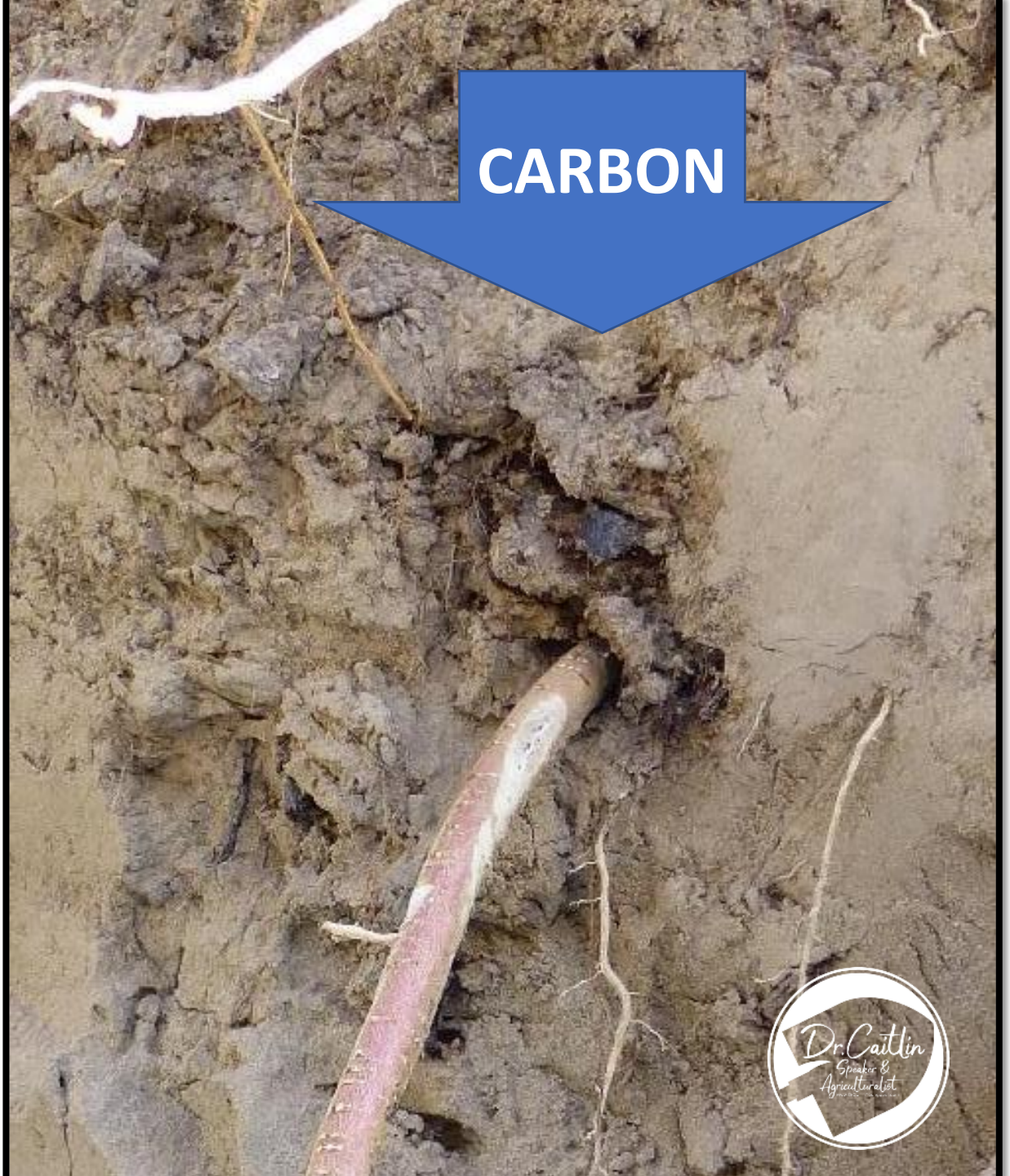


Mineral Cycle



Diversity

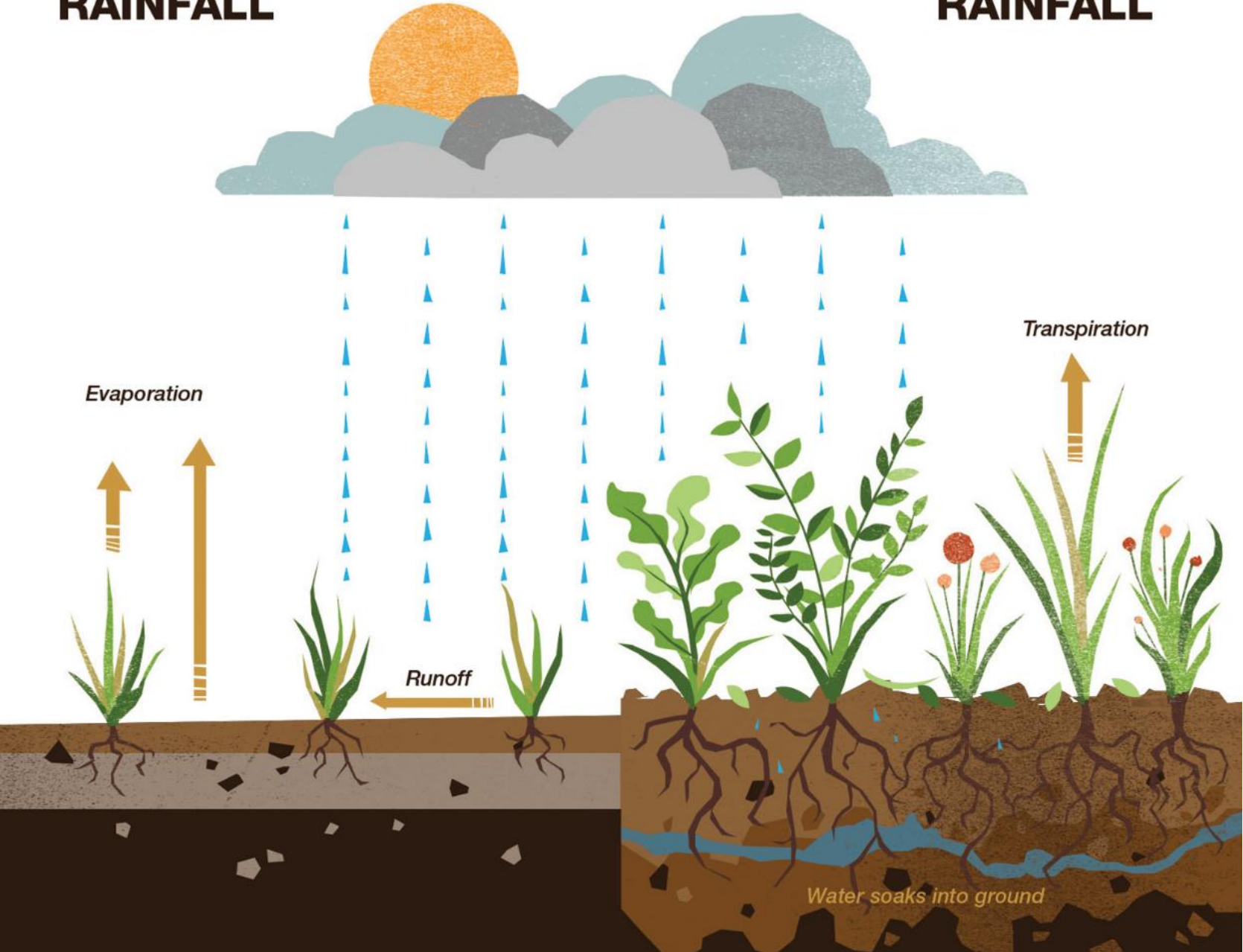


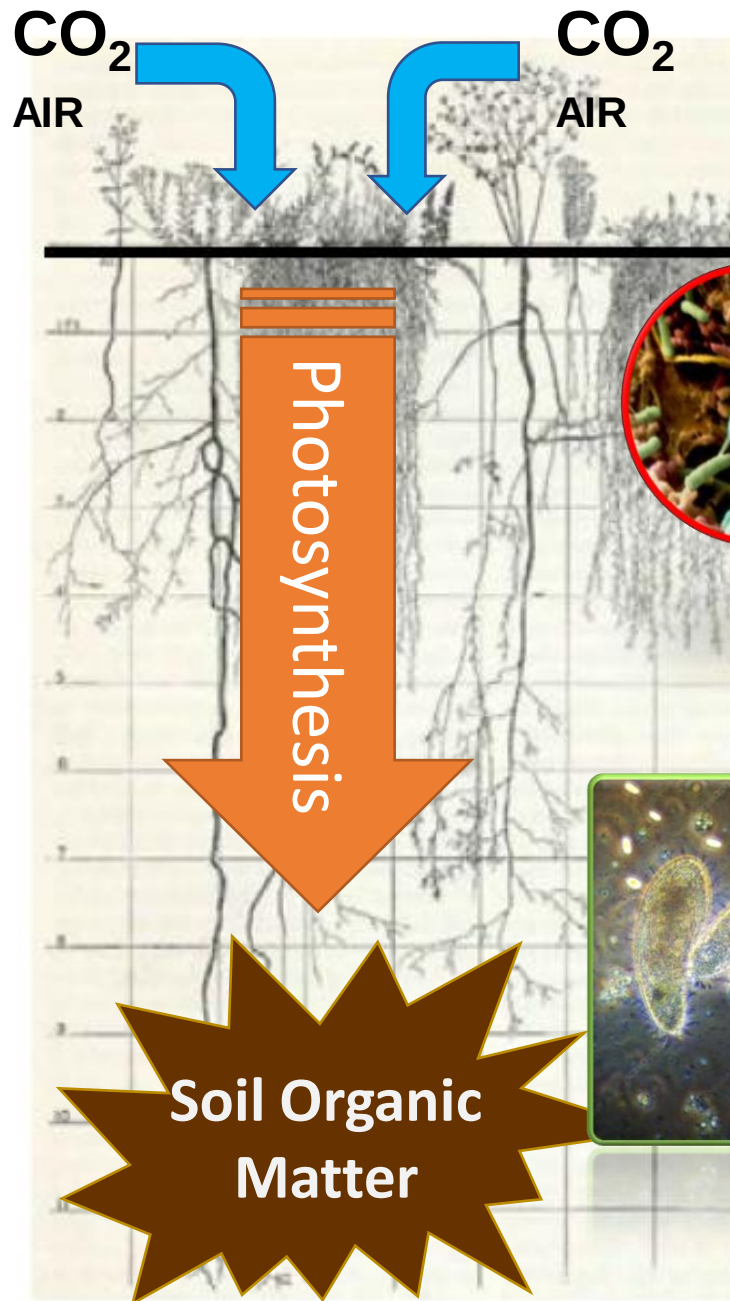
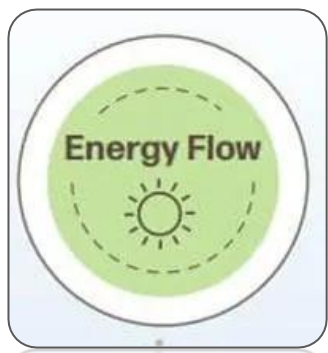




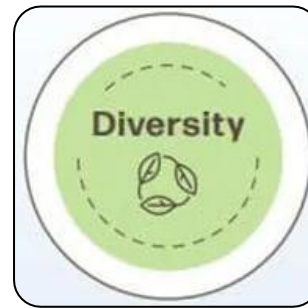
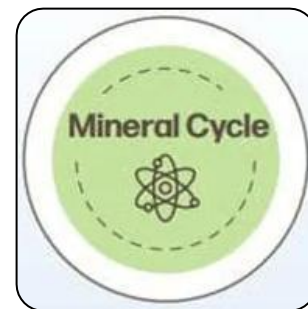
NON-EFFECTIVE RAINFALL

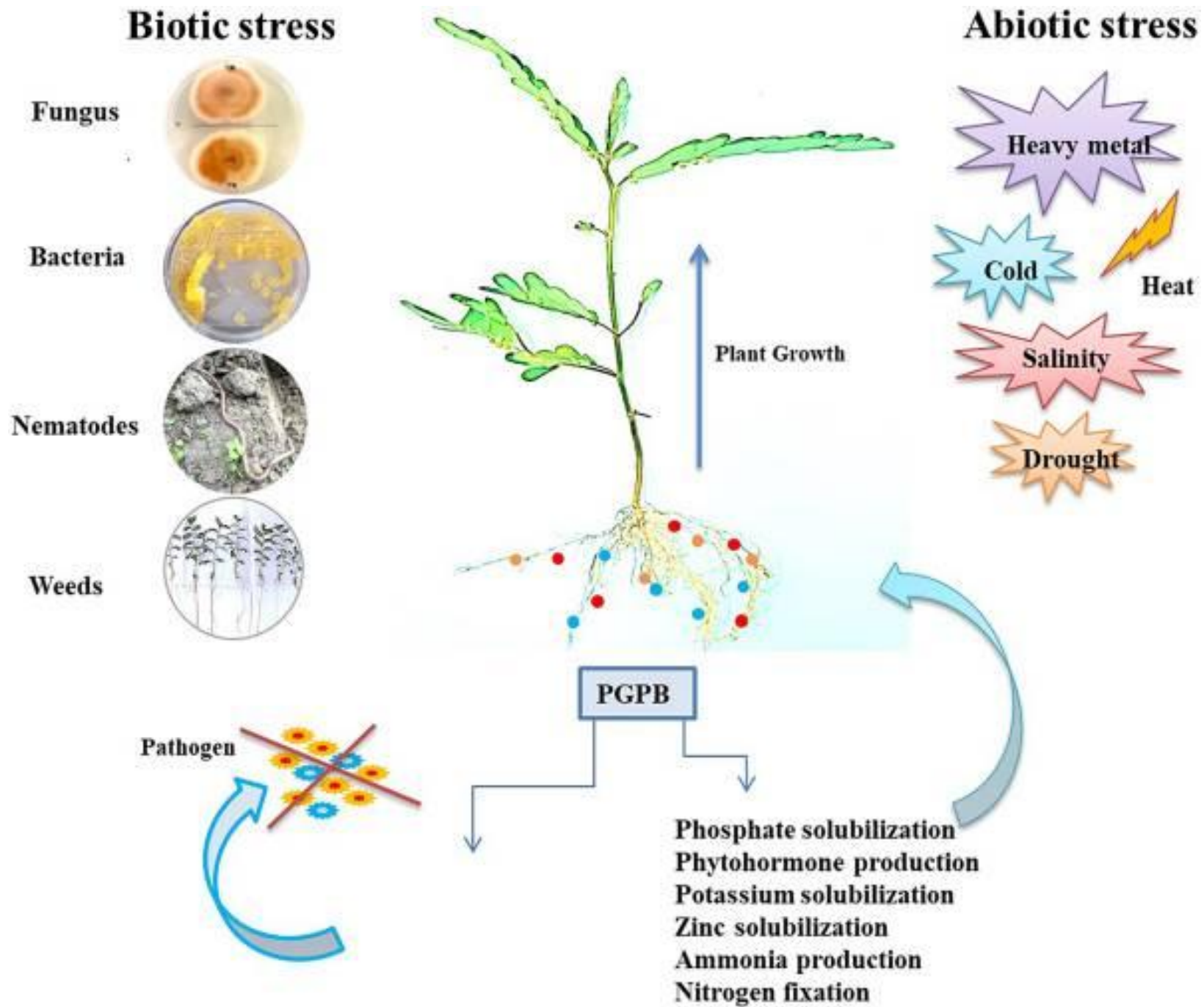
EFFECTIVE RAINFALL



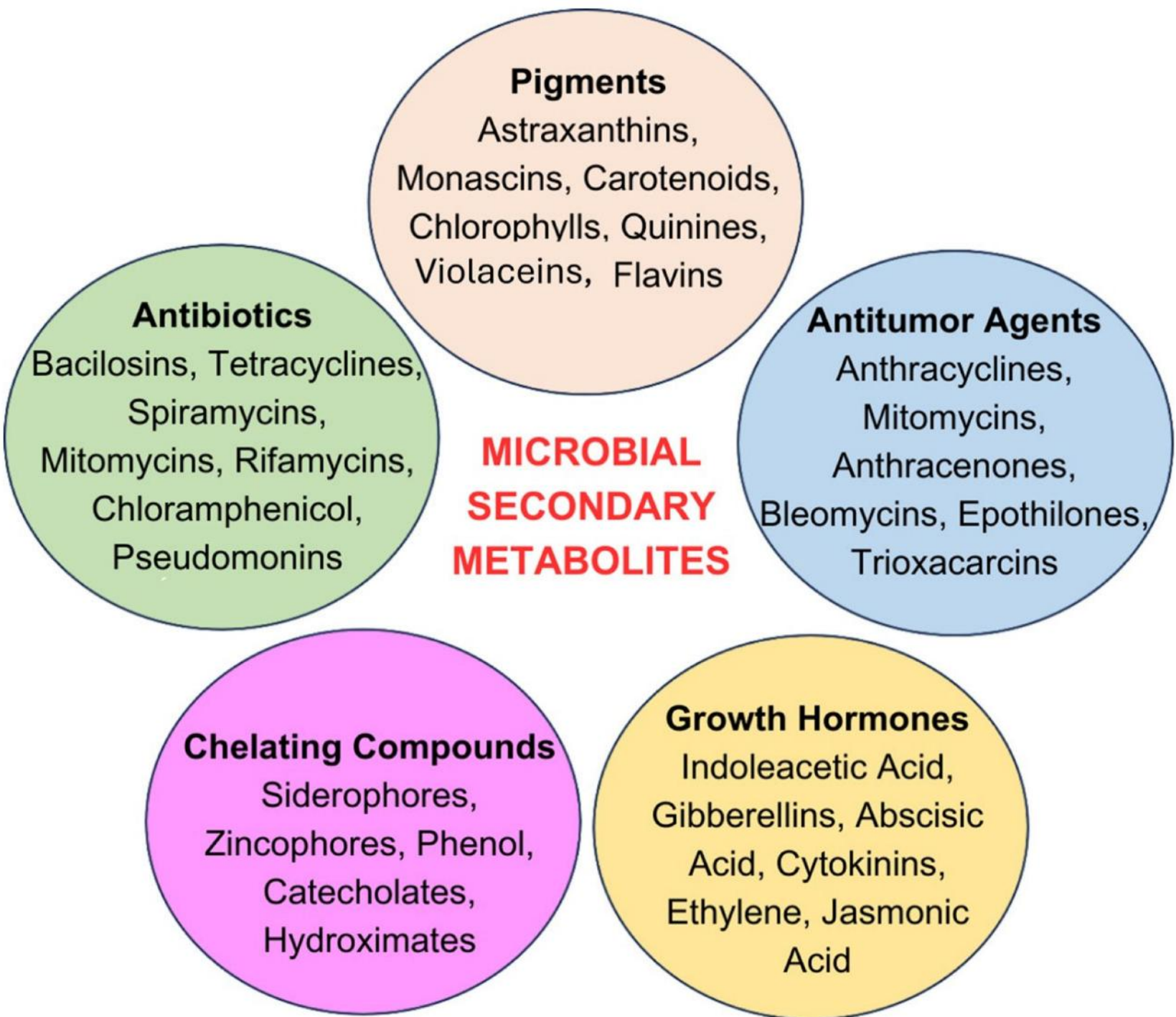


USDA-NRCS North Dakota

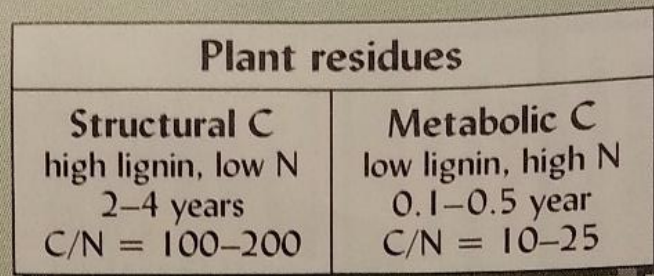




Fanai A, BohiaB, Lalremruati F, et al. Plant growth promoting bacteria (PGPB)-induced plant adaptations to stresses: an updated review. *PeerJ*. 2024;12:e17882.



Marks, B.B.; Nogueira, M.A.; Hungria, M. Microbial Secondary Metabolites and Their Use in Achieving Sustainable Agriculture: Present Achievements and Future Challenges. *Agronomy* **2025**, *15*, 1350.



COVER CROPS, GREEN MANURE

**WOOL, KELP, FISH,
ALFALFA, ETC**

**FRESH
MANURE**

Microbe and plant food
(lots of energy)
Improves soil structure
Rapid change

COMPOST

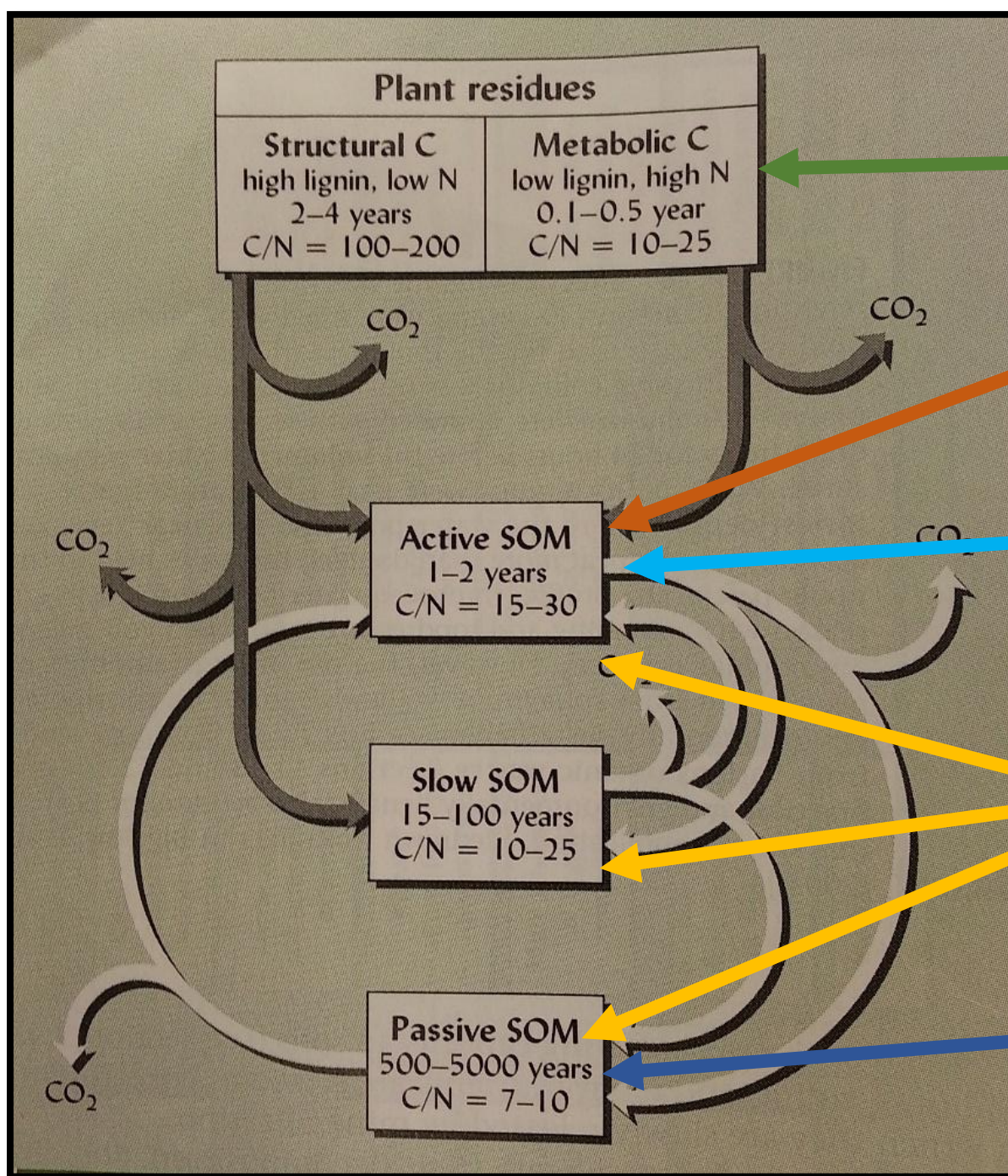
Water holding capacity
Nutrient holding capacity (CEC)
Very slow to change
Not much energy left

**HUMATES
BIOCHAR**

Active SOM
1–2 years
C/N = 15–30

Slow SOM
15–100 years
C/N = 10–25

Passive SOM
500–5000 years
C/N = 7–10



How do we get as much biology around the roots as quickly as possible?

Soil amendment - dry

Compost, vermicast

Seed priming – slurry or liquid

Cover seed with a liquid or slurry before planting

Soil drench or root dip - liquid

Transplants, horticulture, gardens, market farms

Foliar spray, fertigate - liquid

Liquid compost extract (with added nutrients)

Injection - liquid

At planting, or “rip and drip” method

Thermophilic Compost

- Provides energy, nutrients, water holding capacity, and microbes.
- Well documented benefits in scientific literature and farm trials
- Provides energy, minerals, and habitat for microbes
- Improves physical soil properties
- May be expensive to transport and spread.
- Quality varies



Vermicast

- Provides energy, nutrients, water holding capacity, and microbes.
- Tends towards more robust and diverse microbes than most thermophilic compost
- Very high in nitrate - nitrogen (up to 10%) and stimulates seed germination
- Higher in humic acid than therm. compost
- Expensive compared to therm. compost - used in gardens and market farms

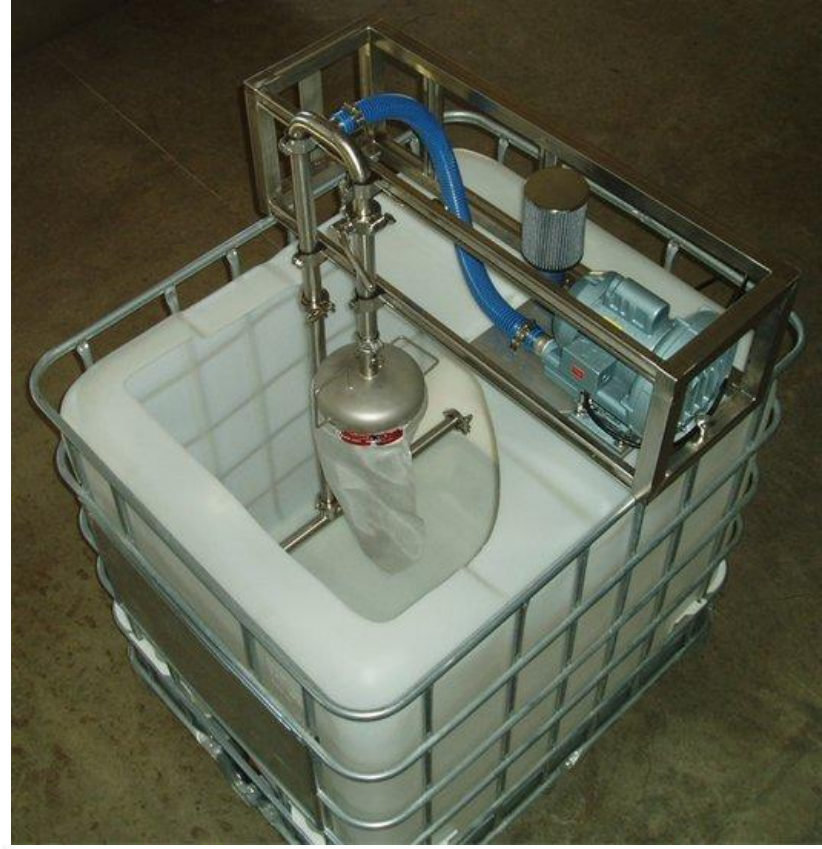


Johnson-Su Compost

- Highly diverse compost made in small bio-reactors (9-12 months)
- Low cost
- Fungal dominant, worms added after initial hot phase
- More microbially diverse than a turned, thermophilic compost
- Used for extracts and seed priming



Extractors



In The Field

Seed Treatment
Foliar Spray
Injection







Create a **slurry**
used for seed
priming and an
extract for
injecting

Add molasses,
humates,
nutrients, etc



2-4 gallons per acre
**vermicast liquid
extract** at planting
injected with seed

Improve germination
rate, plant/soil health,
nutrient cycling



Winter wheat and Corn in E. WY

20 gallons of **liquid compost extract** per acre through the pivot or with a spray rig at boot and/or flag leaf increases yield and protein

10 gallons per acre injected at planting improves root health and germination rates

~ 2 to 5 lbs of compost per acre

Reduce NPK by 1/3



BS Compost - Cheyenne, Wyoming d

Summary

Goal: grow more plants more quickly in a high stress environment with limited inputs

Use compost extracts and slurries to efficiently spread PGPB, secondary metabolites, and humic acids across a large area.

- Seed priming
- Injection
- Foliar spray

Make or purchase composts based on needs and conditions

- Fungal dominant
- Seed germination
- Salinity and toxins
- Nutrient content and mineral ratios

