BUILDING HEALTHY SOIL USING COVER CROPS

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- Owner of Southwest Victory Gardens
- Pima County Certified Master Gardener
- SmartScape Certified
- Former President of Tucson Organic Gardeners

SOUTHWEST VICTORY★ GARDENS
LOCAL STARTS AT HOME

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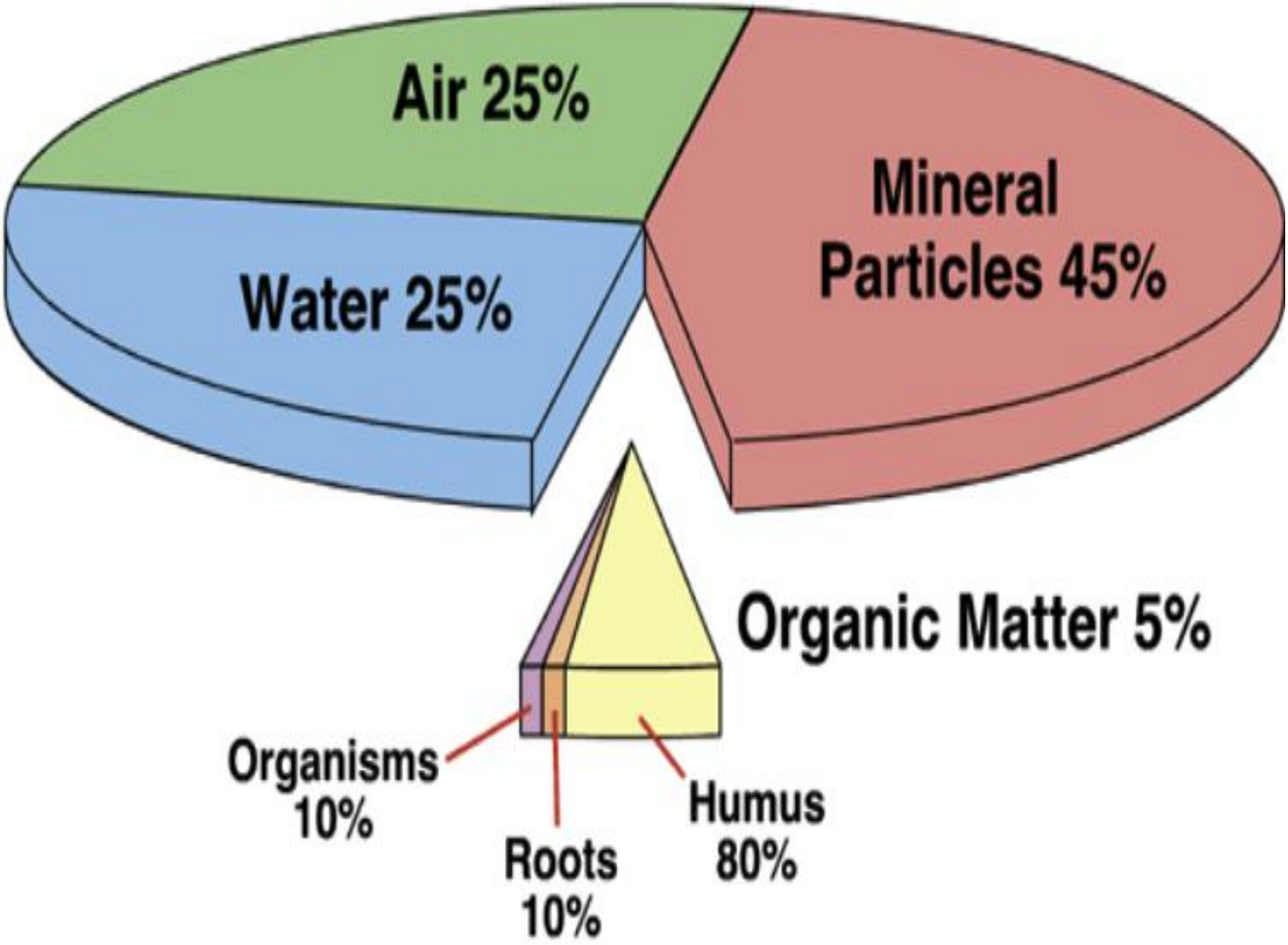
Our Philosophy

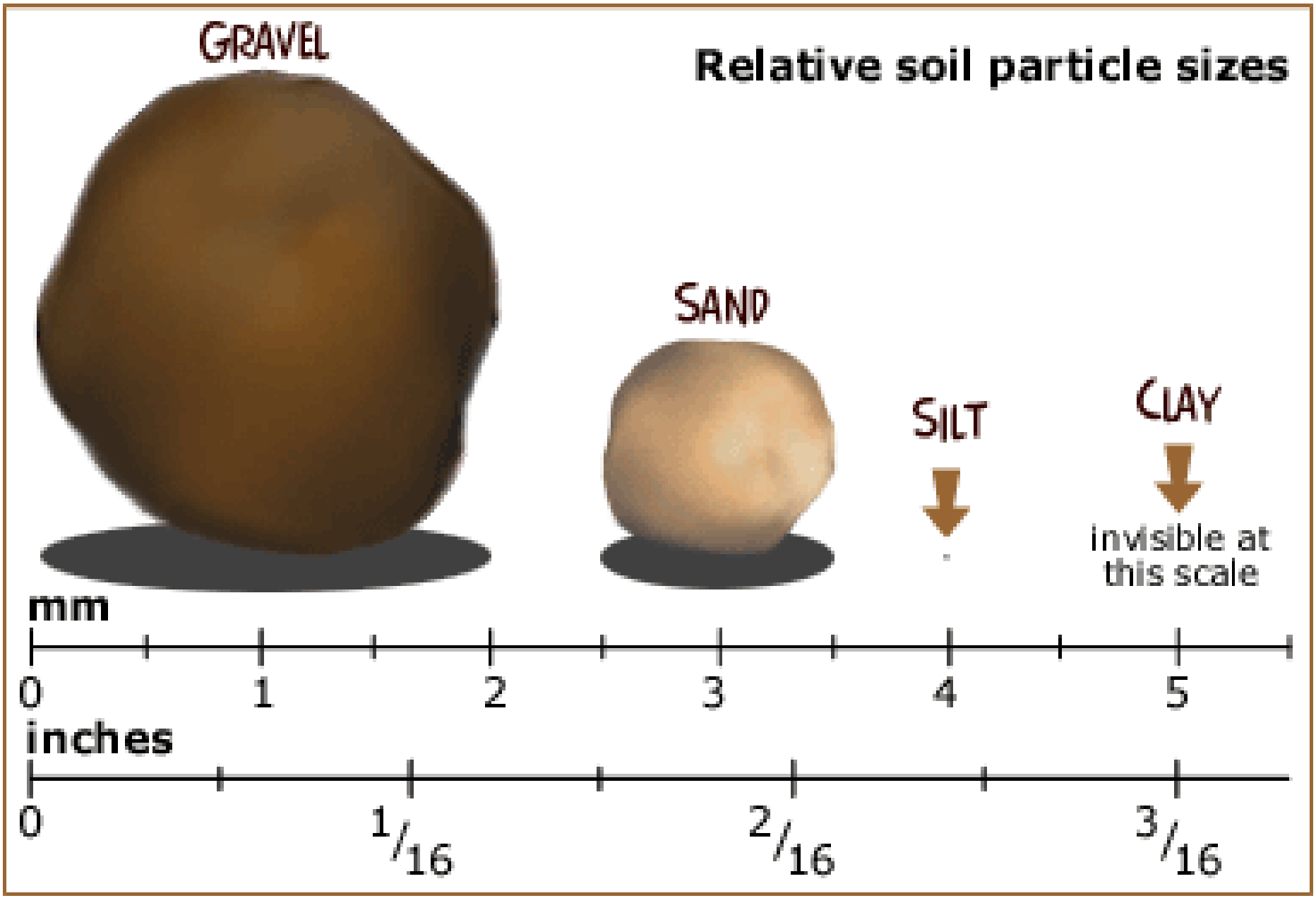
- Healthy soil encourages healthy plants
- Healthy plants require fewer pesticides and fertilizers (inputs)
- Garden with our climate not against it
- Reduce water usage
- Limit external inputs
- Encourage a natural ecosystem

Why Healthy Soil?

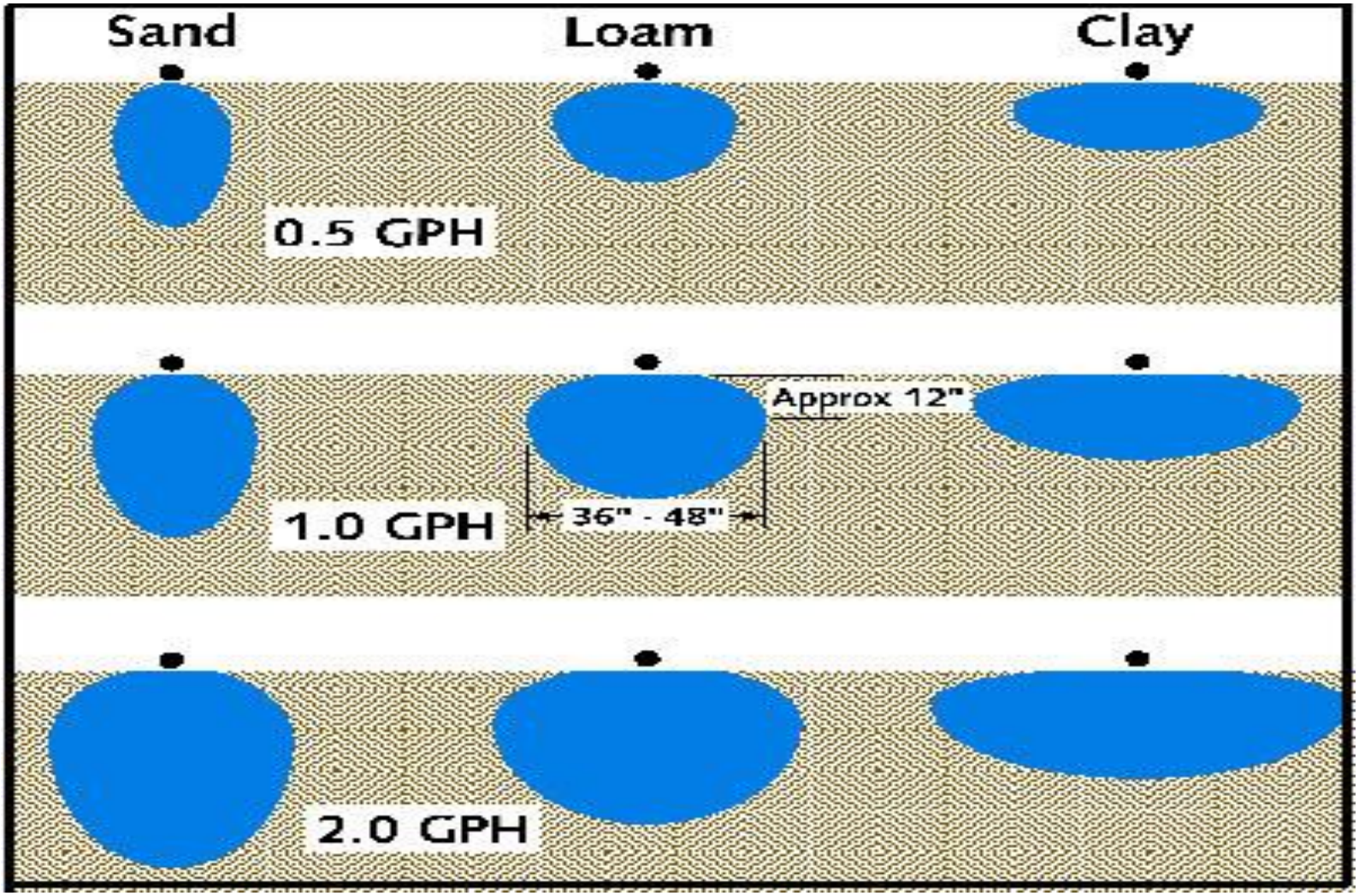
- 2nd Largest Carbon Reservoir on the Planet.
- Holds 4x More Carbon than Trees and Plants.
- In last 40 years, 1/3rd of World's Farm Land has been Destroyed
- 40% of World's Soils are Classed as "Degraded" or "Seriously Degraded"


Air 25%
Mineral Particles 45%
Water 25%
Organic Matter 5%
Organisms 10%
Roots 10%
Humus 80%

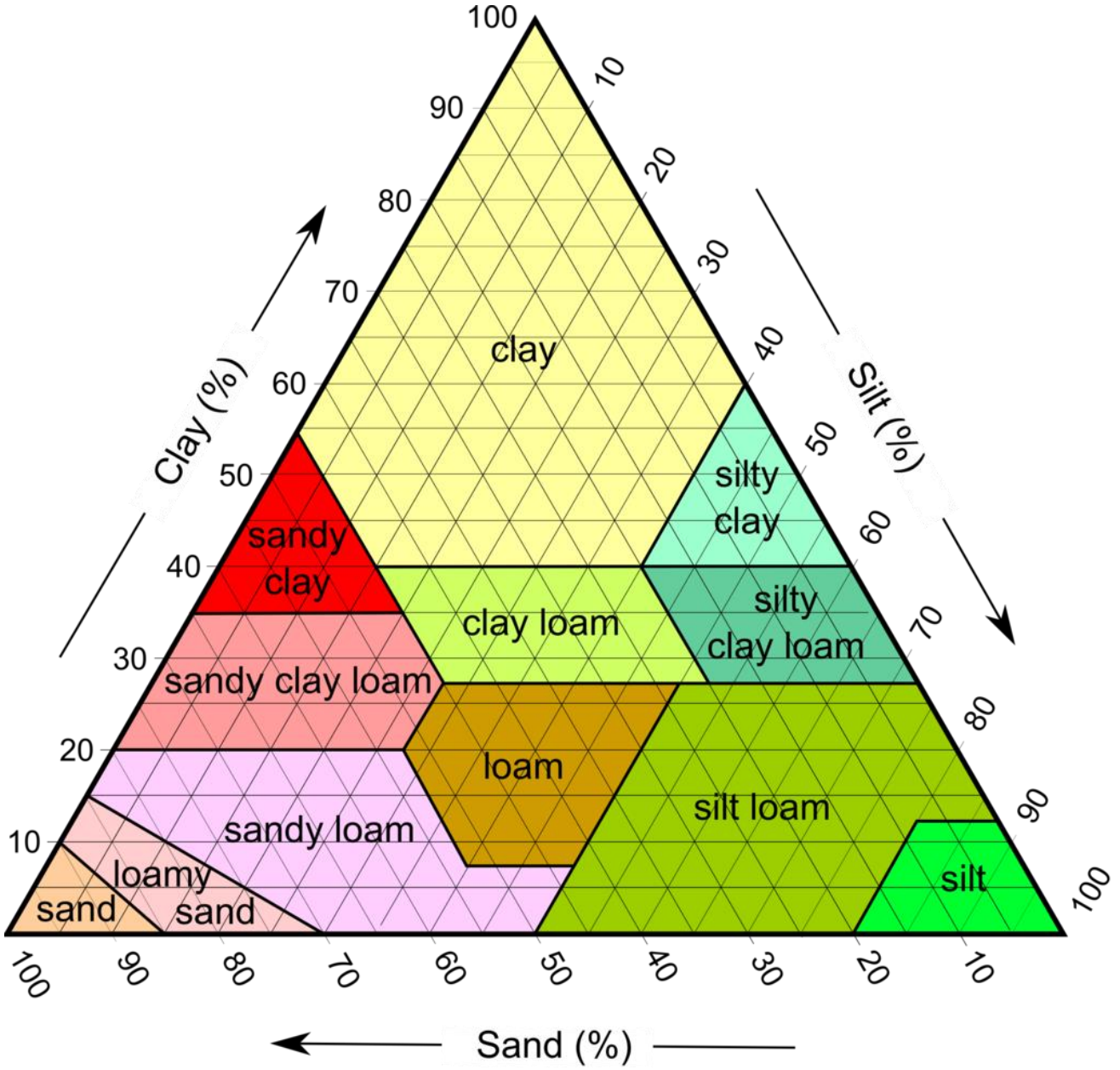
Soil Particle Sizes



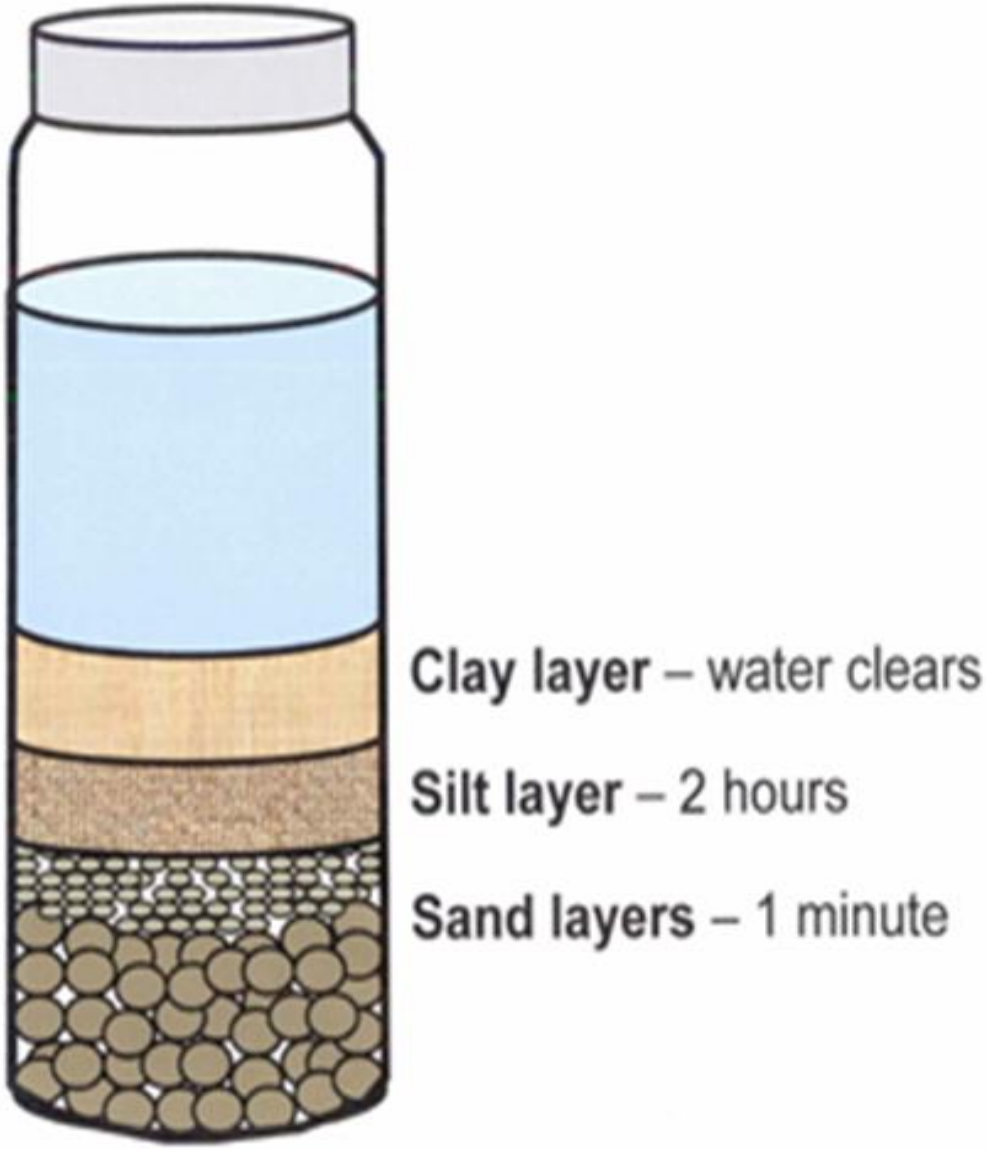
Soil Wetting Patterns



Soil Texture Triangle

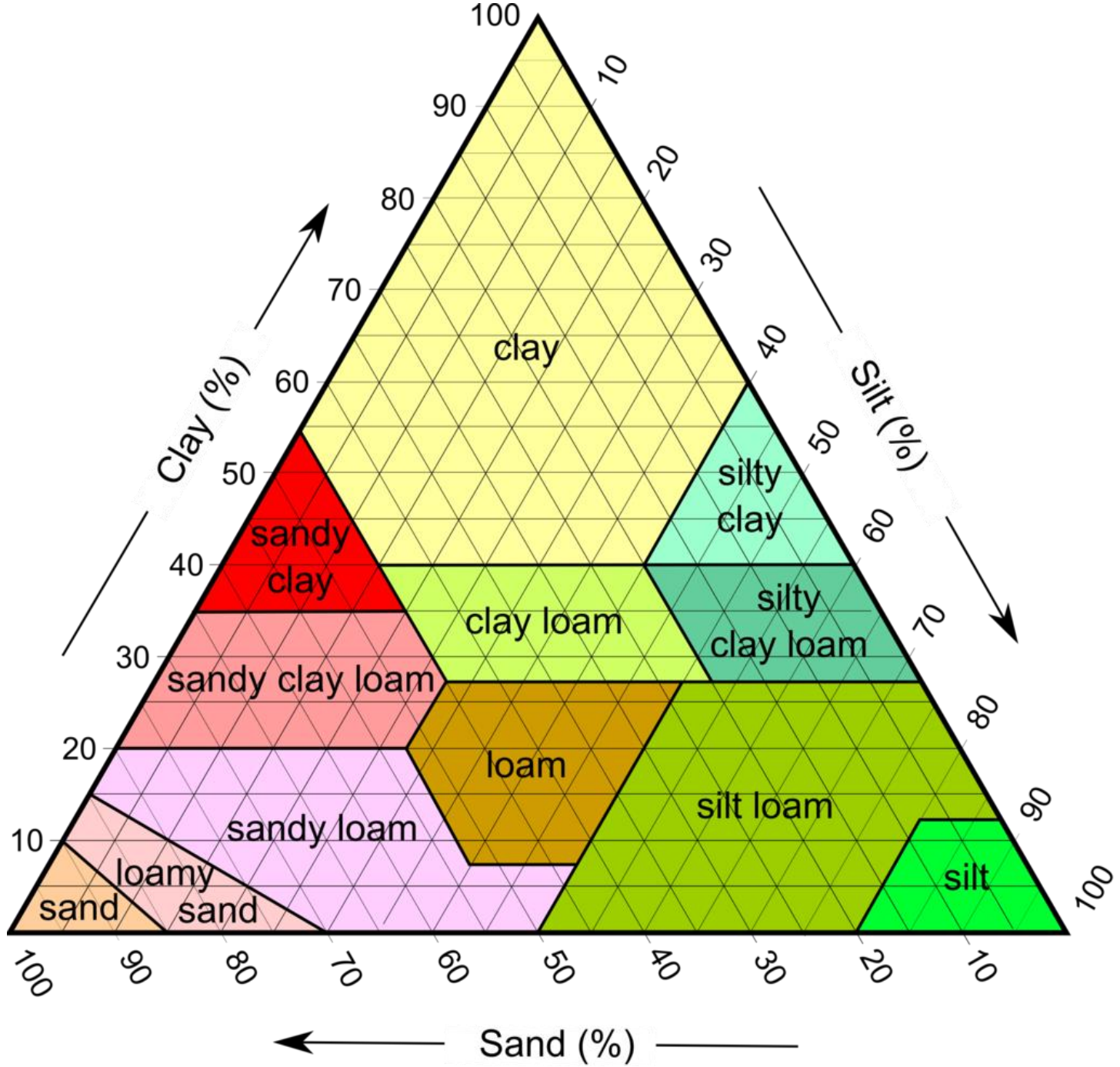


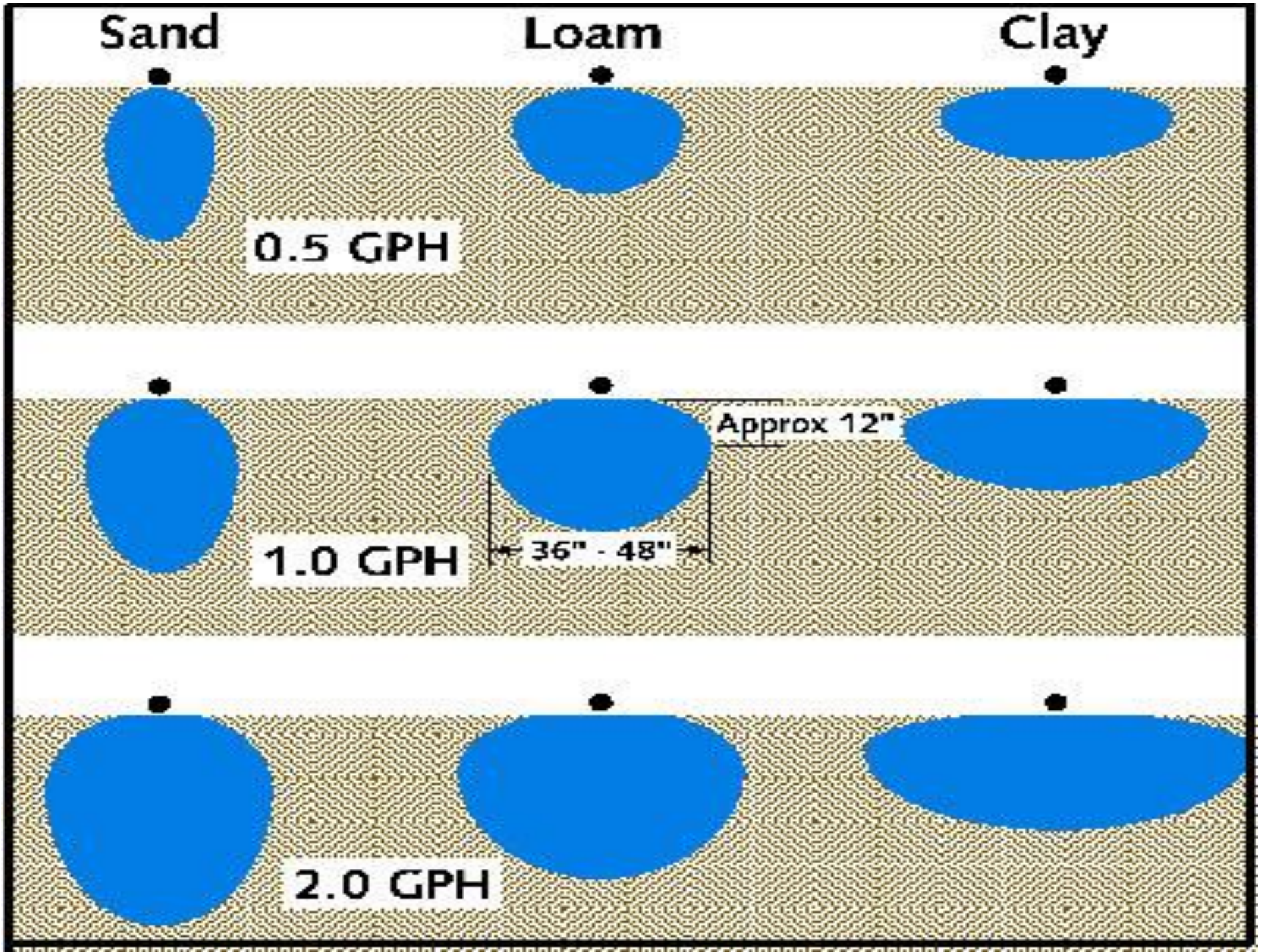
Soil Texture Jar Test

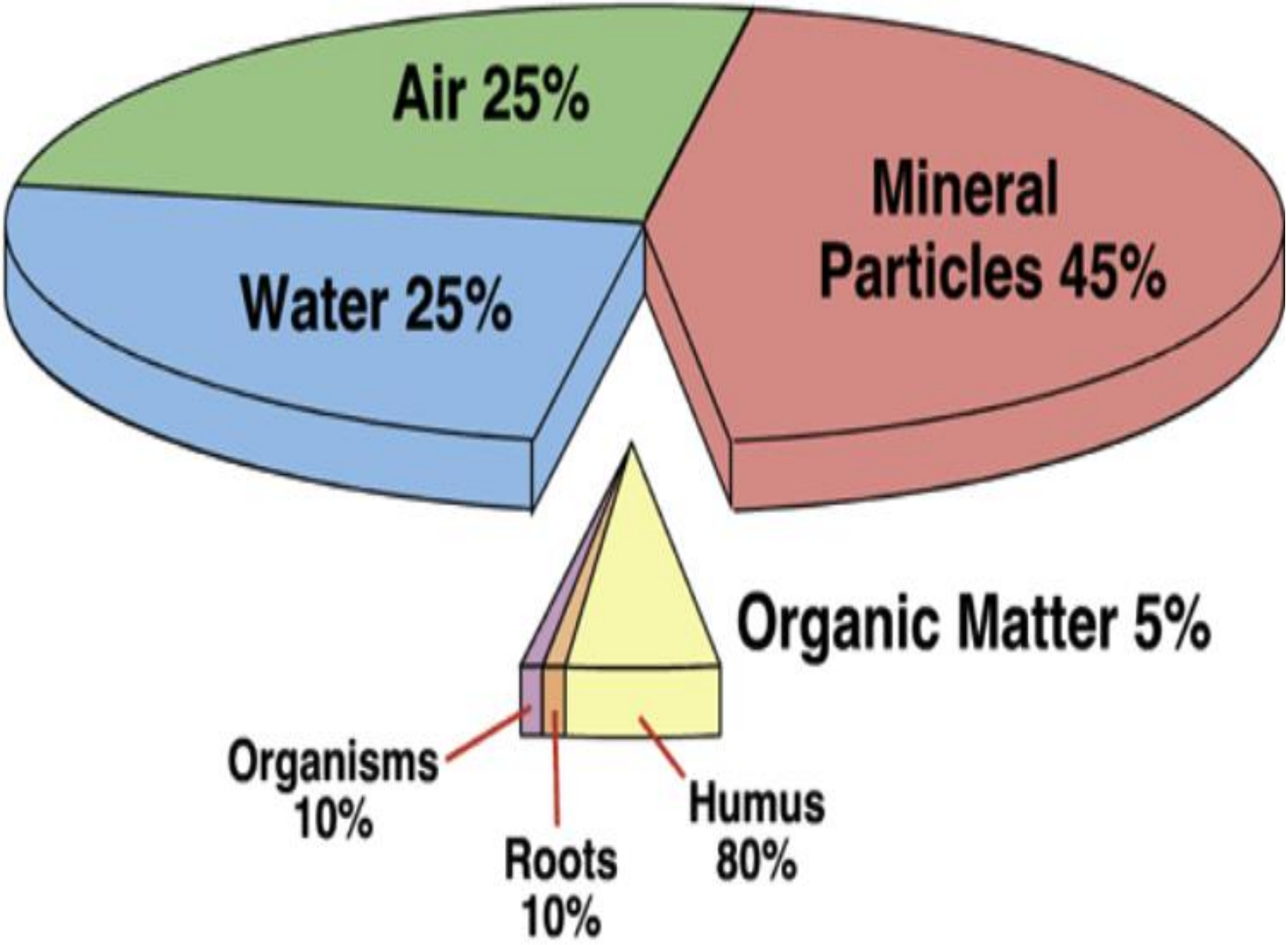


How to Test Soil Texture

1. Fill Jar with 4 ¼” Soil
2. Add Water/Soap
3. Shake Vigorously 15 min.
4. Record Results


clay
silty clay
sandy clay
clay loam
silty clay loam
sandy clay loam
loam
silt loam
sandy loam
loamy sand
sand
silt
Clay (%)
Silt (%)
Sand (%)
100
90
80
70
60
50
40
30
20
10


Sand
Loam
Clay
0.5 GPH
Approx 12"
1.0 GPH
36" - 48"
2.0 GPH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Characteristics of Soil

Desert Soil

- Low Populations of Micro-Organisms
- Low in Organic Matter
- Lacks Nutrients
- Compacted
- High Ph

Healthy Soil

- High Population of Micro-Organisms
- High in Organic Matter
- No Toxins/Pesticides
- Balanced Nutrients/Ph
- Porous
- Good Tilth/Structure

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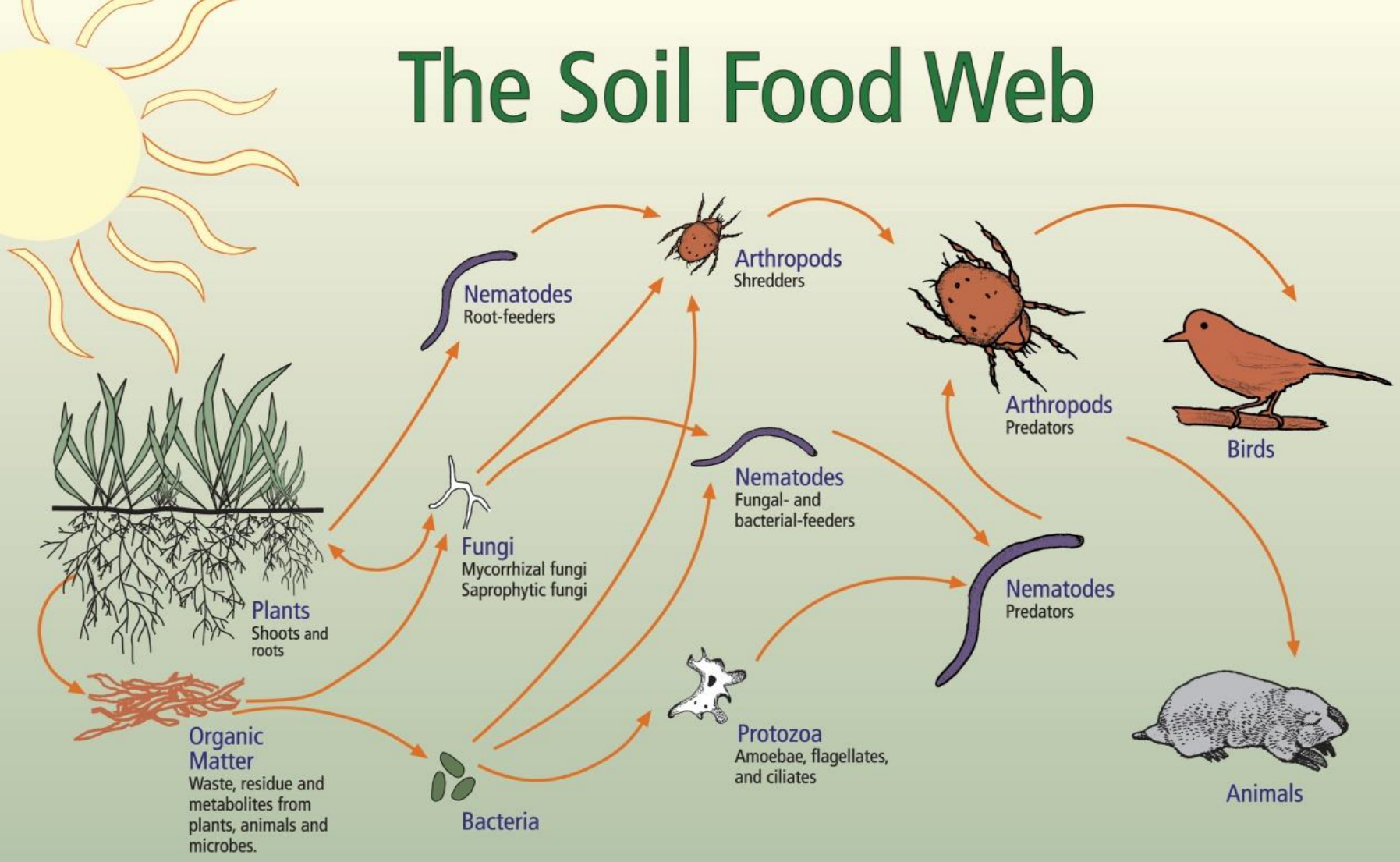
Sustainable Agriculture Research & Education

The Soil Food Web



First trophic level:
Photosynthesizers

Second trophic level:
Decomposers
Mutualists
Pathogens, Parasites
Root-feeders

Third trophic level:
Shredders
Predators
Grazers

Fourth trophic level:
Higher level predators

Fifth and higher trophic levels:
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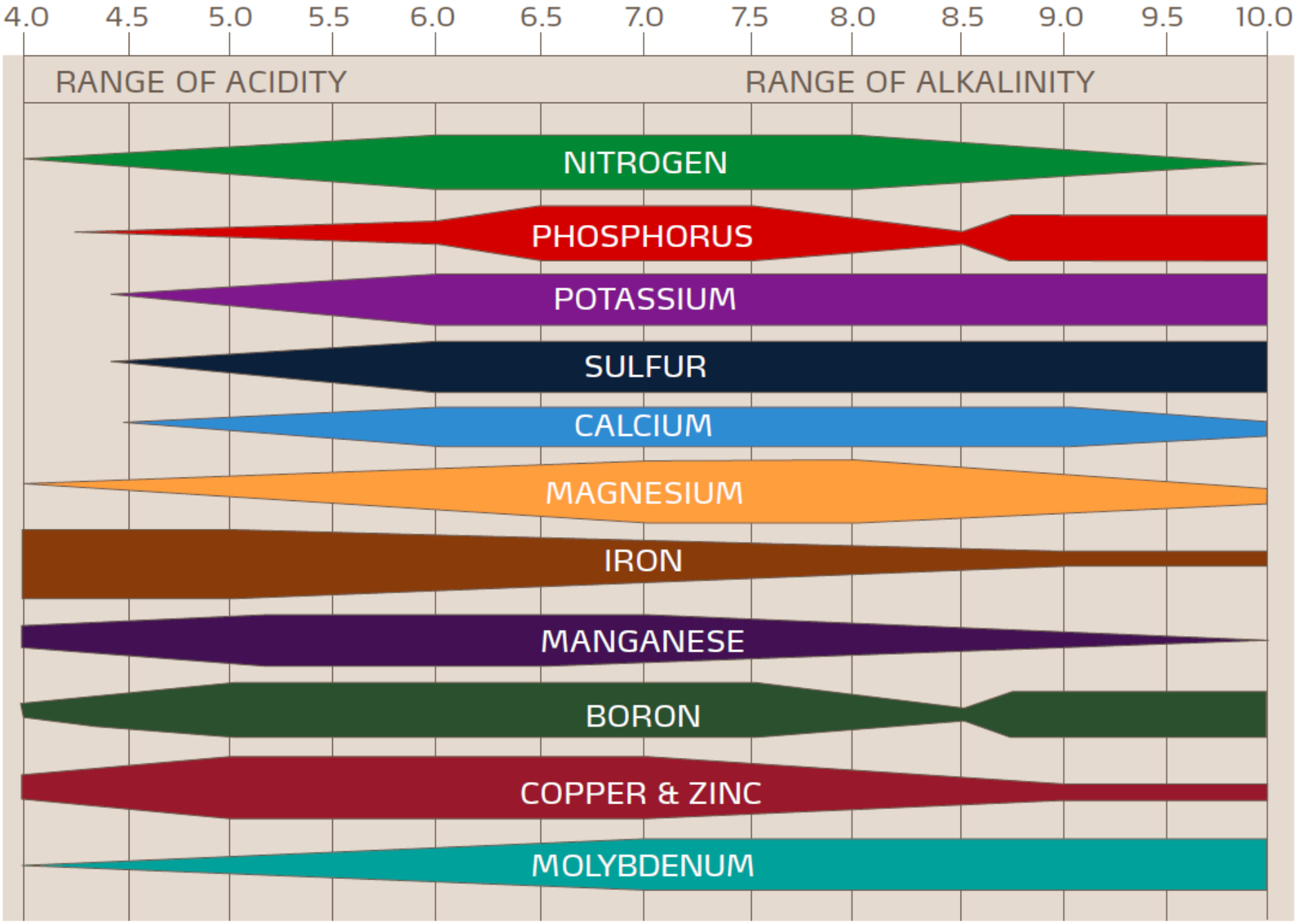
The Influence of Soil pH on Nutrient Availability



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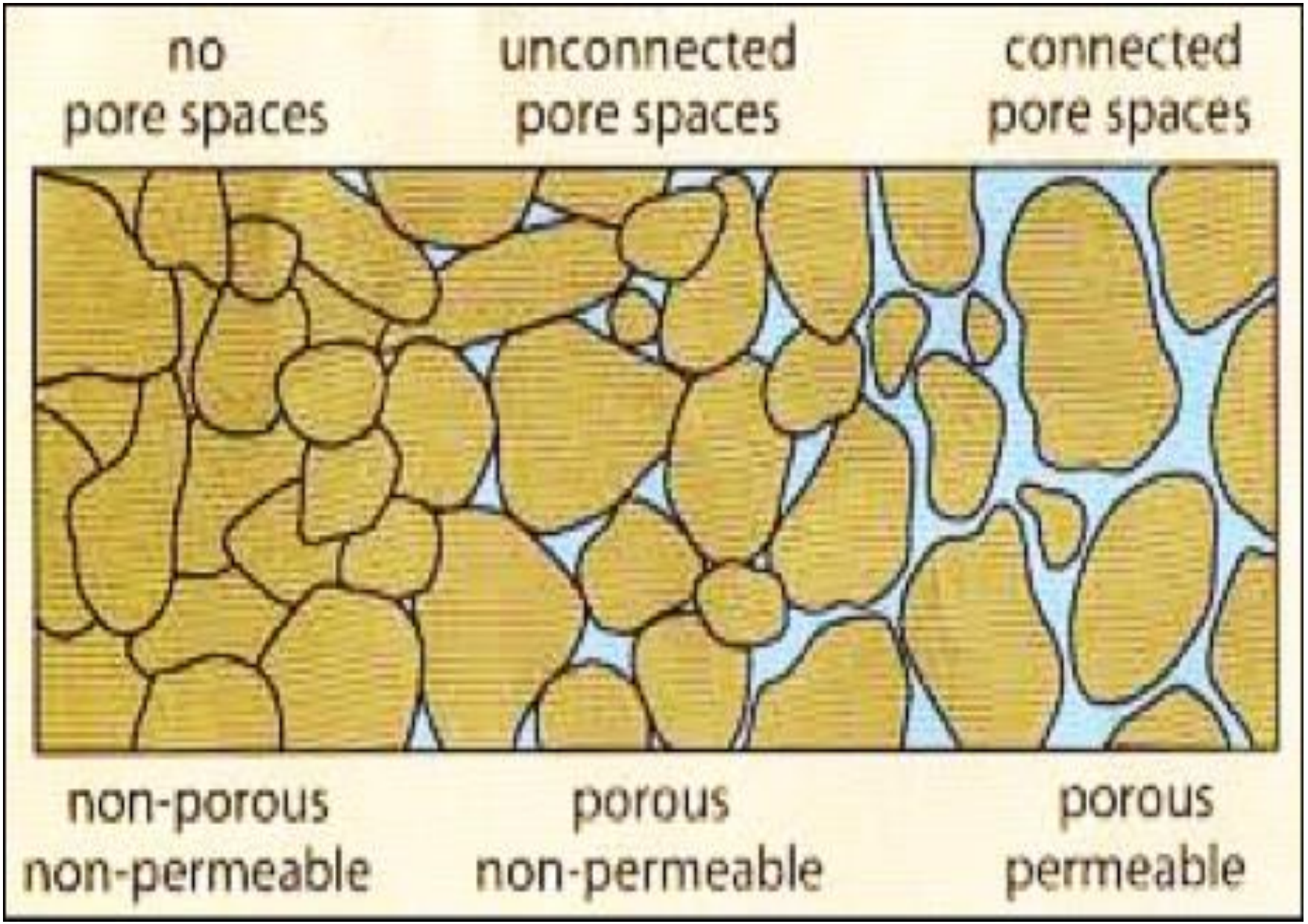
Tilling Destroys Soil Tilth



How to Build Healthy Soils

- Eliminate Synthetic Pesticides/Fertilizers
- Encourage the Soil Food Web
- Use Compost and Compost Teas
- No Till or Low Till
- Use Supplements if Needed
- Grow Roots Not Plants

Soil Food Web Gardening Rules:

1.Some plants prefer soils dominated by fungi; others prefer soils dominated by bacteria.

2. Most vegetables, annuals, and grasses prefer their nitrogen in nitrate form and do best in bacterially dominated soils.

3. Most trees, shrubs, and perennials prefer their nitrogen in ammonium form and do best in fungally dominated soils.

Tucson Organic Gardeners

soiling our hands since 1971

TUCSON ORGANIC GARDENERS PLANTING GUIDE

FOR TUCSON AND THE LOW DESERT

Jan 1 – Feb 15

FROM SEED

Arugula, Broccoli, Cabbage, Chinese Cabbage, Cauliflower, Celery, Cilantro, Collards, Dill, Fennel, Kale, Lettuce, Mustard Parsley, Bulb Onion (See Graphic), Potato

FROM SEEDLING TRANSPLANT

Artichoke, Broccoli, Cabbage, Chinese Cabbage, Cauliflower, Celery, Cilantro, Collards, Dill, Fennel, Kale, Lettuce, Mustard, Parsley, Spinach, Swiss Chard.

March 1 – April 15

FROM SEED

Amaranth, Basil, Bush Bean, Corn (Sweet), Cucumber, Jerusalem Artichoke, Malabar Spinach, Melon, Pumpkin, Sesame, Sorghum, Summer and Winter Squash, Tobacco, Watermelon

FROM SEEDLING TRANSPLANT

Basil, Eggplant, Pepper, Tomato, Tomatillo

April 15 – May 31

FROM SEED

Amaranth, Basil, Cantaloupe, Cowpea, Cucumber, Malabar Spinach, Melon, Okra, Sorghum, Sweet Potato Slips, Summer Squash, Watermelon

FROM SEEDLING TRANSPLANT

Basil, Eggplant, Pepper

June 1 – June 15

FROM SEED

Pole Beans, Cantaloupe, Cowpea, Melon, Sweet Potato Slips

July 15 – August 31

FROM SEED

Bush Beans, Pole Beans, Corn (all types), Cowpea, Cucumber, Cantaloupe, I'Itois Onion (See Graphic), Pumpkin, Sorghum Summer and Winter Squash

FROM SEEDLING TRANSPLANT

Tomato (July 15 - Aug 15)

Sep 1 – Oct 15

FROM SEED

Arugula, Beet, Bok Choy, Broccoli, Brussels Sprouts, Cabbage, Carrot, Cauliflower, Celery, Chia, Chicory, Chinese Cabbage, Cilantro, Collards, Escarole, Fava, Garbanzo, Greens, Kale, Kohlrabi, Leek, Lentils, Lettuce, Mache, Mustard, Onion (See Graphic), Parsley, Parsnip, Pea, Radish, Rape, Rutabaga, Turnip, Spinach, Swiss Chard

FROM SEEDLING TRANSPLANT

Broccoli, Brussels Sprouts, Cabbage, Chinese Cabbage, Cauliflower, Celery, Cilantro, Dill, Fennel, Kale, Lettuce, Mustard, Parsley, Spinach, Swiss Chard

Oct 15 - Nov 15

FROM SEED

Beets, Carrots, Garlic, Greens, Lettuce, Mustard, Pea, Radish, Turnip, Wheat (December – January)

FROM SEEDLING TRANSPLANT

Broccoli, Cabbage, Chinese Cabbage, Cauliflower, Celery, Cilantro, Collards, Dill, Fennel, Kale, Lettuce, Mustard Parsley, Spinach, Swiss Chard

LATE WINTER | SPRING | LATE SPRING | EARLY SUMMER | MONSOON | EARLY FALL | LATE FALL

ONIONS

"SHORT-DAY" BULB ONION SETS
January 1 – February 15

TOHONO O'ODHAM I'ITOIS MULTIPLIER ONION
July 15 – February 1

GREEN BUNCHING/SCALLION
August 15 – February 1

Growing Legumes

- Warm Season – Bush Beans, Lima
- Hot Season – Pole Beans &Tepary Cowpeas
- Cool Season – Peas, Garbanzo and Fava

Types of Beans

- Common
- Tepary
- Cowpea
- Runner
- Soybean
- Fava
- Lima
- Lentil
- Many More!

Cool Season Legumes

- Peas
  - Sugar Snap
  - Snow Pea
  - Shelling
- Fava
- Garbanso or “Chickpea”

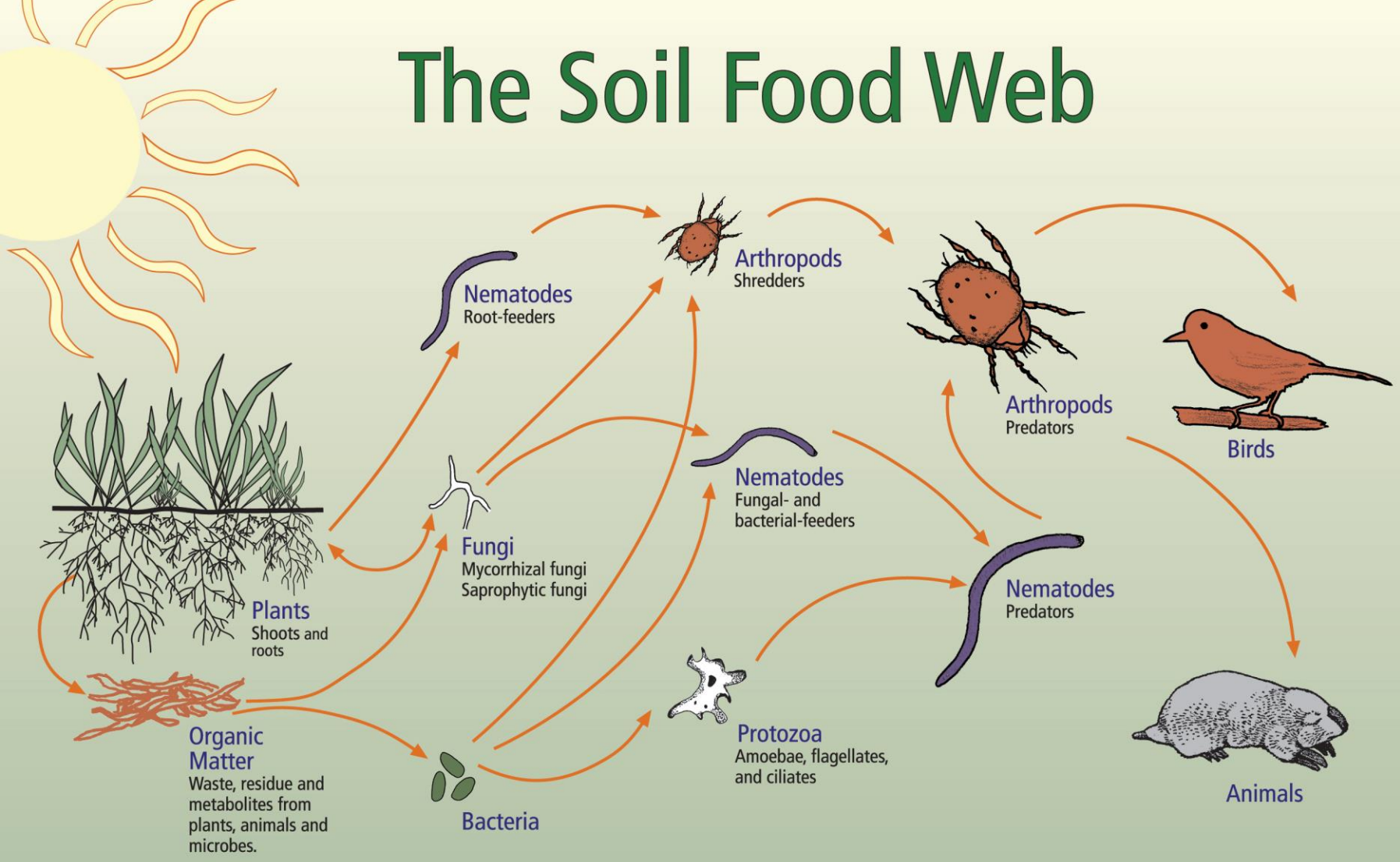
Other Cover Crops

- Vetch
- Alfalfa
- Clover
- Lablab
- Sesbania

Companion Planting

- Insect Control
- Nurse Cropping
- Trap Cropping
- Fertilizers

The Soil Food Web



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Higher level predators

Fifth and higher trophic levels:
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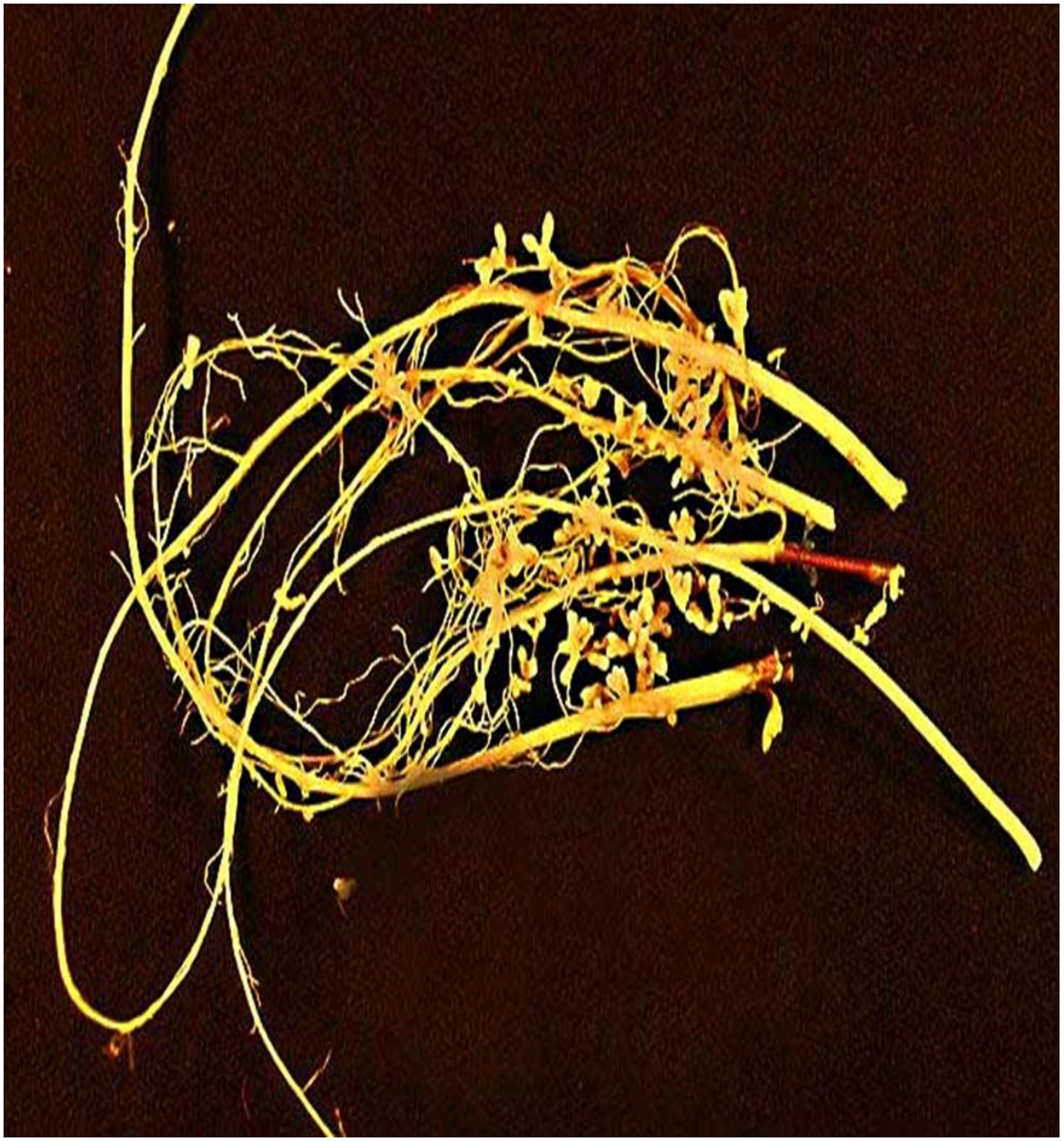
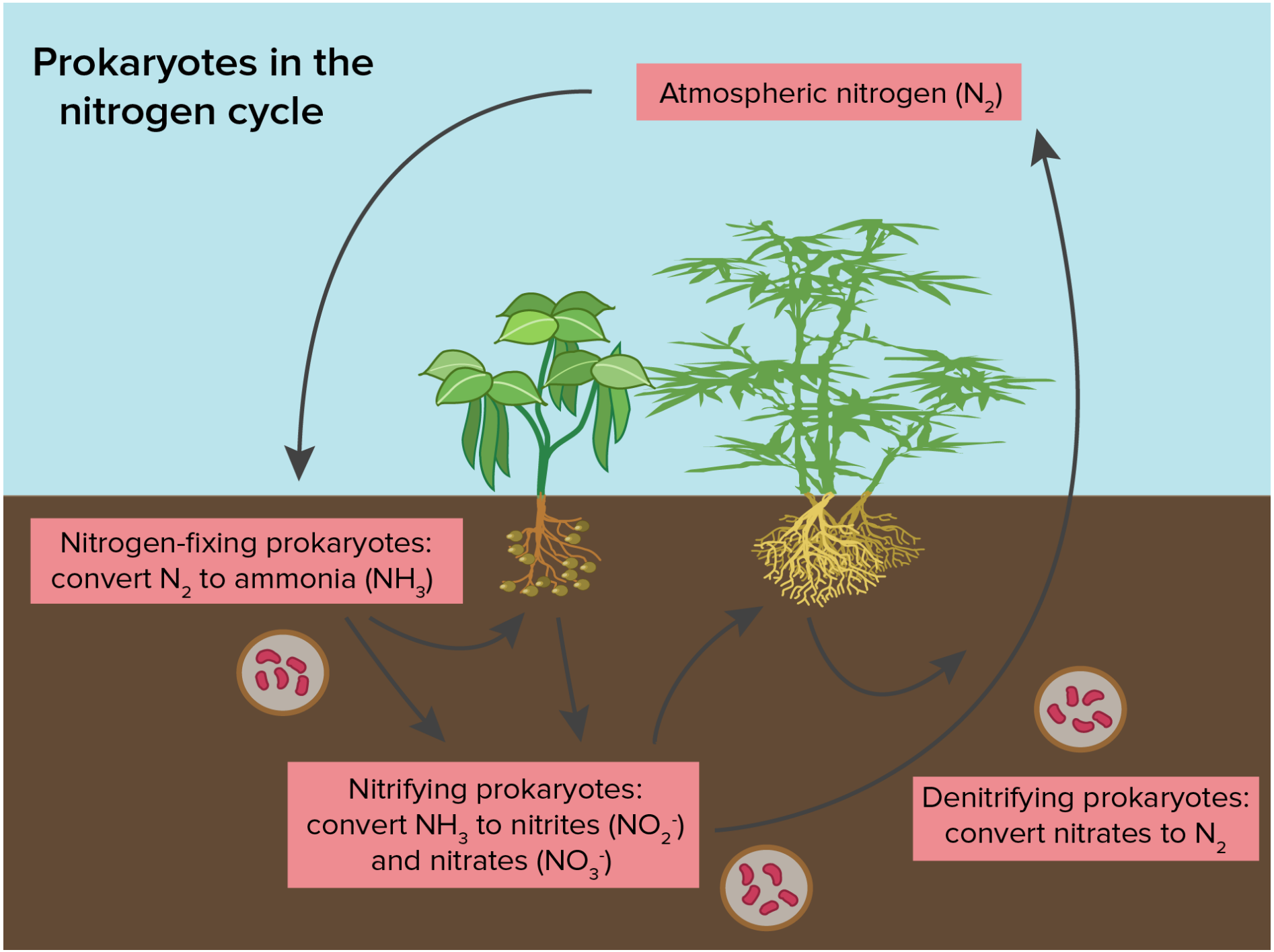
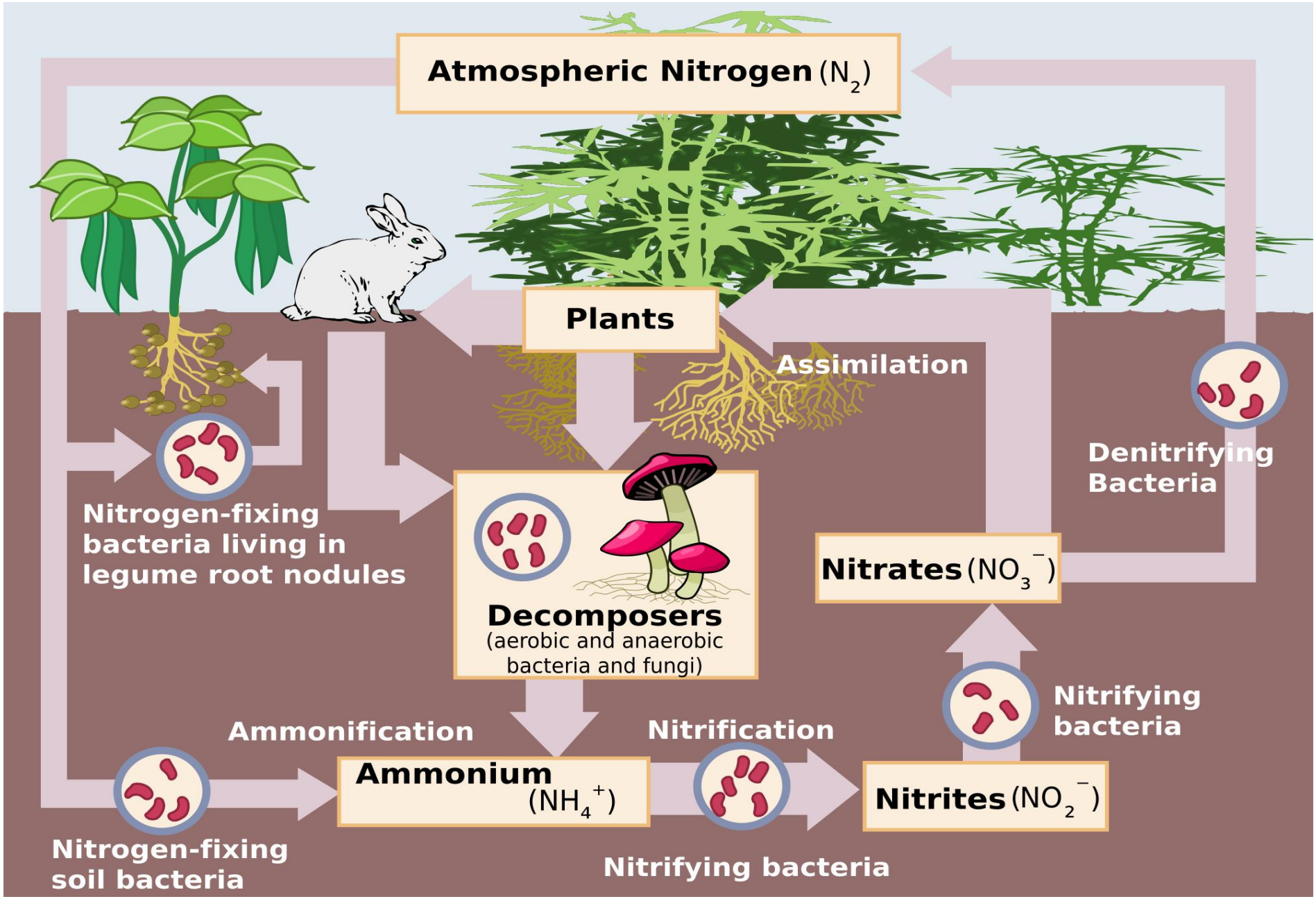
Importance of Legumes



- Crop Rotation
- Nitrogen Fixation
- Rhizobia


Prokaryotes in the nitrogen cycle
Atmospheric nitrogen (N_2)
Nitrogen-fixing prokaryotes: convert N_2 to ammonia (NH_3)
Nitrifying prokaryotes: convert NH_3 to nitrites (NO_2^-) and nitrates (NO_3^-)
Denitrifying prokaryotes: convert nitrates to N_2

Nitrogen Cycle



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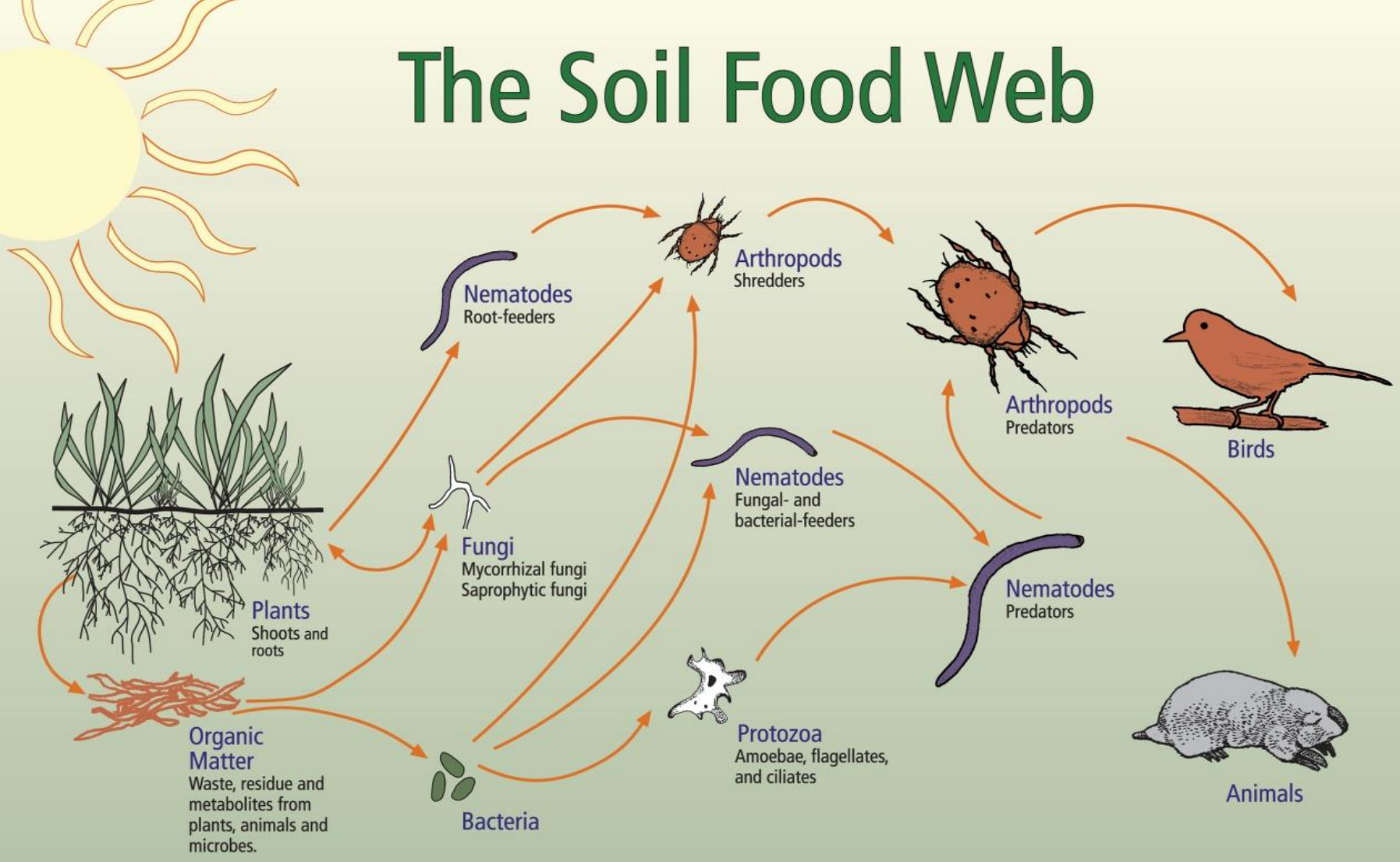

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Soil Food Web Gardening Rules:

4. Compost can be used to inoculate beneficial microbes and life into soils around your yard and introduce, maintain, or alter the soil food web in a particular area.

5. Adding compost and its soil food web to the surface of the soil will inoculate the soil with the same soil food web.

Build the Soil – Compost

- Adds Soil Life
- Improves Tilth and Water Holding Capacity
- Balances Ph
- Eliminates Food Waste
- For New Gardens, Replace 50% of Native Soil with Compost.

Build the Soil – Compost

<u>Be A “Microbe” Manager</u>

- Traditional Composting
- Worm Composting
- Fermentation Methods

Build the Soil – Compost

Traditional Composting

- Bins, Heaps, Piles
- Hot or Cold
- Mixed Ratio of “Greens and Browns”
- Must be turned, and sifted
- Keep moist for best results

Build the Soil – Compost

<u>Worm Bin Composting</u>

- Nutrient Dense Fertilizer
- Indoors or Outdoors
- Can be Very Efficient

Build the Soil – Compost

Fermentaion Composting

- Bokashi
- KNF
- Takakura

Soil Food Web Gardening Rules:

6. Aged, brown organic materials support fungi; fresh green organic materials support bacteria.

7. Mulch laid on the surface tends to support fungi; mulch worked into the soil tends to support bacteria.

8. If you wet and grind mulch thoroughly, it speeds up bacterial colonization.

9. Coarse, dryer mulches support fungal activity.

Build the Soil – Mulch and Cover Crop

- Mulch, Mulch, Mulch
- Wood Chips for Trees and Shrubs
- Alfalfa Hay for Vegetable Gardens
- Avoid Straw
- Biologic not Geologic

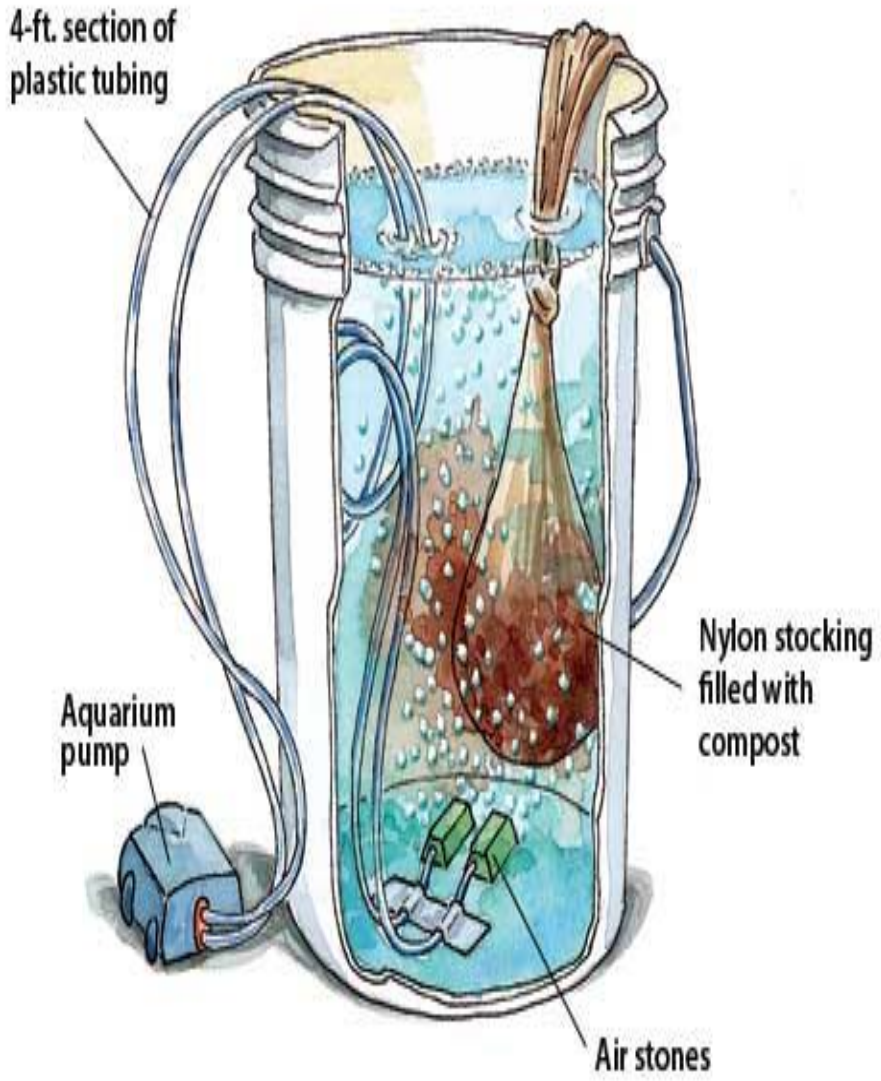
Soil Food Web Gardening Rules:

10. Sugars help bacteria multiply and grow; kelp, humic and fulvic acids, and phosphate rock dusts help fungi grow.

11. By choosing the compost you begin with and what nutrients you add to it, you can make teas that are heavily fungal, bacterially dominated or balanced.

12. Compost teas are very sensitive to chlorine and preservatives in the brewing water and ingredients.

Build the Soil – Compost Teas



Active Aerated Compost Teas (AACT)

- Soak Compost in water and use as soil amendment
- Adding Aeration and Sugars Increases effectiveness
- Add Supplemental Ingredients to Boost Micro-Biology Diversity

Soil Food Web Gardening Rules:

13. Applications of synthetic fertilizers kill off most or all of the soil food web microbes.

14. Stay away from additives that have high NPK numbers.

15. Follow any chemical spraying or soil drenching with an application of compost tea

REDUCE YOUR IMPACT

- Eliminate pesticide use
- Substitute native landscapes for lawns and other high water use plants

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LOCAL STARTS AT HOME

Soil Food Web Gardening Rules:

16. Most conifers and hardwood trees (birch, oak, beech, hickory) form micorrhizae with ectomycorrhizal fungi.

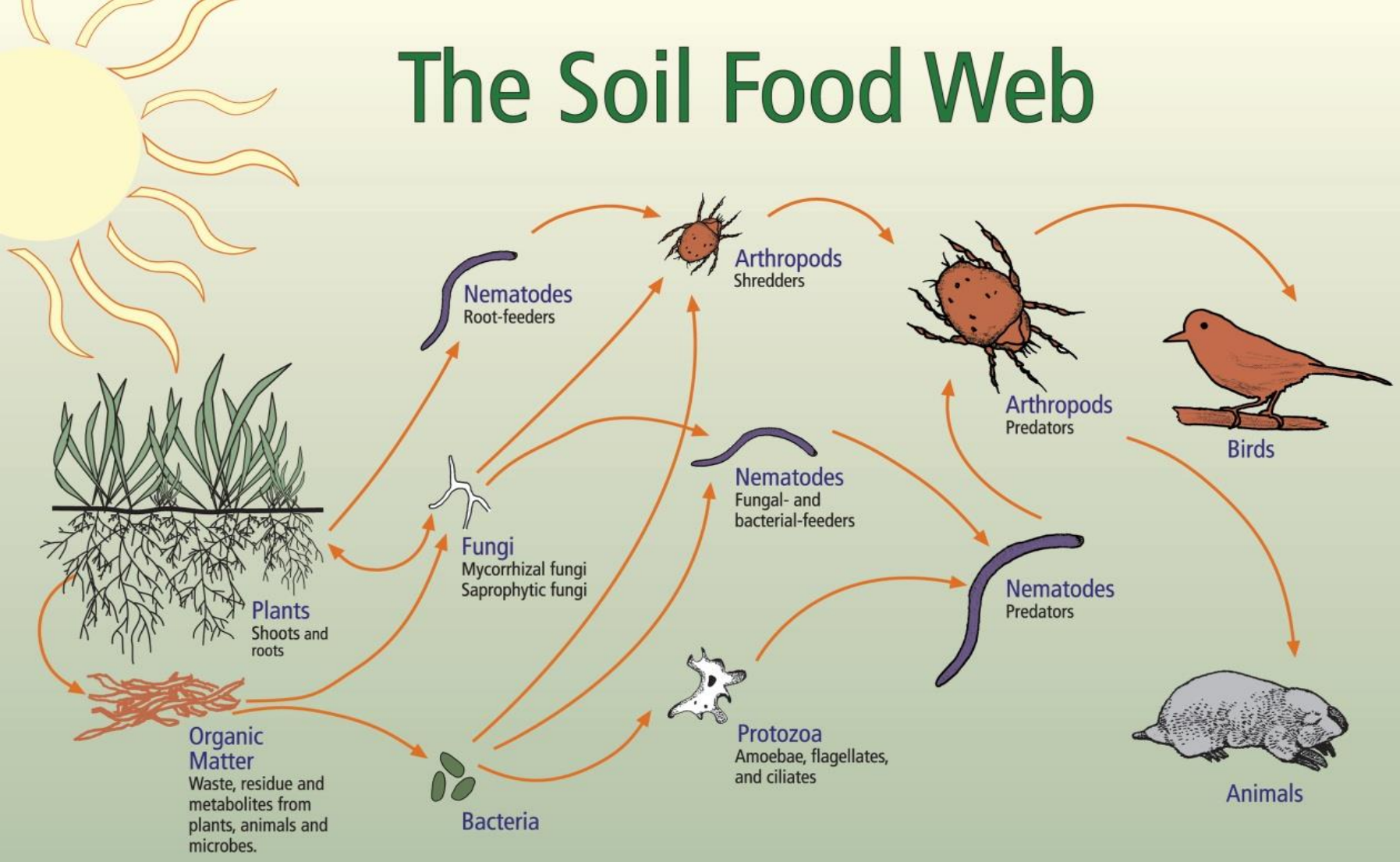
17. Most vegetables, annuals, grasses, shrubs, softwood trees, and perennials form mycorrhizae with endomycorrhizal fungi.

18. Rototilling and excessive soil disturbance destroy or severely damage the soil food web.

19. Always mix endomycorrhizal fungi with the seeds of annuals and vegetables at planting time or apply them to roots at transplanting.

Soil Inoculants and Mycorrhiza

The Soil Food Web



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RESOURCES

- Tanks Green Stuff
- EcoGro
- Reading List
- Gardening Clubs
- Local Businesses
- Friends and Family

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THANK YOU!

(520) 576-7085