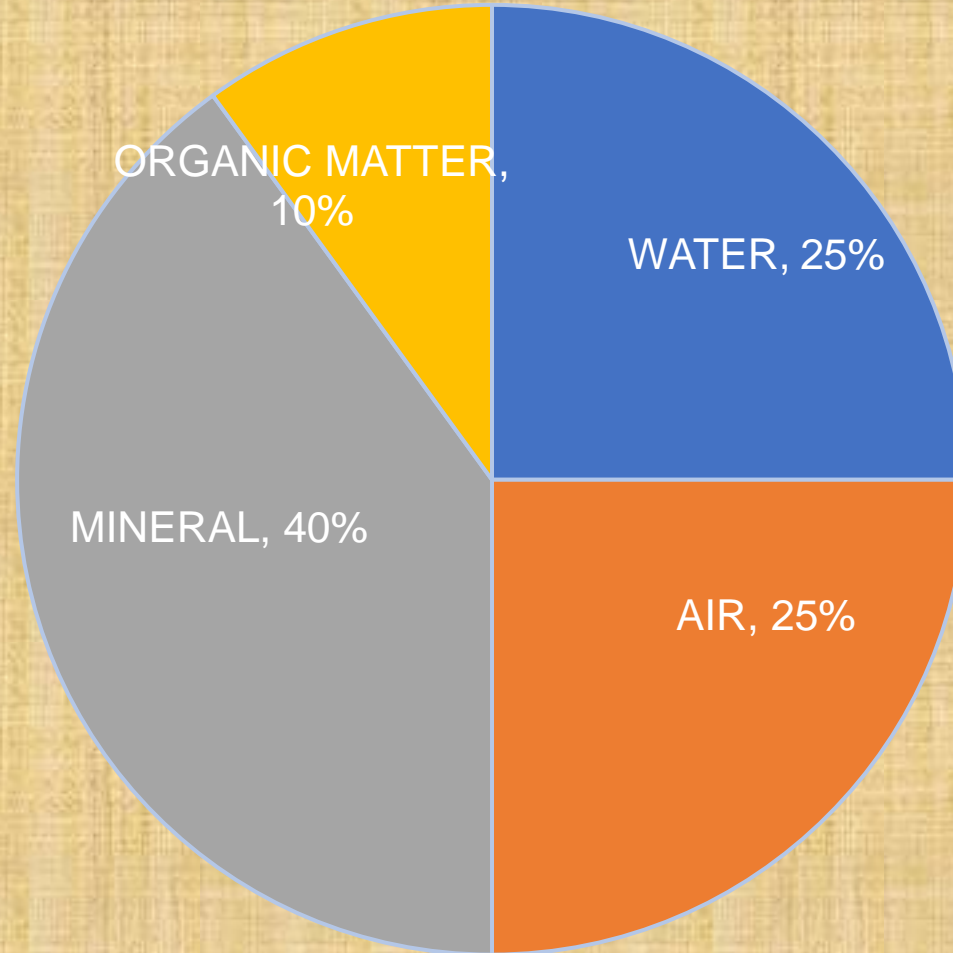
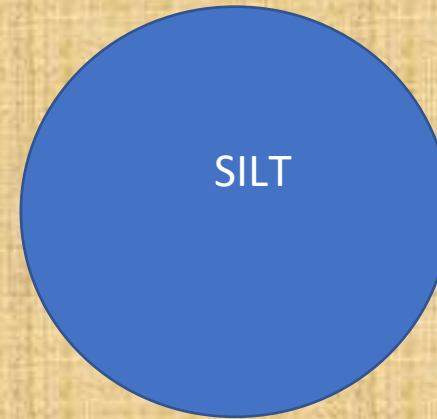


SOIL AND COMPOST

WHATS IN SOIL ?



MINERALS – BROKEN DOWN BITS OF ROCK





The mineral composition of soil affects its behavior

- How much water does it absorb and retain?
 - How easily does it compact?
- How fast does it warm up in spring? (Temperature)

Texture vs Structure

Texture: The amount of sand, silt or clay in our soil.

We **cant change our soil texture.** 😞

Structure: The way the individual sand, silt or clay particles stick together. (Ideal soil feels soft and crumbly or **friable**. The crumbs of soil are known as **aggregates**.)

We **can change our soil structure** 😊 🌱



Difference in texture influence

- Pore space
- Chemical charge (how easily nutrients can stick to the soil)
- Soil strength (how easily it is compacted)

This helps with decisions regarding how much and when to water, fertilize and till soil.

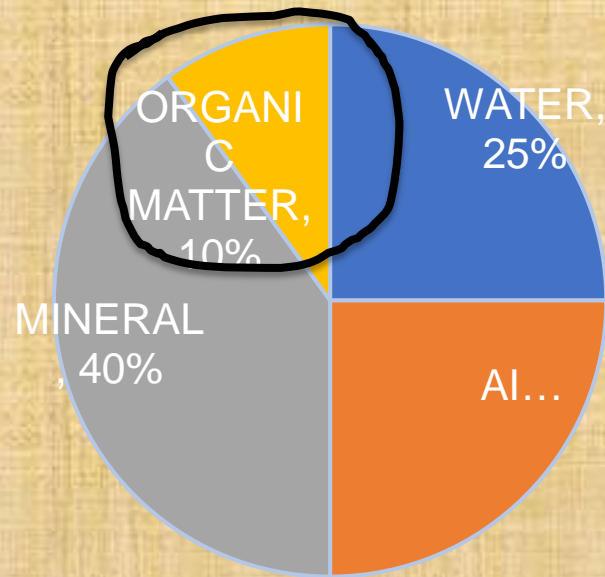
WE CAN IMPROVE SOIL STRUCTURE



| TEXTURE | Sandy | Loamy | Clay |
|-------------------------|--|---|--|
| Soil structure | Not much | Good crumbly, soil aggregates. Supports organic material and the living soil | <ul style="list-style-type: none">✓ Sticks together✓ Vulnerable to compaction✓ May cause drainage problems |
| Nutrients and fertility | Nutrients not stored in soil. Must provide as plants need them. Tends to be acidic | Good nutrient holding, good turnover of organic matter to release new nutrients | Full of nutrients, and organic matter wetness can cause problems with availability, tend to be alkaline. |

Living soil

Within the small fraction of soil that is organic matter only 5% is alive.
The remainder in some stage of decomposition.





Food, water and shelter



Living soil



Feeds plants by constantly consuming and excreting nutrients.



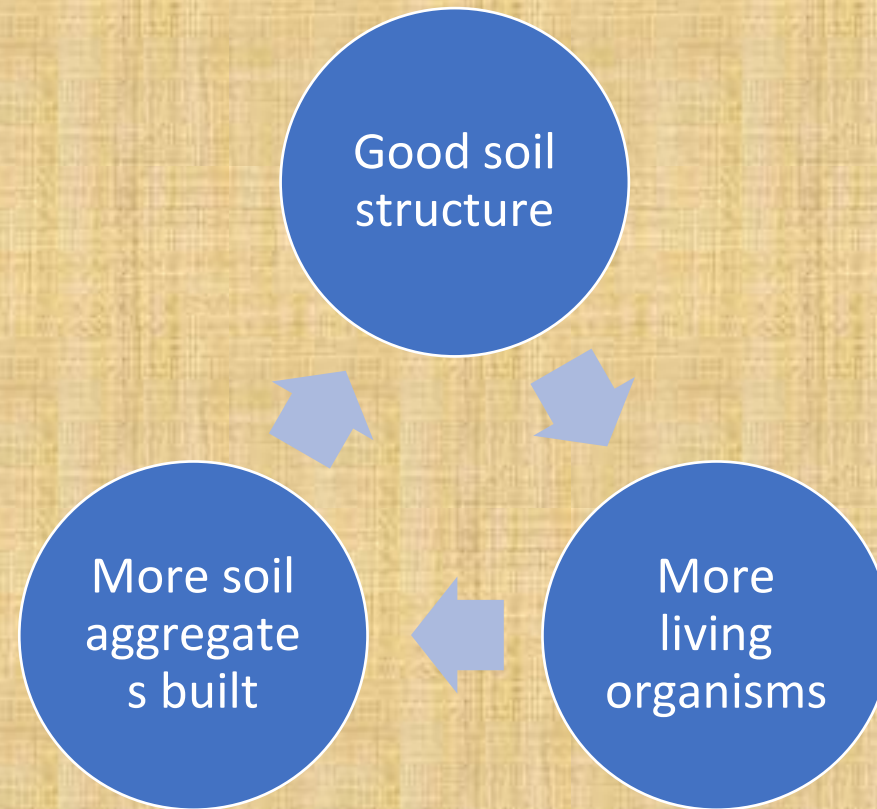
Creates rich ecosystem that protects the garden from pests and disease


A living soil

- Controls the flow or **nutrients and water** to garden plants, primarily through the activity of soil organisms
- Release nutrients to plant by **shredding grazing and digesting** organic matter
- Nitrogen fixing rhizobium bacteria live on roots of bean family **pull nitrogen from air into soil**
- **Mycorrhizal fungi** develop **beneficial relationships with plant roots**, increase their length to improve water and phosphorous delivery.
- Keep **pests and plant diseases in check**.

Advantage of good soil structure

Increases availability of food, shelter water and air for **living soil**.





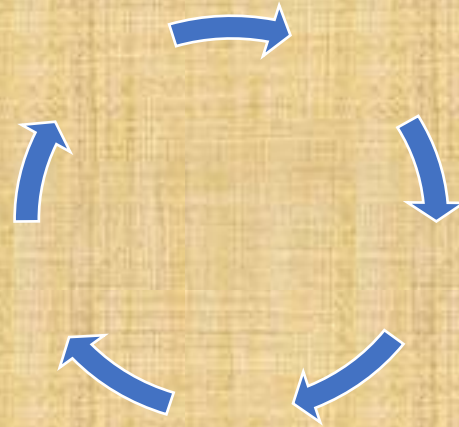
The single solution to provide
food shelter, water and air for
living soil is

Organic matter

ORGANIC MATTER is ANYTHING LIVING OR ANYTHING DEAD THAT WAS ONCE LIVING

(Anything that was once living and doesn't contain toxins can be added to soil).

Aim : a sustainable system



In Nature: organic matter is continually lost, is replenished when plants grow and return to the soil as residues and litter.

Aim with your gardening to

- **Minimize what leaves the system** and therefore what needs to be added.
- Develop a garden that **holds onto water, nutrients and other resources** (recycle and store water and nutrients)

Things to consider when building organic matter

The **Carbon** to **nitrogen** ratio (**brown** to **green**)

This affects how fast amendments decompose to release nutrients.

More nitrogen rich green materials lead to **faster decomposition** and greater nutrient release

Low nitrogen, browner material build **more organic matter**



Practices that add organic matter:

Any practice that returns organic material to the soil

- Grow cover crops/ green manure (lop it and leave it)
- Make compost
 - Compost in place (sheet compost, trench composting)
 - Slow composting
 - Worm composting
 - Leaf mold
 - Manure
- Add a chicken tractor to your garden





COVER CROPS - Any living ground cover planted

- Protect the bare soil from **erosion**.
- Reduce of **water runoff**
- **Suppress weed, insect and disease**
- **Reduces risk or introducing unwanted** pests, weeds, diseases
- Provide **diverse habitat for soil organisms, beneficial insects and aboveground pollinators**.
- Increased **microbial populations**
- Preserve **soil nutrients**.
- Enhance **soil structural stability**;

Examples of how to use cover crops

- Green manure
- Living mulch
- Residue mulch



Green manures (grow and then plough under)

- **High nitrogen cover crop** decompose quickly to fertilize gardens (can reduce eliminate need for nitrogen fertilizer)
- **Non legume crops** lower in nitrogen, take longer to decompose. They scavenge and recycle excess soil nutrients left at end of growing season.
- **Living roots**
 - Add massive amount of organic material below ground. They constantly leak sugars - a hot spot for living soil activity.
 - Large roots and root systems break up compact or clay soil - till soil

Living mulches

- Suppress weeds by blocking sunlight and reducing erosion.

(Should not compete with other plants, be shade tolerant and low growing).

Residue mulches

Leave cover crop on soil as mulch

- Limits weed seed germination
- Enhances weed seed predation by insects.



Grow your own cover crops where you plan to amend the soil

Prepare seedbeds, water and weed as establish

Choosing your crop – what to consider

| | |
|---|---------------------------------------|
| | |
| Nitrogen fixer | Clover, beans, vetch, peas |
| Warm season (cover for bare ground in summer) – between crop rotations | Buckwheat, phacelia, soybeans, cowpea |
| Cool season/ over winter | Rye, clover, forage radish, oats |
| Improve compacted soil | Forage radish |
| Attract pollinators | Flowering forbs |

(Can use one or a combination of plants)

Applications in the garden

- **Between spring and fall planting of vegies,**
 - harvest early veg,
 - plant quick growing warm season crop (buckwheat or phacelia)
 - a couple of weeks before ready to plant fall veg, hand pull or mow cover crop leave on soil surface. Or lightly chop and turn residue into soil.
 - give one or two weeks to mellow before planting new seeds
- **Summer cover crops**
 - use buckwheat as a living mulch. It competes with weeds.
 - Can inter seed if stagger with other crops but must ensure doesn't outcompete.
- **Cool season cover crops**
 - Use at the end of the growing season, grow in fall, may winter kill, suppress weeds in garden low period,
 - must seed 4 weeks before first frost
- **For nitrogen fixing cover crops**
 - inoculate seed with rhizobium bacteria for best results, (each inoculant specific to particular legume so check) soak seed in inoculant overnight before planting.
- Can use in **annual rotation** a year or two before planting

Crops nutrients come once the plant dies

- For max nitrogen, kill just as begin to bud.
- Avoid letting crop go to seed, as nutrient quality suffers and may become weeds.
- Timing also depends on timing of next crop, residue from cc should mellow in soil for 2 weeks before planting. (N rich legumes and succulent buckwheat faster to decompose and can be replanted with next crop sooner after cover crop incorporation)

Ways to kill

- Till it
- Winter kill (frost sensitive cover crops)
- Mow pull and mulch (pull by roots if readily spring back. Leave on soil and plant into it.
Or can pull off planting bed, replace as mulch once new seedlings established.
- Sheet mulching



More ways to build organic matter

- Compost in place
 - sheet composting,
 - trench composting
 - Lop it and leave it
- Build a separate compost system
 - Hot composting
 - slow composting
 - Compost with worms
 - Leaf mold
 - Manures

Quality of compost is affected by what you put in

- How long have the raw materials composted at what temperature
- How was the compost finished and stored.
- Are there weeds?

Helpful hint

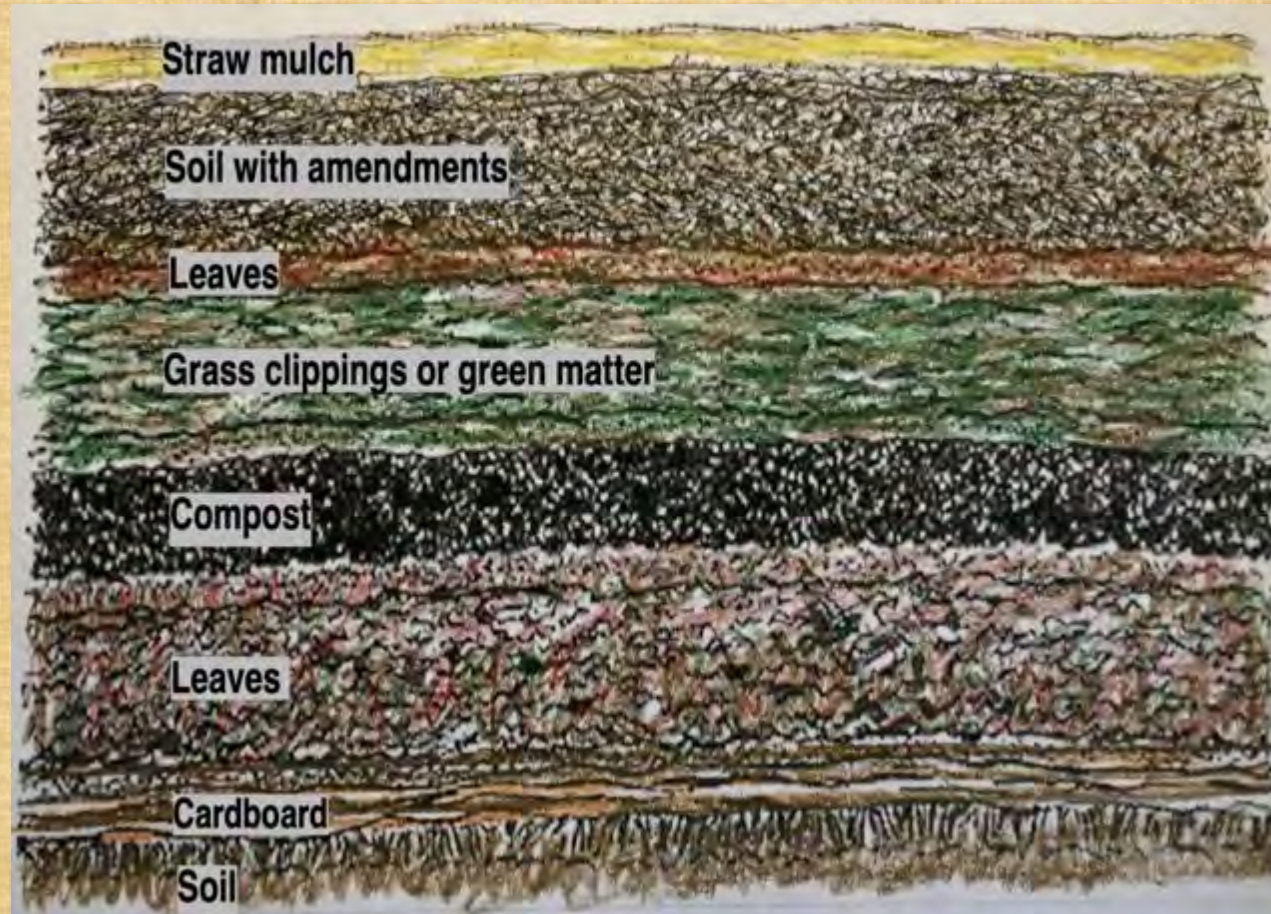
Take a small sample of compost material, wet slightly wrap in moist paper towel and put in open Ziploc bag. Keep moist and warm for several days to see if weeds germinate.

Composting in place – minimizes disturbance of soil ecosystem.

- Add raw un-composted organic materials directly to soil,
- Can also cover soil as mulch to suppress weeds and retain water
- Drawbacks unsightly and keeps soil cooler, in spring wait longer.



Sheet composting (sheet mulching, lasagna gardening)



Trench composting



Lop it AND LEAVE IT

- Comfrey leaves



Compost basics

- Living pile needs food water and shelter and air.
- Add one part green(high nitrogen) to 2 parts brown. (If short of green material add nitrogen fertilizer like blood meal or fish emulsion)
- Needs water so microbes active not waterlogged. Feel like wrung out sponge. So cover with tarp so doesn't dry out.
- Aerate pile to prevent smells,
- Temperature nb, if too cold not active. Minimum size of pile for it to be active, 3 feet wide by 3 feet long 3 feet deep.

Slow composting

- Pile material and sit back and wait, can turn pile on occasion, will speed up. Cover pile and add water to keep moist.

Three cell composter



3 cell composter with removable front slats and hardware cloth sides. One cell is empty so that the other two can be tossed. I generally toss them every 2 weeks to add air and moisture. Each cell is large enough to generate enough heat to kill weed seeds.



Front slat removed to make tossing the piles easier.



Closed. Slant on top to let rain run off.



Back and side showing hardware cloth.



My storage bins of finished and screened compost. Each finished cell of the composter will fill 3 of the garbage pails. Extra time in the black pails also help kill any remaining viable seeds.

Compost ready to go to the gardens.





Worm composting



Leaf mold





Manures

- **Manures provide macro and micro nutrients**, nitrogen phosphorus, potassium and sulfur. Also organic matter
- **Quality varies depending on**
 - animal (e.g. fresh poultry manure, use less than $\frac{1}{4}$ inch)
 - bedding added
 - if composted or fresh
- Best used in spring before planting, if fresh one month before plant,
- Can mix into planting holes for shrubs and trees or use as mulch around shrubs.
- Good green material for pile and sheet composting.



To reduce risk of pathogens

- Use the hot composting method.
- Store carefully don't let rainwater leach off pile, can pollute surface and ground water also removes valuable nitrogen



Chicken tractor great



- Move chickens around lawn, poop adds nutrients doesn't damage grass.
- In garden beds, add manure, clean up residues, reduce insect pests, lightly till soil.
- Manure can harbor pathogens, so wait several months before planting in freshly fertilized soil.

General principles – for soil grower

- **Use what you have** – e.g. instead of bagging leaves, add back to garden as mulch.
- Losses occur through harvest, weeding mowing tilling **so add back**
- Note **roots** below ground **add even more organic matter to soil than crop above ground** (growing cover crop and green manure some of best ways to amend soil).
- **Soil is a diverse ecosystem;** needs diverse garden (diversity of plant - rotations, additions)
- Living soil **prefers sustained supply of food and nutrients over time** rather than feast and famine
- **Disturb less,** (tilling, bare soil and pesticides organic and conventional disturb living soil)
- **Never till wet soil** as will compact especially if clay
- **Keep soil covered** (mulch, decaying organic matter or living plants)
- **Attracting pollinators, and including shade and shelter from wind are also of benefit**

Thanks