

SOIL HEALTH MANAGEMENT



DAY – National Rural Livelihood Mission

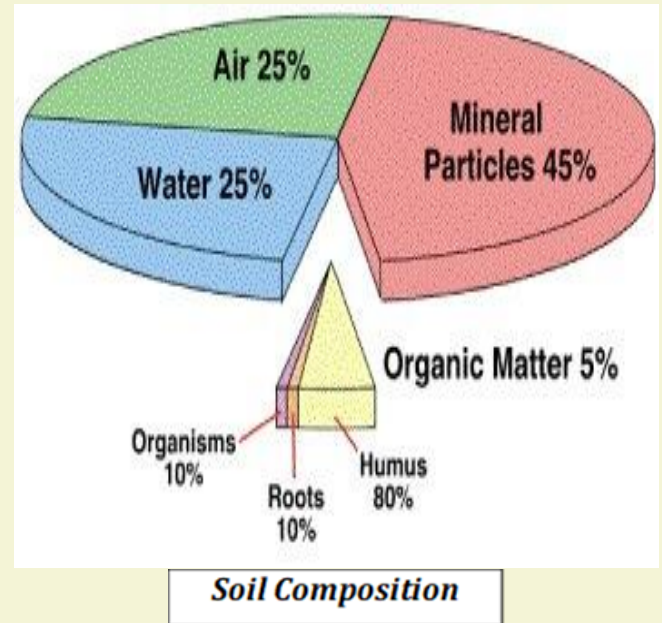
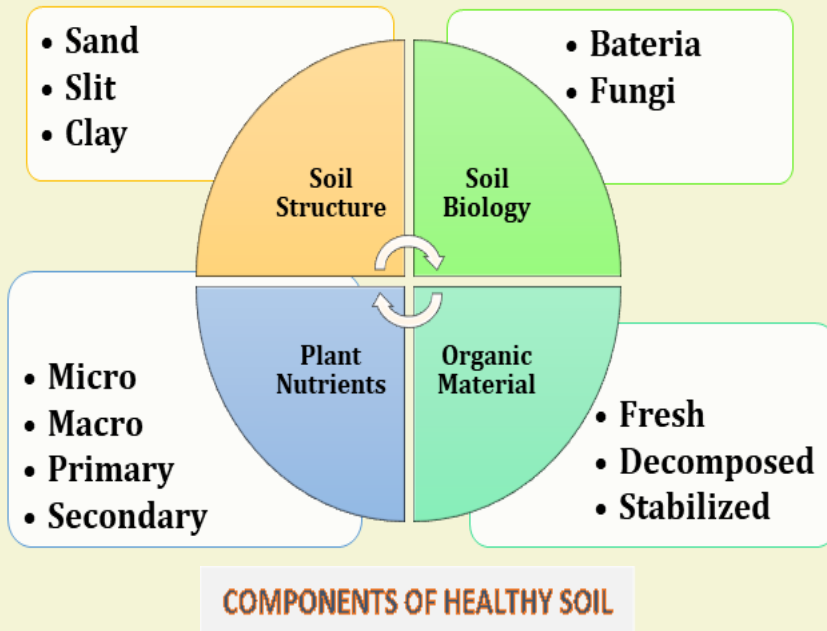




SOIL HEALTH MANAGEMENT

All life depends upon the soil. There can be no life without soil and no soil without life.

Soil health is the continued capacity of a soil to function as a vital, living ecosystem that sustains plants, animals, and humans.



Healthy Soil is that which allows plants to grow to their maximum productivity without disease or pests and without a need for off-farm supplements. Healthy soil is teaming up with bacteria, fungi, algae, protozoa, nematodes and other tiny creatures. Soil bacteria produce natural antibiotics that help plants resist disease. Fungi assist plants in absorbing water and nutrients.

Soil organic matter (SOM) Soil organic matter serves as a reservoir of nutrients for crops, provides soil aggregation, increases nutrient exchange, retains moisture, reduces compaction, reduces surface crusting, and increases water infiltration into soil.





Components vary in proportion and have many intermediate stages. The more organic matter in a sample of soil, the healthier that soil is.

Soil Organic Matter Components	Percentage
Decomposing Organic Matter (active fraction)	33%-50%
Stabilized Organic Matter (humus)	33%-50%
Living Organisms	<5%
Fresh Residue	<10%

Importance of Humus

- Improves soil structure-improved air and water infiltration and movement.
- Improves water retention and release to plants.
- Slowly releases different elements (eg. nitrogen) over time, which plants then use for growth and development.
- Stabilizes soil pH so it improves nutrient availability.
- It chelates or bind metals in soil, preventing metal toxicities.

Ideal Fertile Soil has the ability of soil to supply all the essential nutrients to plants in adequate amounts, available forms, and in suitable proportions (balance). It is measured in terms of available forms of essential nutrient elements in the soil at any given time.

Ideal Fertile Organic Soil Components	Requirements
Organic Carbon	0.8%-1.5%
Total microbial load (bacteria, fungi % actinomycetes)	<1x 10 ⁸ gm of soil
Worms	3-5 /cubic ft of soil
Enough quantity of small life forms and insects such as ants etc. and must be a living soil	





Living Soils for High Agriculture Productivity

Soil Organic Matter is an important indicator of 'Life of Soil' or 'Soil Health' and can be assessed in most soil testing laboratories. **Soil Contains Enormous Numbers of Living Organisms. One cup of undisturbed native soil may contains below mentioned microorganisms:**

Organisms	Numbers
Bacteria	200 billion (2×10^{10})
Protozoa	20 million (2×10^7)
Fungi	100,000 meters (1×10^5)
Nematodes	20 million (2×10^7)
Arthropods	50,000 (5×10^4)

Beneficial Microorganisms

Directly beneficial - symbiotic association: Rhizobia, Mycorrhizae

Directly Beneficial - asymbiotic association: P-solubilizers, Antagonists of disease-causing fungi, Entomopathogens of insect-pests,

Indirectly beneficial: Decomposers of plant biomass - have two benefits

- (a) mineralization-release of bound form of elements to plant available form
- (b) improved soil structure leading to improved root growth and reduced soil compaction.





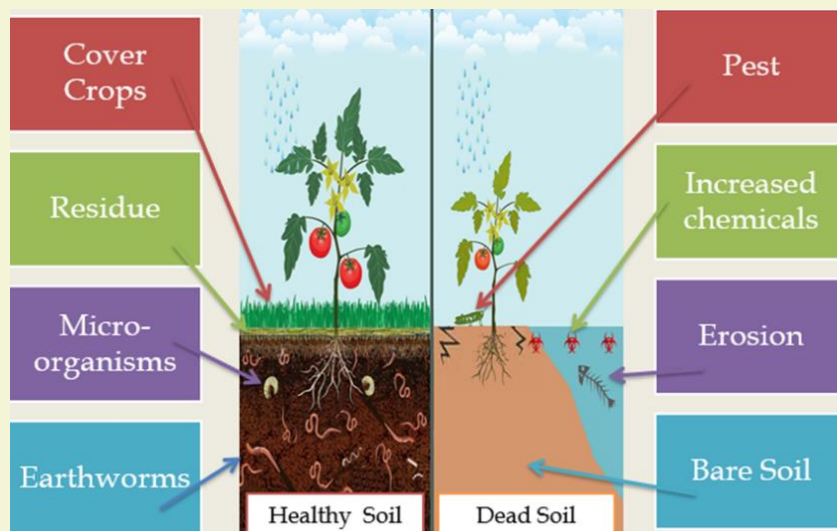
Essentials Elements Needed for Crop Production

- A plant needs 30+ elements in balanced form for excellent growth and yield.
- A plant may not differentiate whether the element in soil is from bag fertilizer or from degradation of plant biomass.
- Most soils and biomass have all the 30+ elements needed for crop production.
- Plants can be enabled to access the bound form of crop nutrients by solubilizing them through microbial activity on plant roots and in soil.
- **ELEMENTS FROM THE ATMOSPHERE**
 - C, O, H and N (all constitutive)
 - These represent 92 to 98 % of a plant's dry weight
- **ELEMENTS FROM THE SOIL (2-5%, plant's dry wt.)**
 - Twelve vital elements of which two are non-constitutive- K and Cl and ten are constitutive- P, B, Ca, Mg, S, Fe, Mn, Mo, Cu and Zn
 - Eighteen elements needed in traces.

Typical nutrient uptake for every t of grain and quantities present in soil:

- Total N in top 30 cm soil can be 2 to 3 t ha⁻¹
- Typical application rate for nitrogen is 100 kg ha⁻¹ for cereals and 20kg ha⁻¹ for legumes.
- Fertilizer use efficiency is generally about 40%.

Crop	N	P	K
Rice	20	5	20
Pigeon pea	40	8	12





Practices & Products for Converting Biomass to Crop Nutrients

About 10t/ha biomass can be produced through crops in rainfed areas and is important resource for high yield without agro-chemicals because it potentially supplies all the nutrients needed for high yield. **In addition, about 3.5t/ha biomass can be produced through loppings of trees grown on boundaries of fields growing these crops**

Biomass as Surface Mulch

- Making compost out of biomass is not essential.
- Using biomass as surface mulch is most beneficial and requires least efforts and money.



Use of Bio-Compost:

- Compost is a source of agriculturally beneficial microorganisms.
- When products like Amritpaani and Panchgavya etc. are applied, the local population of earthworms multiplies in large numbers.

Dhabolkar Method of Green Manuring:

Method to convert unproductive land into productive land

In this method, 20-25 kg of mixed seed from 5 categories (4 crops in each category i.e total 20-21 crops) mentioned are sown: 1. Cereals (Coarse cereals and millets) 2. Pulses (Black gram, Green gram, Chickpea, Bean) 3. Oilseeds (Sesame, Groundnut, Sunflower, Castor) 4. Legumes (Sesbania, Sunhemp, Horse gram etc) 5. Spices (Mustard, Coriander, Methi, Ajwain)



In this mix, pulses, oilseeds, cereals/millets, green manure crop seeds are added @ 6kg each whereas spices are added @ ½ kg each. After 40-45 days of sowing, the entire biomass is incorporated into the soil. This has to be repeated two more times for best results. In this way, the top soil gets replenished with all plant nutrients and also help in buildup of humus.

