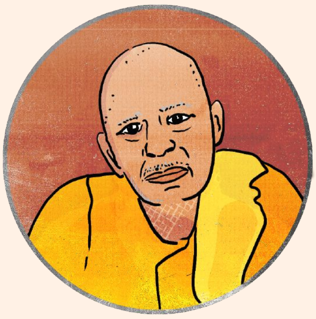
How to test and manage your soil?

A guide to monitoring and managing soil health

This playbook has been designed for rainfed farmers in red and black soil regions of the Deccan Plateau, where topsoil is eroded.



This playbook was created using **Soil Vasu's** resources

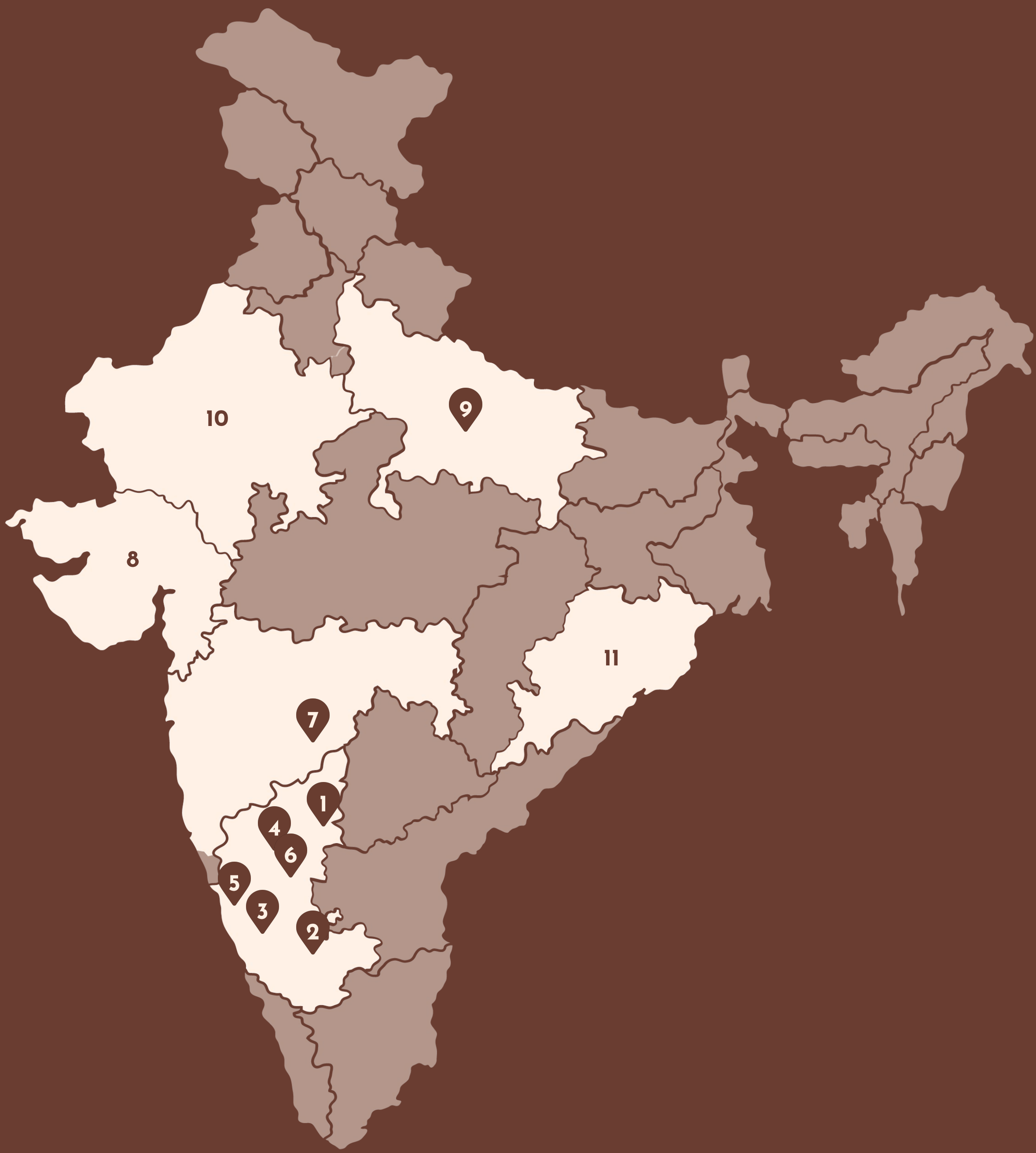
What need/pain point is this playbook addressing?

Crop yield depends on soil quality and health.
This playbook enables users to test the quality of their soil and manage it so as to improve quality and yields.

What are the benefits to stakeholders?

Using this playbook farmers can test their own soil quickly and implement these techniques to improve the health of their soil.

Success Stories



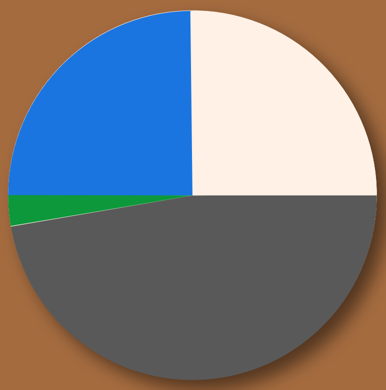
1. Nanjungoad, Bellary, Magadi- ICRA
2. Chitradurga
3. Challakere
4. Parts of Mysuru
5. Chamrajnagar- Purnarchith
6. Kolar-Gram Vikas
7. MH- Kaneeri Math
8. Gujarat
9. Lucknow, UP
10. Rajasthan
11. Odisha

What steps does this solution take?

Soil composition

Average soil is composed of

- Water 25%
- Mineral particles 45%
- Air 25%
- Organic matter 5%



Soil organic matter is more abundant in top layers of soil than in the bottom – this makes topsoil ideal for growing crops.

Features of fertile soil:

1. Soil feels cool and soft to touch when held with pinched fingers
2. When water is poured on soil, it absorbs the water quickly and retains moisture
3. Top soil layer is not hard – soil is aerated (easy to dig) and not too compact
4. If you pick some soil up, you can find insects, ants and earthworms easily in it, and it is rich in humus
5. Usually generates higher yields and better quality of harvest

Why do you need to test your soil?

Different soils naturally contain different amounts of nutrients. Soil testing is the first step to understand the nutrient status of your soil so you can manage it accordingly. Annual testing is recommended for some nutrients (Nitrogen, Sulphur, Boron, Chloride and Manganese) while less frequent testing is acceptable for others. With addition of chemical fertilisers, often an excess of primary nutrients is added to the soil but secondary and micro nutrients remain lacking.

Drawbacks of sending soil to a lab for testing:

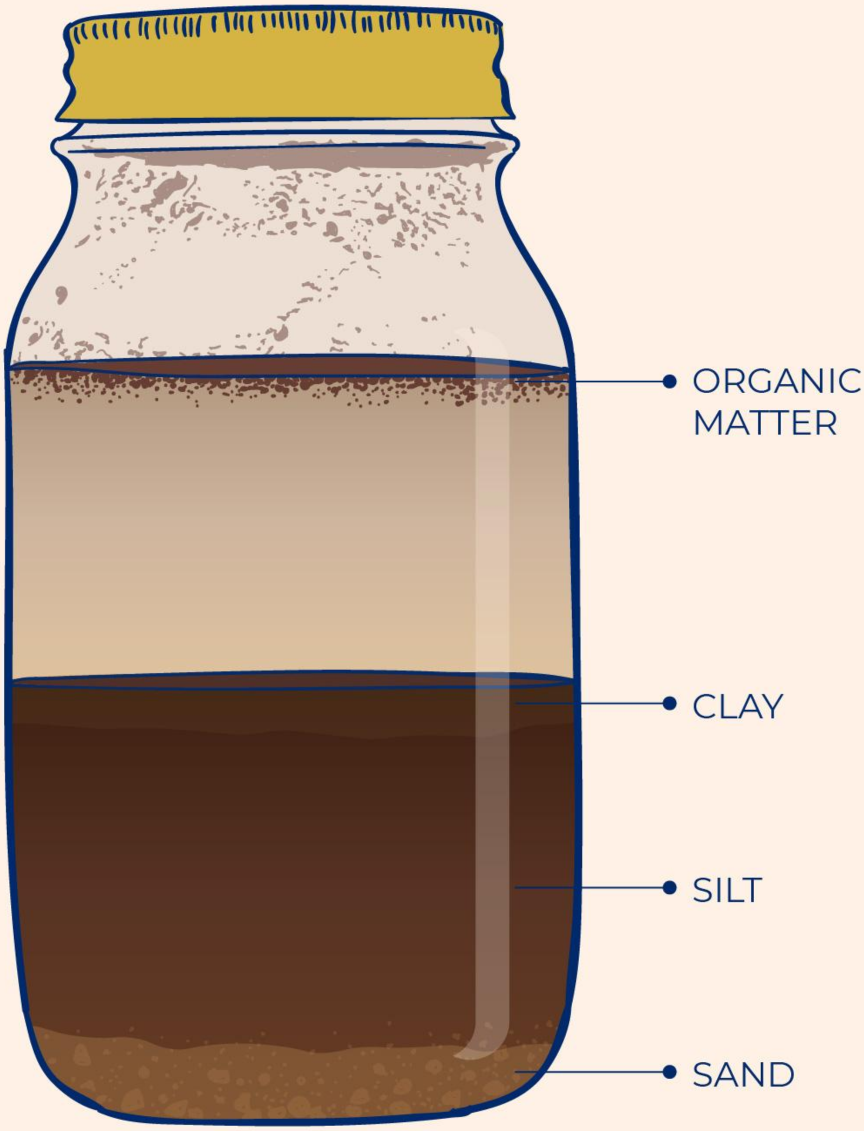
- Labs don't always have necessary equipment and tests using older equipment take a long time to produce results
- Getting results takes a lot of time to get results as labs are backed up
- Most labs recommend chemical fertilisers only - these are high cost inputs

Farmers can test their own soils using some very simple methods so as to gain an understanding of how to manage their soils.

What is the nature of your farm's soil?

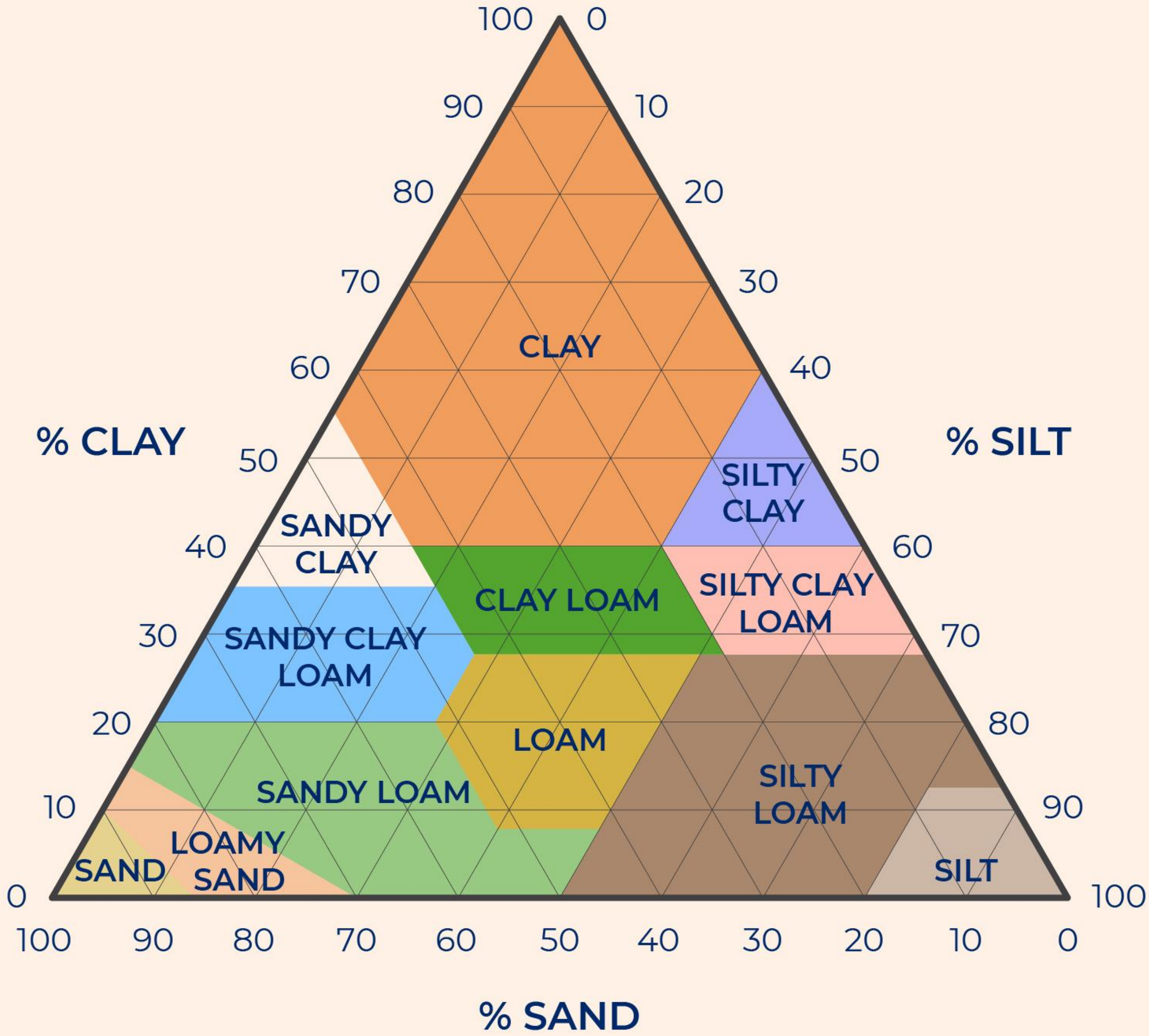
Materials required

- Glass bottle with lid
- Water
- Soil from farmer's field/plot



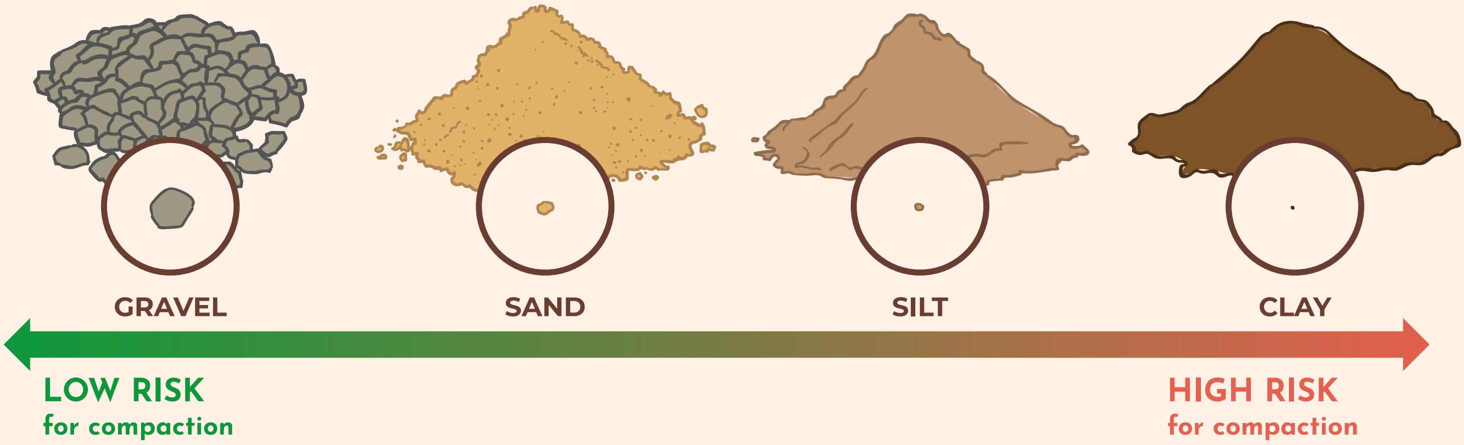
1. Fill the glass bottle about half way with your soil sample.
2. Fill water till the bottle is almost full.
3. Put the lid on and shake the bottle for 5 minutes - shake thoroughly.
4. Leave the bottle standing for about an hour without disturbing it.
5. After an hour you will observe that the soil has settled down in layers.
6. Note that the heavier particles settle to the bottom and lighter clay particles settle on top of those. Also note that organic matter floats up in the water and does not settle down.
7. Note the thickness of each layer from bottom to top and record as sand-silt-clay.
8. Also note how concentrated the organic matter is - for soil that is fertile and grows crops with good yield, this is about 20 % of the soil in the bottle. If this is not the case, add more organic matter (compost, vermicompost, humus) to your soil.

What is the nature of your farm's soil?



Is your soil too compact?

Soil particles represent the mineral part of the soil



How to assess if your soil has compaction issues:

STEP 1
Does the soil smell mouldy?

- YES → YOUR SOIL IS COMPACTED
- NO → STEP 2

STEP 2
Can you dig a hole in your soil?

- NO → YOUR SOIL IS COMPACTED
- YES → STEP 3

STEP 3
Is it easy to dig a hole? (approx. a 30cm depth)

- NOT EASY → YOUR SOIL IS COMPACTED
- YES → STEP 4

STEP 4
Check how your crop/tree roots look

- SHALLOW AND/OR DEFORMED → YOUR SOIL IS COMPACTED
- LONG AND/OR WELL FORMED → STEP 5

STEP 5
Take a metal rod and push it deeper into the soil. How easy is it to push it?

- DIFFICULT, THE SOIL FEELS TOO HARD TO PUSH ANY FURTHER → THE DEEPER HORIZONS OF YOUR SOIL ARE COMPACTED
- EASY → WELL DONE! YOUR SOIL DOES NOT SEEM TO HAVE COMPACTION ISSUES

YOUR SOIL IS COMPACTED

THE DEEPER HORIZONS OF YOUR SOIL ARE COMPACTED

WELL DONE!
YOUR SOIL DOES NOT SEEM TO HAVE COMPACTION ISSUES

Is your soil rich in organic matter?

- Dark in colour
- Rich in humus
- Presence of earthworms and other soil organisms
- Soft

- Light colour
- No presence of plant matter
- Few soil organisms
- Hard

THE SOIL IS RICH IN ORGANIC MATTER

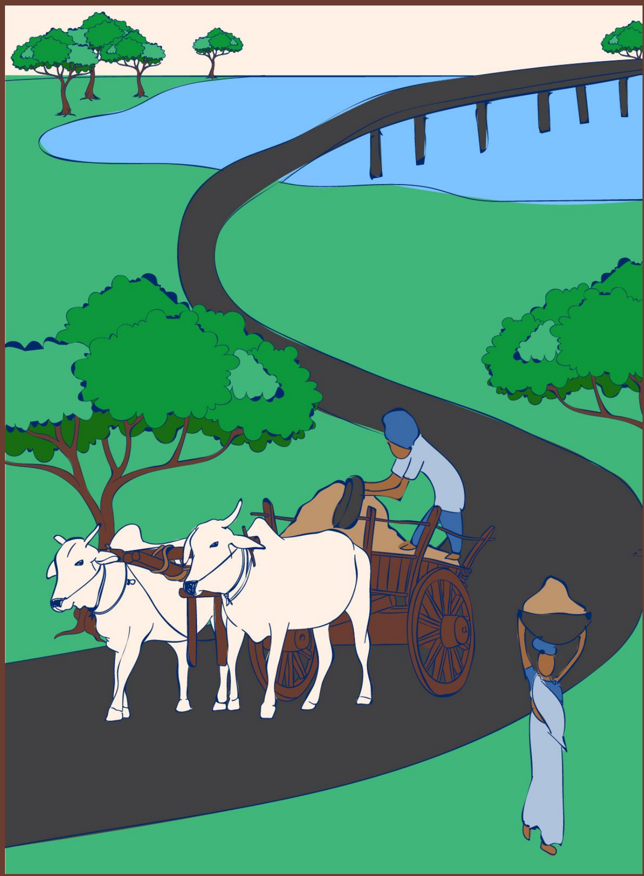
THE SOIL LACKS ORGANIC MATTER

Soil management techniques

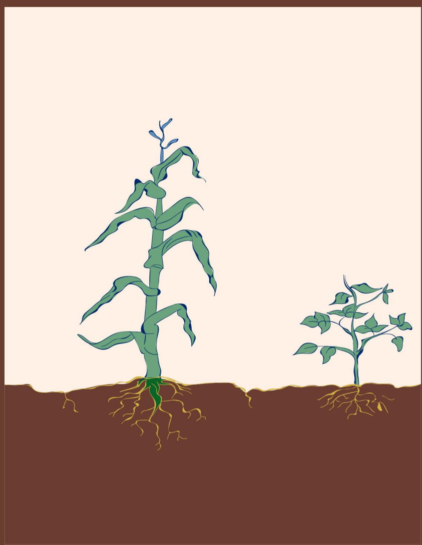
Technique 1: Use silt from lakes

(For soils with very low silt content)

- Silt is a mixture of soil, sand and clay particles. When it rains, top soil from the field gets collected along with the rain water in lakes.
- Digging silt up from the lake bed and applying it to the farm restores this lost topsoil.
- This increases soil moisture and soil fertility on farm.



Technique 2: Practice mulching and keep soil covered



(For hard and dry soils)

Cover the soil in-between row crops and under trees with mulch.

You can use dried crop residue, dried leaves, dried weeds, dry grass, cloth, gunny bags and old newspapers as mulch.

Mulching prevents soil erosion, protects soil from direct sunlight, reduces evaporation of soil moisture, maintains soil temperature, and reduces weeds in the farm.

Technique 3: Mix compost in with the soil

Refer to this playbook on how to make compost on your farm from easily available materials and kitchen + farm waste.
Adding compost to the soil enriches the soil with nutrients essential for plants to grow well, thus reducing the need for inputs.

Technique 4: Use natural fertilisers to improve NPK levels in soil

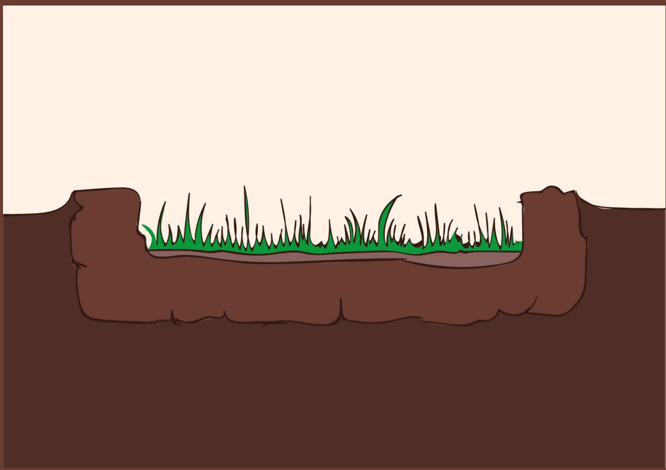
Element	Deficiency indicators	Organic fertilisers
Nitrogen	Leaves turns yellow or brown. Growth rate of plant reduces.	Spray Trimurthi tonic. Use compost tea.
Phosphorous	Leaves turns greenish-brown. A red or purple patch is sometimes visible behind the leaves	Maintain soil moisture. Add compost to soil.
Potassium	Leaves look like they have burnt patches. Stem gradually dries up.	Spray Panchagavya on soil. If soil has low clay content, add compost to soil.

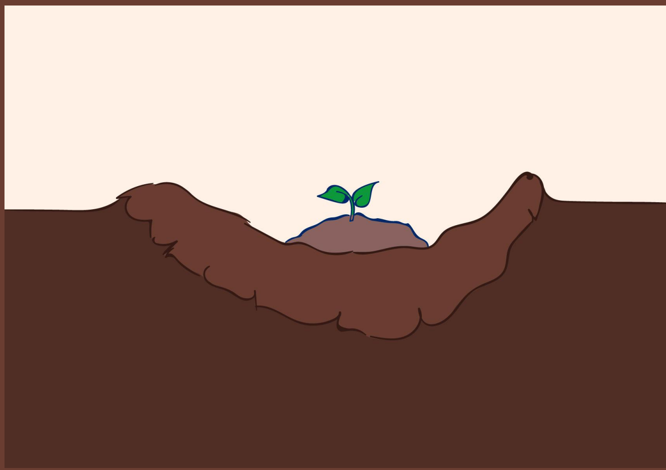
Technique 5: Use ecological farming methods to minimise damage to soil

Features - link to Ecological farming methods center

- Low tillage
- Mixed cropping and crop rotations

Technique 6: Make shallow trenches on field before rains





You can make square trenches (for softer soil) and crescent/half moon trenches (for soil that is harder to dig).

These are easy to make and can even be dug with a hand plough.
Making these square trenches helps to retain water on field, increases soil moisture and reduces soil erosion.

Technique 7: Make compost tea for the field before sowing season

Ready in 3 weeks - this is a quicker solution for soil that is lacking nutrients and organic matter. Ideal for farmers who have livestock like cattle and goats or easy access to the dung of these animals.

Procedure:

1. Take 5-75 kg of animal dung (goat/cow/sheep/chicken) – dung should not be dry
2. Take green leaves from trees/grass/weeds in 1/10th proportion of dung weight - medicinal weeds are preferred, you can use fragrant flowers too.
3. Fill a 200 litre plastic drum with 100 litres of water.
4. Mix the dung and green leaves together with a stick and put into a gunny bag. Tie up the bag and immerse in the water in the drum.
5. Stir the water in the drum ten times clockwise and then ten times anti-clockwise.
6. The compost tea should be ready in 3 weeks – make sure it doesn't have a bad odour.
7. Mix 1 part tea with 10 parts water to use – mix in with soil or spray on plants. Apply once every month after 15 days of sowing any crop