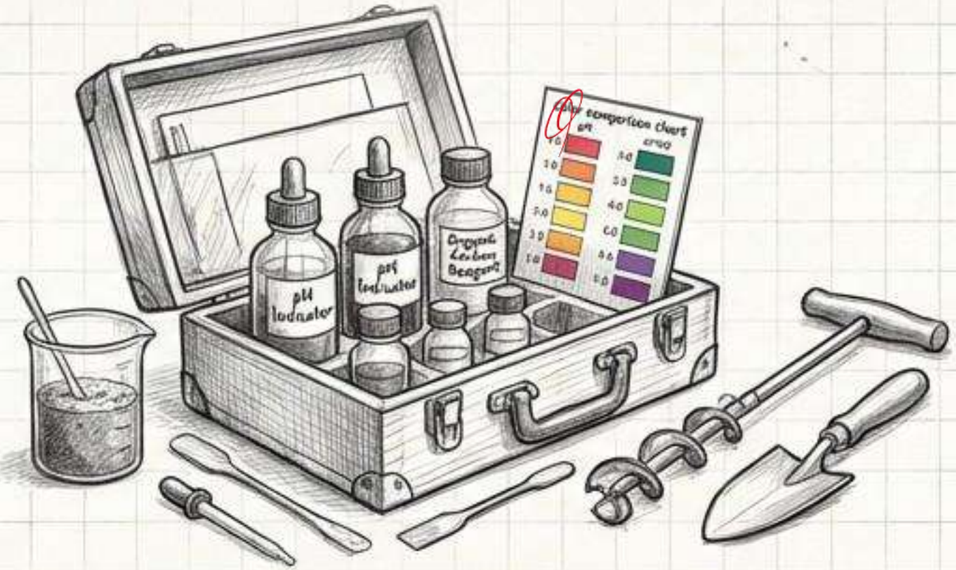
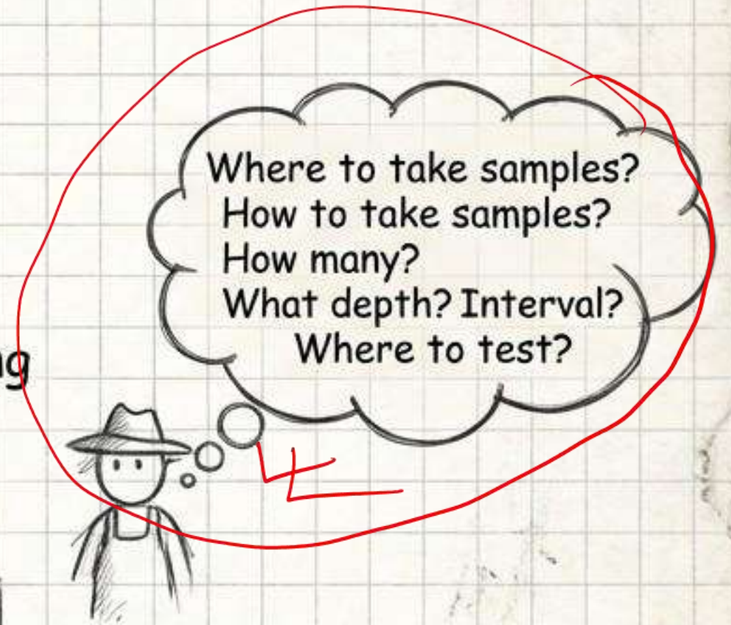
Chapter 4: Soil Sampling and Its Processing

Introduction of Soil pH and Organic Carbon





1. **Introduction:**
   - **Context:** In present days everybody is talking about soil testing and soil health card distribution.
   - **The Problem:** Common farmers have very little idea about soil sampling, testing, and its profitable practical benefits.

The 4 Phases for Success

1. Collection of soil samples
2. Analysis of soil samples
3. Interpretation
4. Recommendation

Strictly followed

2. Collection of Soil Samples

The Challenge:
Soil sampling is the most challengeable task; a few grams of soil represents a given area. The sample must reflect true fertility.

Uniformity vs. Variation:

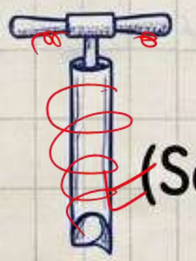
- Level/Uniform Field: One composite sample is enough for 4-5 ha.

- Variations: Separate composite samples required for differences in:
  - Slope
  - Colour
  - Texture
  - Crop growth
  - Unusual spots
  - Management practice

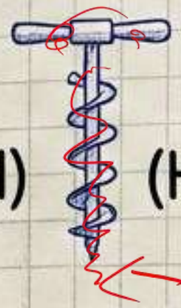
2.1 Sampling Tools & 2.2 Sampling Depth

2.1 Sampling Tools

Spade / Khurpi



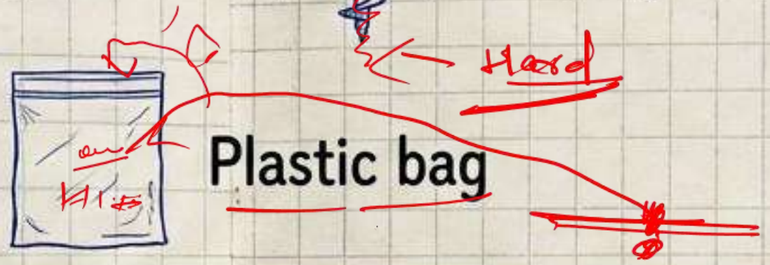
Tube type
(Soft/Moist soil)



Screw type
(Hard/Dry land)

Scale

Plastic bucket



Plastic bag

Water proof marker

2.2 Sampling Depth

- Field Crops: 10–20 cm (Root growth zone). *Note*: 15–20 cm usually enough.

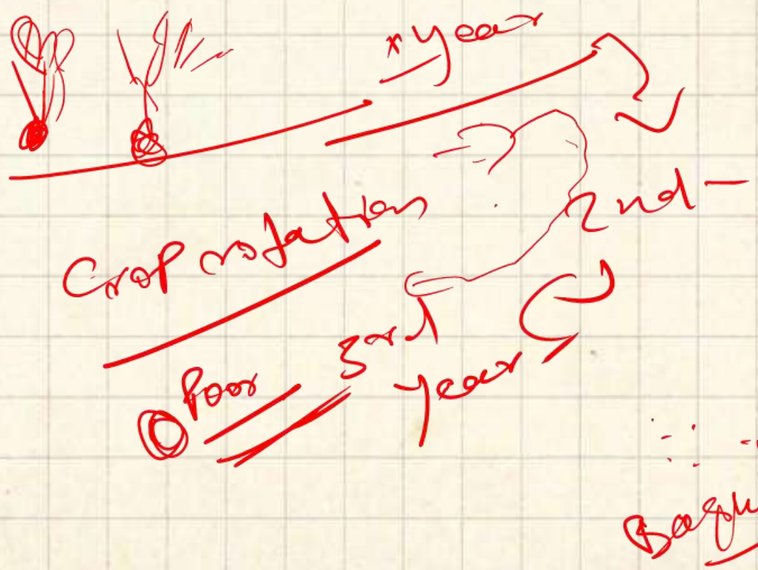
- Pasture Crops: 10 cm.

- Deep Rooted Crops (Sugarcane, Cotton, Plantation, Horticultural): 80–100 cm (90 cm).

2.3 Time & 2.4 Methods of Sampling

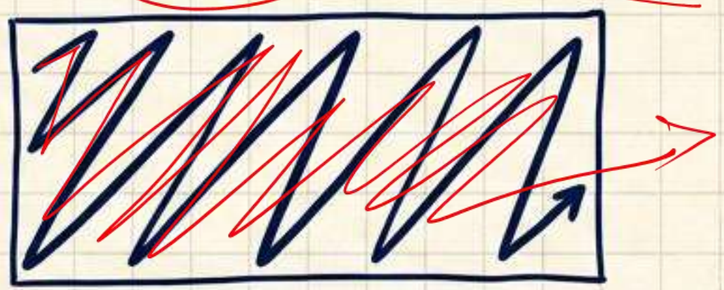
2.3 Time of Sampling

- Collect well before planting/sowing.
- Frequency:
  - Single crop: Once in 3 years.
  - Intensive (2–3 crops): Every year (prior to sowing first crop).

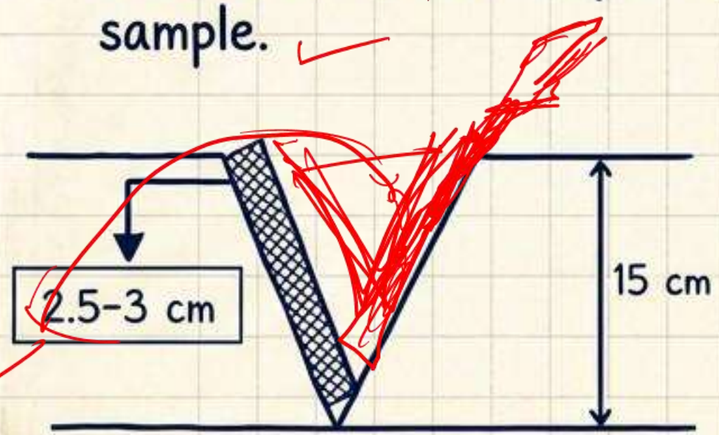


2.4 Methods of Sampling

- Greatest source of error is the soil sample itself.
- Pattern: Zigzag manner covering entire field.



- Mix: 10–25 sub samples (cores) = 1 composite sample.

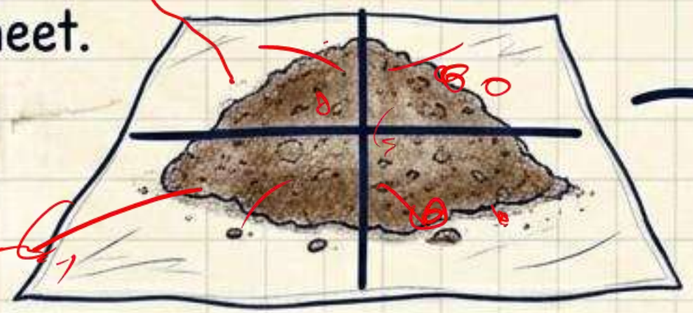


1. Clean spot →
2. Make 'V' cut (0–15cm)
3. Take 2.5cm thick slice.

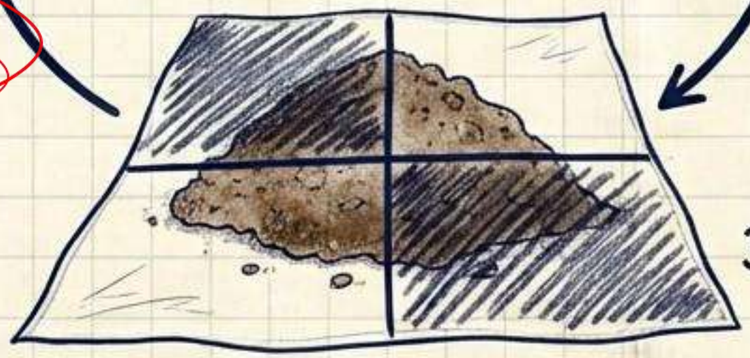
Process of Sample Size Reduction (Quartering)

Objective:
Reduce volume without losing representation.

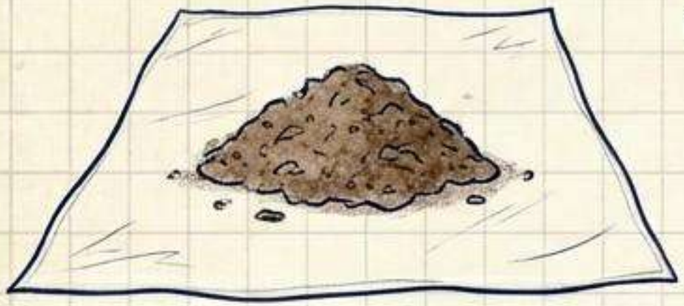
1. Mix collected samples thoroughly on cloth/sheet.



2. Divide bulk into 4 parts with '+' sign.



3. Discard soil from opposite corners.



4. Mix remaining soil. Repeat until ~500g remains.

Final Step: Keep in clean polythene bag.

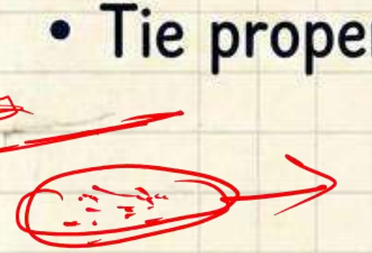
2.5 Sample Preparation & 2.6 Storage

2.5 Sample Preparation

- Spread on plastic/thick brown paper in shade.
- Cleaning: Remove stones, roots, leaves, coarse concretions. Break lumps.
- Sieving: Crush gently (wooden mortar/pestle). Sieve through 2mm sieve. Discard material > 2mm.

2.6 Sample Storage

- Send for analysis ASAP.
- Store in polythene bags or plastic containers.
- Tie properly and tag.



WARNING: SUN DRYING STRICTLY PROHIBITED.

Ideal: Air dry at 20–25°C and 20–60% Relative Humidity.

2.7 Information & 3. Benefits

Why? Helps for precise fertilizer recommendations.

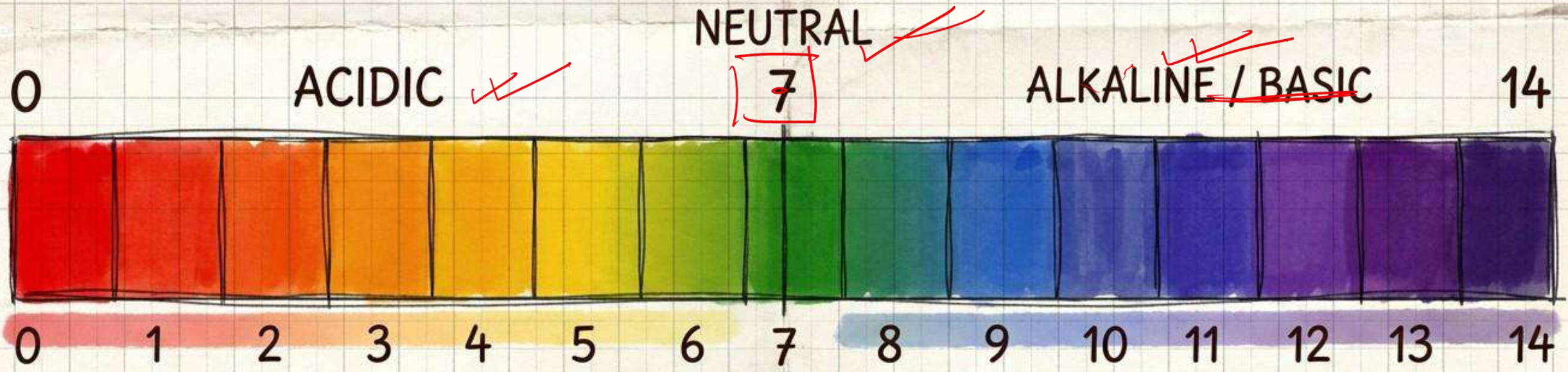
3. Possible Benefits for Farmers

- Alert: Identifies deficiencies & toxic nutrients.
- Identify: Areas of problem soil (reclamation).
- Efficiency: Rational fertilizer inputs.
- Yield: Observe % increase in yield.

Soil pH (The Power of Hydrogen)

Definition:

- From French term "Power of Hydrogen".
- Measure of hydrogen ion (H^+) and hydroxyl ion (OH^-) concentration.
- Determines Acidity vs. Alkalinity.



The Mathematics of pH

Strict Definition: pH is the negative log of H^+ ion activity.

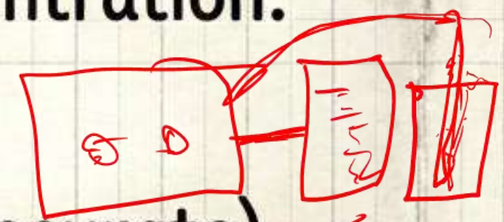
The Log Scale Rule:

- pH is reported on a negative log scale.
- 1 unit change = 10-fold change in H^+ concentration.

Acidity Increases

pH 6 has 10 times more H^+ than pH 7

pH 5 has 100 times more H^+ than pH 7

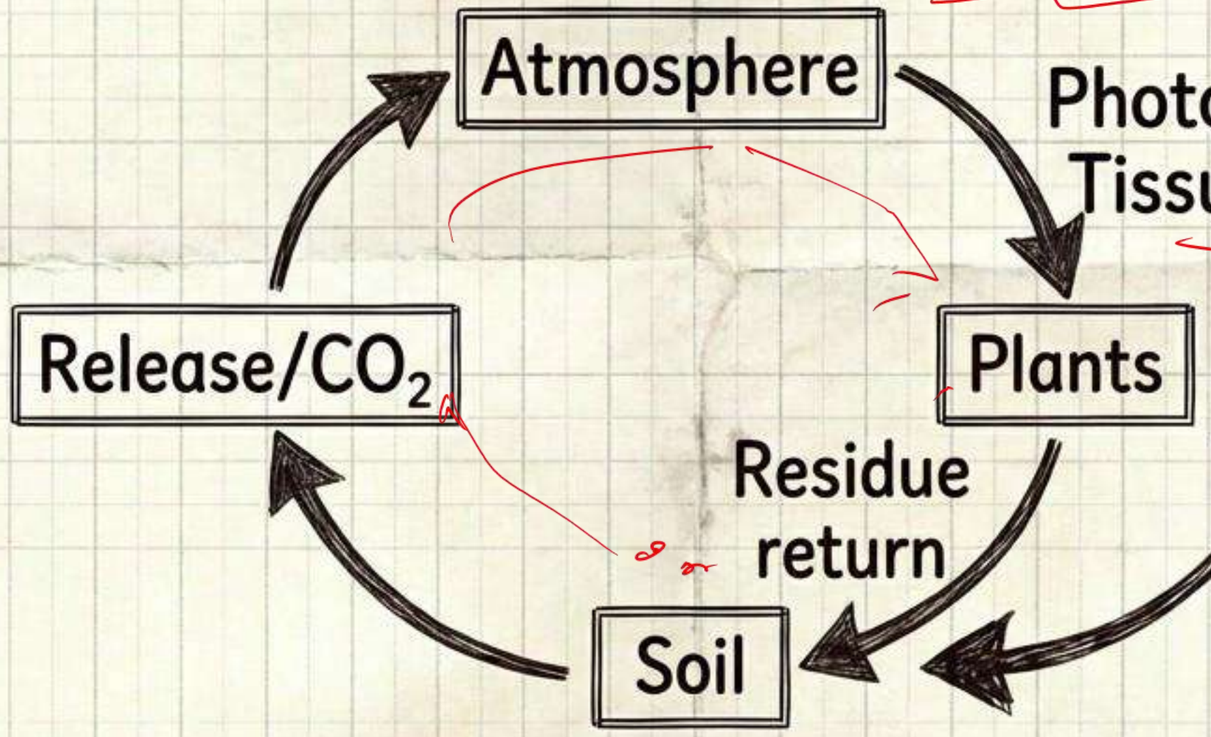


Measuring Soil pH:

1. pH Meter (Most accurate)
2. Indicators / Dyes (Simple, less accurate)

The Carbon Cycle & Soil Organic Carbon

Carbon (C): Essential building block of life. Common in air, ocean, soil, rock. Organic Chemistry = study of C in living systems.



FACT:
Soil holds the largest portion of active carbon on earth.

Agriculture's Role: Can release C or Sequester it. Impacts Soil Health (physical, biological, chemical condition).

Importance of Soil Organic Carbon

Physical Benefits

- Promotes structure (tilth) = Stability
- Improves aeration & water drainage/retention
- Reduces erosion

Yields improve when SOC increases

Chemical/Biological Benefits

- Fertility & Nutrient holding capacity
- Sequestration: Reduces nutrient leaching

The Risk: Physical disturbance → CO_2 formation → Net loss of Carbon.

Management Practices for C Sequestration

Goal: Enhance SOC levels & Reduce Carbon loss

Management Practice	Function/Explanation
Conservation Tillage	No-till/min-till. Stores SOC; keeps physical stability intact.
Crop Residue Management	Returning residue adds Carbon; maintains SOM.
Cover Crops	Adds root/biomass. Reduces erosion. Enhances nutrient cycling.
Manure and Compost	Directly increases soil carbon. Increases aggregate stability.
Crop Selection	Perennials (root mass/litter). High residue annuals reduce net C loss.

SOC vs. SOM (The Conversion)

- SOC (Soil Organic Carbon): Refers only to the carbon component.
- SOM (Soil Organic Matter): Difficult to measure directly.

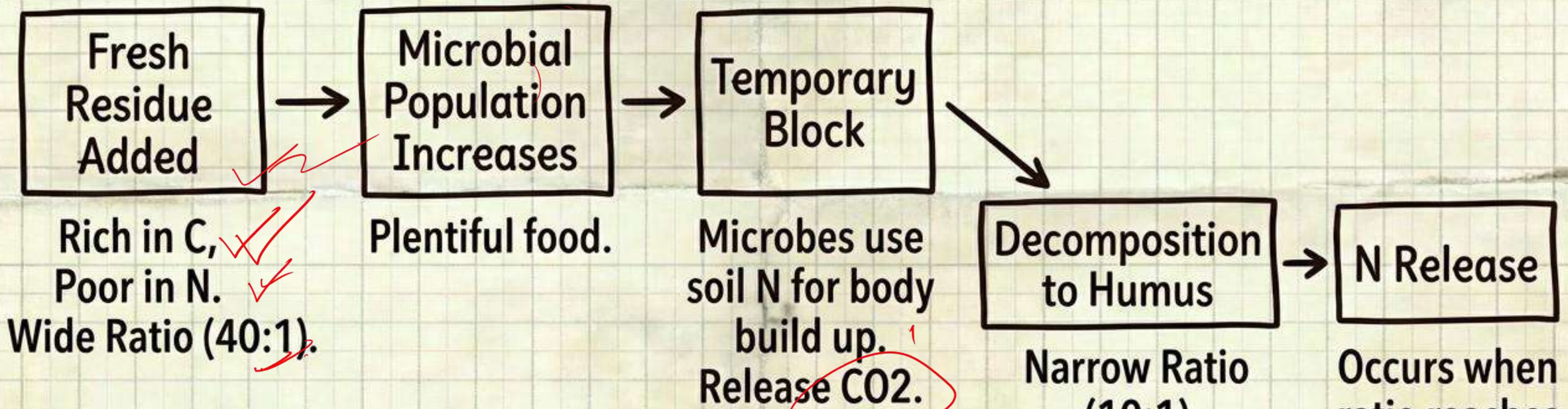
About 58% of the mass of organic matter exists as Carbon.

$$\text{Organic Matter (\%)} = \text{Total Organic Carbon (\%)} \times 1.72$$

Conversion Factor

C:N Ratio (Carbon : Nitrogen)

Ratio between Nitrogen in microbes/residues and Carbon content.



Key Ranges:

- Cultivated Soils: 8:1 to 15:1
- Average: 10:1 to 12:1

Practice Questions

Multiple Choice

1. Soil sample depth for agronomy crops? (10cm, 15cm, 20cm, 25cm) ☐
2. pH meter discovered by? (SPL Sorensen, Beckman, Dokuchaev, All) ☐
3. C:N ratio of Indian soil? (10:1, 15:1, 20:1, 25:1) ☐
4. Soil sample dry temperature? (20–25°C) ☐

Fill in the Blank

1. Soil pH comes from French term meaning _____.
2. About _____% of mass of OM exists as carbon.
3. Deep rooted crops collected upto _____ cm depth.

Descriptive

1. Write process of preparation of soil sample?
2. Explain pH?
3. Write the Carbon cycle?
4. What is C:N ratio?