

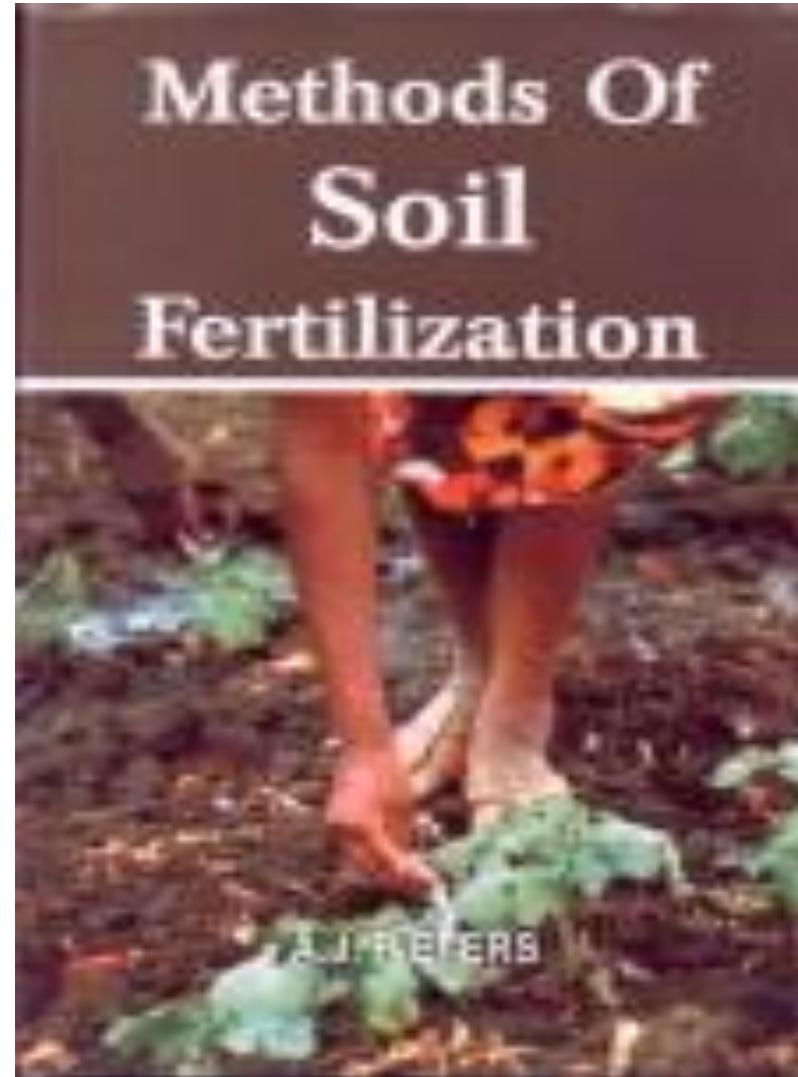
Components and Models of Sustainable Agriculture Management (SAM)

- 1. Nutrient and soil management,**
- 2. Soil organic matter**
- 3. Soil and water conservation,**
- 4. Water: Harvesting and management**
- 5. Impacts of SAM**

Soil: Integrated Nutrient Management and Fertilization

Steps of Implementation:

- Minimize soil erosion, organic and nutrient leaching
- Recycle, reuse organic nutrients
- Enhance biological source of nutrients
- Compensate for nutrient loss (harvest and leaching)
- Select adapted and efficient crop species
- Optimize fertilizer rate



Soil: Integrated Nutrient Management and Fertilization

Major fertilizer constraints to farmer:

- **High price of fertilizer (less subsifize)**
- **Nutrient contents of fertilizer usually less than state**
- **Fertilizer availability not on time**
- **Too complicated procedure to purchase fertilizer**
- **Lack of credit to purchase fertilizer**



2. Soil Organic Matter (SOM) Management

- Important of SOM
- Factors affecting SOM
- SOM Management



Important of Soil Organic Matter

- **SOM content is a key on decreasing soil degradation**
- **Affect on soil physical, nutrient availability (chemical) and biological properties**



Factors affecting Soil Organic Matter buildup

- **Primary factors:**
 - (1) O_2 content
 - (2) C/N (ratio)
 - (3) Moisture content
 - (4) Temperature
- SOM turned over—tillage
management**



Soil Organic Matter Management

- **Main Soil Organic Matter Managements:**

**mulching, composting,
conservation tillage, animal
manure -- increase SOM**



Soil Organic Matter: Animal Manure as fertilizer

What it is?:

- animal manures (AM) are the droppings (solid wastes) which rich in nutrients (such as N, P and bases)

How it work?:

- let the droppings from cattle farm dry up several weeks
- after matured, the manure can be used for organic fertilizer



Soil Organic Matter:

Animal Manure as fertilizer

- **Advantages:**
 - as fertilizer alternative rich in N, P and bases
 - animal manures are relatively cheap, easy to apply
- **Disadvantages:**
 - long term benefit rather than immediate
 - bulk volume, difficult to handle, transportation



Soil Organic Matter: Composting

- **What it is?:**
 - Piling up crop and other farm wastes in layers to make them decompose quickly
 - it produces organic fertilizer/humus that improves soil fertility, soil biodiversity, soil aggregation, soil moisture
- **How it work?:**
 - used in all soils with low fertility
 - sandy soil with poor water holding capacity
 - high value crop, horticulture



Soil Organic Matter: Composting

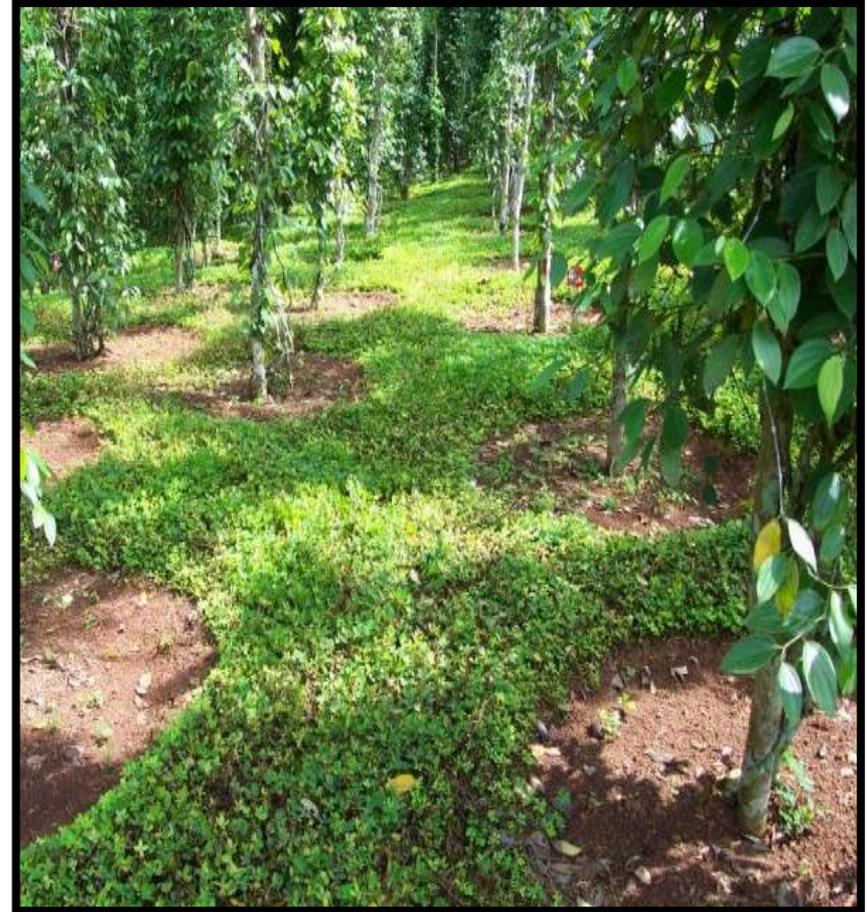
- **Advantages:**
 - large amount of biomass wastes are available
 - Easy to make
 - has multiplier effects: soil fertility and social-
 - economics as well
- **Disadvantages:**
 - need a lot of labor to make it
 - Nutrient composition varies, depend on material used
 - need bulk, larger volume than inorganic fertilizer



Soil Organic Matter: Green Manure

What it is?:

- **Green manures (GM) are fast growing plants, legume or non-legume, planted or inter-cropped on piece of land**
- **During or after the growing season, GMs are slashed or sprayed and use as mulch or incorporated into the soil**
- **It increases plant nutrients and improves soil structure**



Soil Organic Matter: Green Manure

How it work?:

- **Planted before or after planting, used for various type of soils, especially for poor soil**
- **Used for high valuable crop, control erosion and increases plant nutrients**

Soil Organic Matter: Green Manure

- **Advantages:**

- provide fodder (food for cattle), soil con-servation, soil fertility, and suppress weed

- GMs are cheap, easy to manage

- GM seeds are easily available

- **Disadvantages:**

- long term benefit,

- during dry season compete for water uptake

- some GMs may compete for light and nutrient



Soil Organic Matter: Organic Farming

- **What it is?:**

- a production system that sustains agricultural production by avoiding toxic chemicals (avoid synthetics)

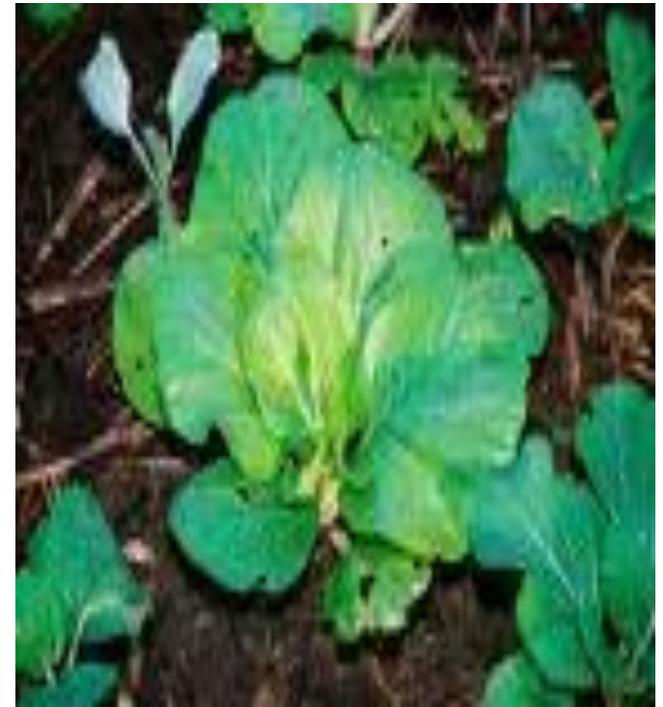
- Relies on the maximum extent feasible such as crop rotation, crop residue, animal manure, legumes, biological control

- Differ considerably among sites

- How it work?:**

- suitable for good types of soil

- mostly for higher economic crops



Soil Organic Matter: Organic Farming

- **Advantages:**
 - healthier food
 - higher soil fertility
 - getting popular with higher price (selected consumer)
- **Disadvantages**
 - applicable for limited area
 - difficult to handle pest
 - can be lower productivity



Soil and Water: Conservation Practices

1. Conservation till
2. Cover crops (Green manure)
3. Composting
4. Animal manure
5. Mulching
6. Crop rotation
7. Agro forestry
8. Strip cropping
9. Terrace

Soil and water: Conservation tillage

CONTRAST DEFINITION:

- **Conventional (intensive) till:** continuous surface soil manipulation by plowing, no-mulch on soil surface: moldboard, and disking till
- **Conservation till:** less or no surface soil manipulation, > 25% *in situ* mulch on soil surface: mulch, conservational till



Soil and water: Conservation tillage

- **Why Conservation till (CT):**
 - conventional till decreases soil Q (induces soil degradation)
 - CT more sustainable
- **How it works?:**
 - >25% mulch on surface
 - less or no soil surface manipulation
 - for upland: well drain, sandy loam to clay loam
 - region with less labor



Soil and water: Conservation tillage

- **Advantages :**
increases SOM,
increases soil aggregate strength, decrease erosion, conserve soil and water, reduce the cost
- **Disadvantages:**
difficult to plant,
cultural restriction

Soil and water: Mulching

- **What it is?:**

- mulch is vegetative material used to cover soil
- it reduces evaporation, increases soil moisture, reduces run off/erosion, increases plant nutrient

- **How it work?:**

- used before and after planting, spread over soil surface or around crop stand
- used for high valuable crop, degradable soil



Soil and water: Mulching

- **Advantages:**
 - mulch keeps the soil moist longer than bare soil
 - it controls soil run off/erosion, increases plant nutrient
 - it suppresses weed
- **Disadvantages:**
 - labor intensive
 - it can introduces new pests and diseases into a field



Soil and water: Agro forestry

Advantages:

- multi functions: provide food and fodder, increase soil conservation, soil fertility, and suppress weed
- provides short term and long term benefits

Disadvantages:

- more complicated farming system



Soil and water conservation: Terrace

- **Why terrace?:**
 - upland: high run off, high erosion (induces soil degradation)
 - land slide
- **How it work?:**
 - reduces run off and erosion
 - for upland: sloping land, deep soil
 - region with high labor



Soil and water conservation : Terrace

- **Advantages:**
Decrease erosion,
long term: increase yield
- **Disadvantages:**
high cost,
long term effect,
not suitable for shallow soil



Terima kasih