

TILLAGE AND PLOUGHING OF SOIL

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Abstract

Tillage and ploughing are essential agricultural practices that significantly influence soil health and crop productivity. Tillage involves the mechanical manipulation of soil to create favorable conditions for seed germination, root growth, and nutrient uptake, while ploughing, a primary tillage operation, focuses on soil inversion and loosening. These practices improve soil aeration, water infiltration, weed control, and incorporation of organic matter. The concept of tilth reflects the ideal soil condition required for optimal plant development. Various tillage types, including seasonal, off-season, primary, and secondary tillage, serve specific purposes in crop production. Modern tillage systems, particularly conservation tillage, emphasize sustainable soil management by reducing soil disturbance and preserving residues, thereby enhancing long-term soil fertility and environmental sustainability.

Introduction on tillage & ploughing of soil

Tillage and ploughing are fundamental agricultural practices that play a vital role in preparing land for successful crop production. Tillage refers to the mechanical manipulation of soil to create a favorable environment for seed germination, root growth, and overall plant development. Through various operations such as loosening, turning, and breaking the soil, tillage improves soil structure, enhances aeration, promotes water infiltration, and facilitates the incorporation of organic matter and fertilizers. A well-prepared soil condition, known as tilth, ensures proper balance between air, water, and soil particles, which is essential for healthy crop

establishment. Ploughing, an important component of primary tillage, involves cutting and inverting the soil to a certain depth using different types of ploughs. This process helps in burying weeds and crop residues, controlling pests, and exposing deeper soil layers to air and sunlight. It also aids in breaking hard soil layers, thereby improving root penetration and nutrient uptake. Proper ploughing creates furrows that enhance moisture conservation and facilitate field operations. In modern agriculture, tillage practices range from conventional intensive ploughing to conservation and reduced tillage systems, each having specific advantages and limitations. While tillage improves

immediate soil conditions, excessive disturbance can negatively impact soil health. Therefore, adopting appropriate and balanced tillage and ploughing practices is essential for sustainable crop production and long-term soil fertility.

Introduction of tillage

Tillage is a term derived from old Anglo-Saxon words that relate to the act of preparing soil for crop production. It refers to the process of ploughing, cultivating, and conditioning the land to support seed sowing and plant growth. Often regarded as the foundation of agriculture, early thinkers like Jethro Tull emphasized the importance of thorough soil preparation to create fine soil particles, which help improve seedbed quality and promote better crop establishment and yield.

Definition of tillage

Tillage refers to the mechanical manipulation of soil to create favorable conditions for crop growth. It involves breaking, loosening, and turning the soil to a desired depth so that plant roots can easily penetrate, absorb nutrients, and develop efficiently. Proper tillage improves soil structure, aeration, water infiltration, and overall crop productivity.

Tilth

Tilth refers to the favorable physical condition of soil that supports proper plant growth after tillage operations. It indicates how well the soil is structured for seed germination, root development, water movement, and aeration. Depending on the degree of soil breakdown and aggregation, tilth can be classified as coarse, fine, or moderate. A good tilth ensures an ideal balance between soil particles, moisture, and air, which is essential for healthy crop establishment and growth.

Objectives of Tillage

- To develop a well-prepared seedbed that promotes uniform and healthy seed germination.
- To create favorable soil conditions for optimum crop growth and development.
- To effectively manage and control weed growth.
- To enhance the soil's capacity to absorb and retain rainwater.
- To incorporate organic manures and fertilizers evenly into the soil.
- To improve soil aeration, allowing better exchange of gases.
- To ensure proper contact between seed and soil for efficient moisture uptake.

- To break hard layers (hardpan) and increase the effective rooting depth of the soil.

Types of Tillage

Tillage practices can be broadly classified based on the time at which they are performed:

1. Seasonal (On-season) Tillage:

This type of tillage is carried out during the cropping season. It includes all soil preparation operations done just before sowing and during crop growth to ensure proper seedbed preparation, weed control, and better crop establishment.

2. Off-season Tillage:

This tillage is performed when the field is not under active cultivation. It is mainly done to improve soil structure, conserve moisture, control weeds, and manage crop residues in preparation for the next cropping season.

Types of Preparatory Tillage

- a. Primary Tillage
- b. Secondary Tillage

a. Primary Tillage

Primary tillage is the first major soil-working operation, performed to loosen the

soil deeply and prepare it for further cultivation.

Objectives:

- Reduce soil compaction
- Break and rearrange soil aggregates
- Bury crop residues and weeds
- Destroy pests and insects

Implements Used:

- Indigenous ploughs
- Mould-board ploughs
- Disc ploughs
- Subsoilers and chisel ploughs

b. Secondary Tillage

Secondary tillage includes lighter operations performed after primary tillage to refine the soil and prepare an ideal seedbed.

Characteristics:

- Shallow soil manipulation
- No major soil inversion
- Lower power requirement

Objectives:

- Break clods and level the field
- Control weeds
- Mix residues with topsoil

Implements Used:

- Harrows
- Cultivators
- Levellers
- Clod crushers

Tillage Systems

A tillage system refers to the sequence of operations carried out for crop production, including soil preparation, planting, fertilization, and residue management. These systems influence soil properties and crop performance.

1. Conservation Tillage

Conservation tillage refers to a group of soil management practices in which a significant portion of crop residues is retained on the soil surface after planting. Generally, at least 30% of the soil surface should remain covered with residues to reduce water erosion. In areas prone to wind erosion, maintaining about 1000 pounds per acre of residue on the surface is considered essential during critical periods. These practices help protect the soil, conserve moisture, and improve overall soil health.

Types of Conservation Tillage

a. No-till:

In this method, the soil is left undisturbed throughout the year. Seeds are sown directly into the soil using specialized equipment, with minimal disturbance limited to narrow planting slots. It is also known as zero tillage or direct seeding.

b. In-row Subsoiling:

This approach disturbs only narrow

strips where crops are planted, while the rest of the soil surface remains covered with residues. Deep soil layers are loosened without turning the soil, helping to break compact layers.

c. Strip-till:

Strip-tillage involves preparing only narrow zones where seeds will be planted, leaving the areas between rows undisturbed and covered with residues. It improves seedbed conditions while conserving soil structure and moisture.

d. Ridge-till:

In this system, crops are grown on raised ridges formed and maintained over time. Residues remain between ridges, and cultivation is used to rebuild ridges and control weeds.

2. Reduced Tillage

- Leaves **15–30% residue cover**
- Involves fewer tillage operations than conventional methods
- Reduces cost and soil disturbance

3. Conventional Tillage

- Involves intensive ploughing and multiple operations
- Leaves less than **15% residue cover**

- Produces a clean and fine seedbed but may increase erosion risk

Ploughing of Soil

Ploughing is a primary tillage operation that cuts and turns the soil to form furrow slices. It helps in soil inversion, aeration, and weed control.

Important Terminologies

- **Furrow:** A trench created during ploughing
- **Furrow Slice:** The soil mass cut and turned by the plough
- **Furrow Wall:** The uncut soil surface beside the furrow
- **Crown:** Top portion of the turned soil
- **Back Furrow:** Raised ridge formed when ploughing starts from the center
- **Dead Furrow:** Depression formed between two ploughed strips
- **Headland:** Unploughed strip at field ends used for turning machinery

Methods of Ploughing

1. Gathering Method

- Ploughing starts from the center
- Soil is turned towards the center
- Forms a ridge (back furrow)

2. Casting Method

- Ploughing starts from the edges
- Soil is turned outward
- Leaves a central depression (dead furrow)

3. Continuous Ploughing

- Efficient and economical method
- Minimizes idle movement of machinery
- Combines gathering and casting techniques

4. Round and Round Ploughing

- Plough moves in circular paths
- Can start from center or edges
- Suitable for avoiding ridges and furrows

5. One-Way Ploughing

- Uses reversible plough
- Soil is turned in one direction only
- No back furrows or dead furrows formed
- Suitable for sloping lands

Conclusion

Tillage and ploughing are essential practices that ensure proper soil preparation for successful crop production. They improve soil structure, aeration, moisture retention, and nutrient availability while helping control weeds and pests. However, excessive tillage can degrade soil health, leading to erosion and loss of fertility.

Therefore, adopting balanced and sustainable tillage practices, such as conservation and reduced tillage, is crucial for maintaining soil productivity, conserving resources, and ensuring long-term agricultural sustainability. **References**

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