# 9. Tillage

**Can you recall?**

- Why the cultivable soil is banned for grazing animals?
- How does the soil look during sowing time and after harvesting?
- What is the difference between loose porous soil and compact hard soil?
- Why the tractor is mostly used now a days instead of bullocks in farm operations?
- Which operations farmer does before sowing?

**Keep in mind**

Soil serves as a natural medium for the growth of plants; but in its natural state, it is not in an ideal condition for growing the crops satisfactorily. The beating action of rain drops, irrigation and subsequent drying, weeds, stubbles, harvesting of crop, labour and subsequent activities cause soil compaction. Soil condition must be made favourable for crop growth and development from sowing to harvesting. The seeds require loose, friable soil with sufficient moisture and air for better germination and easy penetration of younger roots into the soil for absorption of nutrients, minerals, air and water. These ideal conditions of soil are achieved by proper manipulation of soil and bring it into good tilth condition.

## 9.1 Definition

**9.1.1 Definition of Tillage :** Tillage may be defined as follows.

- The physical manipulation of soil with different tools and implements to bring the soil in a good physical condition for better germination and subsequent growth of plants.
- Tillage of the soil consists of breaking the hard and compact surface to a certain depth and other operations that are followed for bringing the soil in a good physical condition i.e. fine tilth for plant growth.
- It is manipulation of soil with different tools and implements with an object to make the soil surface loose and brining it to favourable conditions for seed germination, seedling establishment and growth of crops.

### 9.1.2 Definition of tilth

- The term soil tilth means the physical condition of soil resulting from tillage operations.
- Soil tilth is the physical condition of soil in which soil becomes loose, friable, crum, soft, properly aerated but not very powdery.

**Know the Scientist**

JethroTull (1664-1741) was a British agronomist. He invented seed drill, hoe and plough, which were driven by horse.

He studied law and graduated from Oxford University in 1699. He began farming in 1700 and took greater interest in agricultural operations.

Tillage practices are as old as agriculture, Jethro Tull proposed that plants absorb minute soil particles hence suggested thorough ploughing and other operations were necessary for bringing soil in an ideal condition. He is known as father of tillage.

**Advantages of tilth ?**

Good soil tilth provides adequate aeration, maintain soil temperature, soil moisture, soil aggregates, moisture content also ensure good infiltration, easy and smooth movement of sowing implements. The good tilth condition maintains spaces, i.e. the macro and micro pores in equal proportion for retention of soil moisture and soil air.

## 9.2 Objectives of tillage

The various objectives of tillage are as follows.

**(1) To make the soil loose and porous**

This will enable rain or irrigation water to enter the soil easily and less losses of rain water and soil due to run-off and erosion. Due to adequate proportion of micro pores the sufficient amount of water will be retained in soil for crop growth and less losses of water due to percolation.

**(2) To aerate the soil**

Tillage enables the metabolic processes of living plants and micro-organisms to continue smoothly. Due to adequate air and moisture, desirable chemical and biological activities would go on at greater speed. This would result in rapid decomposition of organic matter and making plant nutrients available to crops.

**(3) To increase the soil temperature**

This can be achieved by maintaining proper amount of air and water in the soil and also by exposing the soil to the sun. The optimum soil temperature in active root zone of the crop is necessary for proper growth and functioning of plant roots and useful organisms in the soil.

**(4) To control weeds**

Weeds are enemies of crops as they compete with crops for plant nutrients, moisture, space and sunlight, that will result in poor crop yields. Therefore, management of weeds with suitable tools and implements is the definite advantage of tillage.

**Observe and Discuss**

1. How will you feel while walking on ploughed field and sown field?
2. Why the water lodging conditions after heavy rains do not appear in ploughed land ?
3. Why the bullocks do walk easily during sowing?

**(5) To remove stubbles of previous crop**

Deep tillage helps in removing stubbles of previous crop and other sprouting materials like bulbs, stolons, etc. and helps in making a clean seed bed.

**(6) To destroy insects**

Many of the insect pest remain hidden in the top soil layer during off-season and reappear on the crop in the next season. Insects are either exposed to the Sun heat or to birds, who would pick them up. Some harmful grubs or cutworms can be destroyed by proper tillage operations. Collection and destruction of the crop residues and weeds are helpful to control pest like jowar stem borer, cotton bollworm, etc.

**(7) To break hard pan**

Tillage with specially designed implements such as sub-soiler or plough is often useful to break hard pan if any, formed just below the ploughing depth. This is helpful for better penetration of roots in deeper layers and also for maintaining proper drainage in the soil. It also increases soil depth for water absorption.

**(8) To incorporate organic manures and fertilizers into the soil**

Organic manures such as F.Y.M. or compost and fertilizers should not only be spread on surface of the soil but properly incorporated (mix thoroughly) into the soil for minimizing the loss of plant nutrients.

Sometimes, bacterial cultures or pesticides are also required to be drilled into the soil for control of pest like white ants, termites, white grubs, cutworms, etc. and this purpose can be served by using proper tillage implements.

**(9) To invert the soil to improve fertility**

By occasional deep tillage the lower layer of the soil which is less fertile comes to the top, while the upper layer rich in organic matter and plant nutrients goes down, thus plant roots can get benefit of the rich layer.

**(10) To prepare proper seedbed for germination of seeds and growth of the crop**

Finally, it is necessary to prepare the suitable seedbed as per requirement of the crop and soil for good germination and emergence of seedling and also for proper growth and development of the crop for achieving higher yields.

**Use your brain power**

1. What will happen, if crop is grown without any tillage practice?
2. Why ploughed soils are not water logged easily?
3. Why the birds generally seen on the land where tillage practice is going on?

## 9.3 Types of tillage

Tillage operations are grouped into three types on the basis of their time at which they are carried out.

**These are**

- Preparatory tillage
- Seed bed preparation
- Intertillage or intercultivation

### 9.3.1 Preparatory tillage

It means the tillage operations which are carried out before the sowing of any crop. These operations done after the harvesting of the previous crop and upto seed bed preparation for next crop. It consists of a number of costly and time consuming operations, which are carried out by using suitable implements at proper moisture content of the soil. These operations are necessary for proper germination, emergence and growth of the crop. The various tillage operations which come under preparatory tillage are:

(1) Ploughing (2) Clod crushing
(3) Levelling of land (4) Harrowing
(5) Manure mixing

**(1) Ploughing**

Ploughing means breaking of hard soil with different ploughs. This is considered to be the most essential operation for making the soil loose and porous to a desired depth as per requirement of the crop. Depth depends upon the effective root zone of the crop.

Fig 9.1(a) : Bullock ploughing

Fig 9.1 (b) : Tractor ploughing

**(2) Clod crushing**

This operation is necessary for working soil to fine tilth. This operation is not always necessary, if ploughing is done at right time i.e. when soil moisture is optimum then very few clods are formed. However, when the ploughing is done at less moisture content or after drying the soil, then big clods may formed and therefore it is necessary to crush the clods with the help of implements known as clod crushers.

Fig 9.2 : Clod crushing

**(3) Levelling the land**

This is done occasionally and it is not an operation, which requires to be done every year. This operation is necessary for sloppy lands in order to ensure even distribution of rain and irrigation water. This will avoid yellowing of plants due to stagnation of water in low-lying areas.

Fig 9.3 : Levelling of land

**(4) Harrowing**

This is one of the most common operation which is done invariably for preparing good seedbed. The objects of harrowing are breaking clods, levelling the land, collecting stubbles, destroying newly germinating weeds, compacting the soil, mixing bulky organic manures and fertilizers with the soil.

Fig 9.4 : Harrowing

**(5) Manure mixing**

The bulky organic manures such as F.Y.M. or compost and fertilizers (Basal dose of fertilizer) should mixed thoroughly with the soil before sowing of the crop. The bulky organic manures and fertilizers should be spread evenly on surface of the soil.

(a) (b)

Fig 9.5 :Manure mixing in soil

### 9.3.2 Seed bed preparation

These operations are carried out after last preparatory tillage operation and upto sowing. The land is to be laid out properly for sowing seeds, irrigating crops if necessary and for transplanting seedlings. These operations are known as seed bed preparation and comprise of following operations.

(1) Harrowing
(2) Layout of the field
(3) Compacting the soil

**(1) Harrowing**

If irrigation layouts are prepared immediately after completion of preparatory tillage then this operation is not required. Some times there may be

long gap or period between the preparatory tillage and preparation of irrigation layouts and for destroying newly germinated or young weeds existing in the field this operation is essential.

**(2) Layout of the field**

Irrigated crops like sugarcane, turmeric, ginger, cotton, potato and vegetables require preparation of irrigation layouts for sowing seeds, planting or transplanting seedling and also for giving irrigation water to the crop.

Opening ridges and furrows in the field for crops like sugarcane, irrigated cotton, potato and vegetables. border strips or saras for cereals like jowar, wheat, etc. flat beds for leafy vegetables and forage crops . broad bed furrows (BBF) or raised beds for turmeric and ginger are generally prepared as per requirement of the crop by using suitable implement.

Fig 9.6 : Layout of the field

**(3) Compacting the soil**

Sometimes soil may be loosened more than the requirement, which is not desirable for small seeded crops like sesamum and mustard or adventitious rooted crops such as jowar or bajara, which are liable to lodge at maturity stage. Therefore, the soil may need compacting .

### 9.3.3 Intertillage or interculture

Tillage operations which are carried out in standing crop or in between the crop rows are called intertillage. It includes the following operations.

Gap filling, Thinning, Weeding, Hoeing, Top dressing of fertilizers, Earthing up, Mulching, Detrashing.

**Do you know ?**

Maharashtra government followed some policies to pick-up the sedimentary (mud) soil from medium and small lake, nala, dam and use it for farm, which improves soil fertility of the field. The water storage capacity of such lake, nala, dam, etc. is improved.

**1. Gap Filling**

Some times, there may not be emergence of crop seedlings at some of the places in crops lines and these gaps (spots without crop) are filled either by dibbling seeds or transplanting seedlings. This operation is necessary for maintaining the optimum plant population of the crop. Gap filling is done about 8 to 10 days after sowing of the crop.

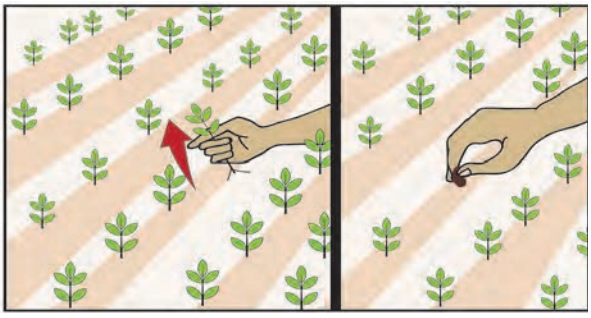

Fig 9.7 : Gap filling

**(2) Thinning**

It is process of removing excess plants from the field for maintaining optimum

Fig 9.8 : Thinning

plant population of the crop and for providing uniform space for normal growth and development of the crop. This operation is carried out about 2 to 3 weeks after sowing of the crop.

**(3) Hoeing**

This operation is necessary for removing weeds, conservation of soil moisture, mixing fertilizers with the soil and improving aeration of the soil. 2 to 3 hoeings are carried out from 2 weeks upto 5 or 6 weeks after sowing of the crop.

**Fig 9.9 : Hoeing**

**(4) Weeding**

Removal of weeds in the crops with the help of weeding hook (*khurapi*) by manual laboures is called weeding. One to three weedings are required in crop season depending upon the weed intensity and type of crop.

**Fig 9.10 : Weeding**

**(5) Top dressing of fertilizers**

The application of fertilizers in standing crop is known as top dressing. It is necessary for supplying plant nutrients essential for normal growth, development and yield of the crop.

**(6) Earthing up**

Supporting basal portion of the crop plants with soil for proper development of underground commercial plant parts is known as earthing up. This operation is done in case of crops like turmeric, ginger, potato and erect type of groundnut.

**(a) Earthing up using bullock drawn implement**

**(b) Manual Earthing up**

**Fig 9.11 : Earthing up**

**(7) Mulching**

Covering surface of the soil in between the crop rows with the help of organic mulch such as plant residues or inorganic mulch like polythene sheet for conservation of soil moisture, management of weeds, maintaining soil temperature, etc. is known as mulching.

Fig 9.12 : Mulching

**(8) Detrashing**

Detrashing refers to removal of unwanted bottom dry and green leaves at regular interval. Crop like sugarcane bears large number of leaves (30 to 35) equal to the number of internodes. Detrashing helps in maintaining clean field, enhances air movement and enriches $CO_2$ with the crop canopy. It also reduces the infestation problem by pest and diseases, reduces bud sprouting, facilitates easy entry and movement in the field, etc.

### 9.3.4 List of tillage implements

**(A) Implements for preparatory tillage**

**(1) Ploughing:** Various types of wooden and iron ploughs are used.

**(a) Deep ploughing** (20 to 30 cm deep)**:** Bullock drawn iron plough, Bullock drawn mould board plough, Tractor drawn mould board plough, two furrow bar point plough, Disc plough, etc.

**(b) Shallow ploughing** (12 to 15 cm deep)**:** Small mould board plough, Deshi or wooden plough

**(c) Sub-soil ploughing:** Sub-soil plough or sub-soiler

**(2) Clod crushing**

**(i) Norwegian harrow**

**(ii) Disc harrow**

**(iii) Deccan blade harrow (blade harrow)**

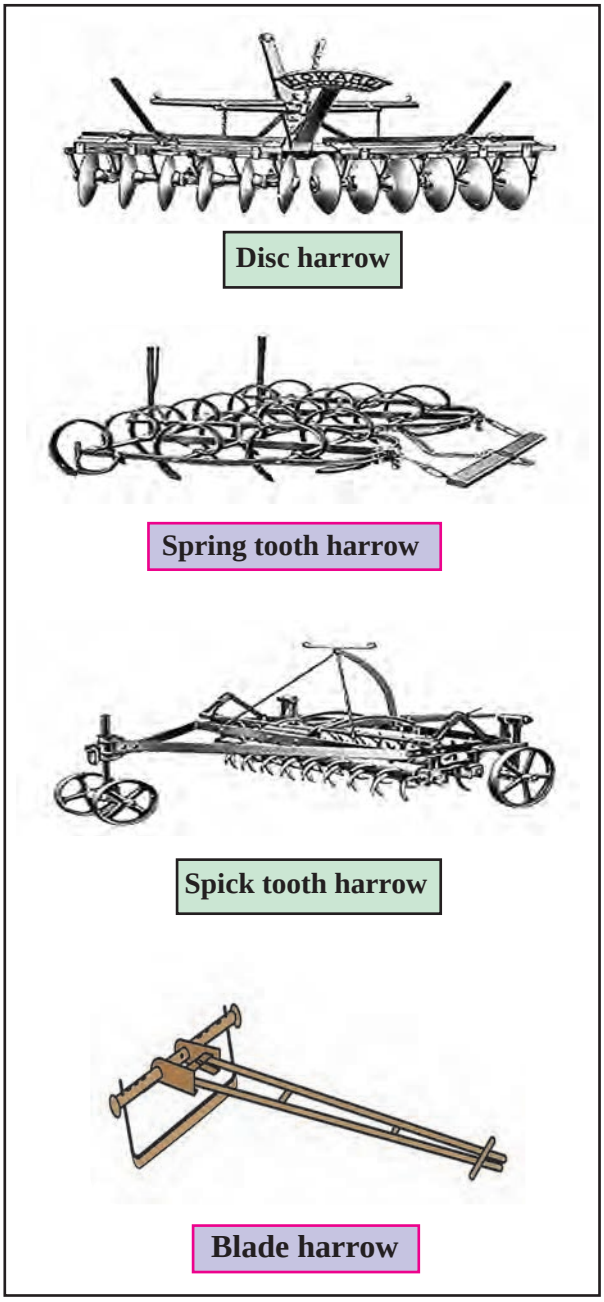


Fig 9.13 : Harrow

**(3) Cultivators**

This implement can used for seedbed preparation and also for inter cultivation operation. The implement having tines which are having provision of vertical adjustments also. These are- (1) Disc cultivator, (2) Rotary cultivator, (3) Tine cultivator

**(4) Levelling of land**

Iron keni, wooden levelling boar, American Petari, blade harrow (when soil is loose and slope is less than 3 %)

Bulldozer: It is used when the soil is hard and slope of the field is more than 3%

**(5) Harrowing**

Deccan blade harrow or different type of harrows according to the type of soil.

This is the implement which cuts the soil to a shallow depth for smoothening and pulverizing the soil as well as to cut the weeds and to mix material with soil. Also used to break the clods after ploughing to collect trash from the ploughed land and to level the seed bed.

**Types of harrow**

(1) Disc harrow

(2) Spring tooth harrow

(3) Spike tooth harrow

(4) Blade harrow (Bakkar)

(5) Guntaka

(6) Triangular harrow

**(6) Manure mixing:** Disc harrow, blade harrow, Disc plough, and deshi wooden plough.

**(7) Compacting of soil:** Maind, wooden log, and inverted harrow and rollers like iron roller, stone or wooden roller.

**(8) Puddling:** Rice puddler. (bullock or tractor drawn) , Deshi wooden plough.

**(B) Seed bed preparation**

**(1) Ridges and furrows:** Different type of ridgers are used. e.g. Jeevan, Jagat and Jamboo ridger.

**(2) Preparation of border strips and saras:** Sara former is used for preparation of saras in the field. Bund former is used for preparing bunds at required distance. For making irrigation layouts hand tool like spade is used.

**Fig 9.14 : Ridger**

**(3) Sowing seeds:** Indigenous seed drill – *dufan, tifan or chaofan* (two, three or four tined seed drill)
Two bowl seed drill (ferti- seed drill) for sowing seeds and fertilizer application, Mechanical seed drill.

**(4) Planting sugarcane:** Sugarcane planter.

**(5) Covering seeds:** Blade harrow and wooden plank.

**(C) Implements for interculture or Intertillage:**

**(1) Weeding:** Hand tool like weeding hook (*Khurapi*) is used.

**(2) Hoeing:** Different type of hoes used are as follows :

(i) Entire blade hoe

(ii) Slit blade hoe

(iii) Akola hoe

(iv) Japanese hand hoe and Karjat hoe

(v) Peg tooth cultivator and shovel tooth cultivator

(vi) Paddy weeder

(vii) Hand hoes

(viii) Tyne tooth hoe

**(3) Earthing up**

**Sugarcane**- Sabul plough and ridger is used.

**Erect type groundnut**- Entire blade hoe is used.

Hand tool like hand kudali, trenching hoe is also used for carrying out earthing up.

**(D) Harvesting implements**

(1) **Groundnut:** Groundnut digger or groundnut harvester and blade harrow, hand digger.

(2) **Potato:** Potato digger or deshi wooden plough is used.

(3) **Cereals, oil seeds and pulses:** Combine harvesters are used in developed countries for carrying out harvesting, threshing and winnowing as well as bagging at a time.

(4) **Wheat and rice:** Wheat and rice harvester and improved *vaibhav* sickle is used.

(5) **Safflower:** Safflower harvester or safflower combine harvester.

(6) **Hand tools** - like sickle is used for harvesting cereals, pulses, some of the oil seeds and fodder crops. Chopper is used for harvesting of sugarcane crop, *tikav*, *hand kudali* for harvesting turmeric, ginger and potato, *Vaibhav* sickle is used for harvesting rice crop.

**(E) Threshing implements**

(1) **Jowar, Bajra, Wheat and Rice:** Vicon thresher or different type of power operated threshers are used.
(2) **Wheat:** Olpad wheat thresher
(3) **Paddy:** Paddy foot thresher
(4) **Shelling of maize cobs:** Maize sheller-hand driven or power operated.
(5) **Shelling groundnut pods:** Groundnut Sheller
(6) **Sunflower:** Sunflower thresher or sheller is used.

Hand tools like wooden thresher is used for threshing cereals, pulses and some of the oil seeds.

**(F) Winnowing:** Winnowing fan, box winnower.

## 9.4 Modern concepts of tillage

Modern tillage method such as minimum tillage, zero tillage and stubble mulch tillage are practiced in U.S.A. and Europe. Most of these practices are not suitable for Indian conditions due to several reasons. In developed countries straw and stubbles are left in the field as such further decomposition. In India, use of heavy machinery is limited and therefore, problem of soil compaction is rare. Minimum tillage can be practiced under Indian conditions by reducing number of ploughings to the minimum necessary requirement. The modern concepts of tillage can be followed in fruit crops after proper establishment.

### 9.4.1 Minimum tillage

Minimum tillage means reducing tillage operation to the minimum necessary requirement for ensuring a good seed bed, rapid germination, satisfactory and favourable growing conditions for the crop.

Tillage operations can be reduced by omitting the operations which do not give much benefit when compared to the cost and by combining operations like sowing and fertilizer applications by using two bowl seed drill i.e. seed cum ferti-drill or mechanical seed drill and by using herbicides for weed management.

**Advantages of minimum tillage**

(1) It improves the soil conditions due to decomposition of plant residues *in situ*.
(2) Higher infiltration as the soil is covered with vegetation.
(3) Less resistance to root growth due to improved soil structure
(4) Less soil compaction

For getting the above mentioned

advantages about 2 to 3 years are required after practicing the minimum tillage.

**Think about it**

(i) What will happen if number of ploughings are increased in low rainfall region?

(ii) When the cost of cultivation will lower down?

**Disadvantages of minimum tillage**

(1) Some times it may affect seed germination and emergence of seedlings.

(2) More nitrogen application is required as the rate of decomposition of organic matter is slow.

(3) Nodulation is affected in some of the legume crops like peas and broad beans.

(4) Sowing operation is difficult with ordinary implements.

(5) Continuous use of herbicides causes environmental pollution problems.

### 9.4.2 Zero tillage

It is the extreme form of minimum tillage in which preparatory tillage or ploughing is completely avoided and tillage operations for seed bed preparation are restricted in adopted areas where soils are subjected to wind and water erosion and cost of tillage and labour is too high. In this method the machinery used performs four functions in one operation viz. clean narrow strip over crop row, open the soil for seed insertion, place the seed and cover the seed properly.

In case of fruit crops only trenches are opened at required distance for planting trees and other operations are not carried out. In zero tillage herbicides are used before sowing for destroying weeds or vegetation. Generally, non-selective herbicides (parquat or Glyphosate) with short residual effect are used before sowing of the crop and during sub-sequent stages of crop growth the selective herbicides are used for management of weeds. The plant residues are also used as mulch for conservation of soil moisture and management of weeds in the crop.

**Advantages of Zero tillage**

(1) Zero tillage soils are homogenous in structure with more number of earthworms.

(2) It increases organic matter content of the soil.

(3) Surface run-off is reduced and infiltration of water is increased due to mulching.

(4) It saves cost on preparatory tillage and intertillage.

**Disadvantages of Zero tillage**

(1) Some times the germination and condition of the crop is affected.

(2) Sowing operation is difficult with ordinary implements.

(3) More nitrogen application is required as the rate of mineralization is slow.

(4) Continuous use of herbicides may cause environmental pollution and residual effects.

(5) Some times perennial deep-rooted weeds become serious problem.

### 9.4.3 Mulching

Covering surface of the soil in between the crop rows with the help of organic mulch such as plant residues or inorganic mulch like polythene sheet for conservation of soil moisture, management of weeds, maintaining soil temperature, etc. is known as mulching.

The organic mulch such as plant residues i.e. wheat straw, sugarcane trash, stubbles of the crop, grass clippings, crop stump, straw, bark, chipads, compost saw dust, cotton burs, rice husk, bran, wooden pieces leaf litter, etc. are spread in between crop rows @ 5 tonnes per hectare. The black polythene sheet spread on surface of the soil in between crop rows

is more effective than white polythene sheet. Mulching with polythene sheet is more costly than plant residues and used in case of high value crops only.

### 9.4.4 Stubble mulch tillage

Covering the soil surface with crop residues or stubbles during the fallow periods for protecting the soil from unfavourable weather conditions (heavy rains and winds) is known as stubble mulch tillage or stubble mulch farming. Generally, disc plough or disc harrow is used to incorporate some of the plant residues into the soil after harvest of the crop. This hastens the decomposition but still keep enough residues on surface of the soil as mulch. Similar to zero tillage, heavy power machinery performing different functions such as cleaning strip, sowing seeds and fertilizer application is used for sowing the crop in stubble mulch farming.

**Do you know ?**

In winter shedding of leaves occurs naturally. It is useful for summer, as it covers the soil and prevent evaporation losses. It's called natural mulch.

**Purpose of Mulching**

(1) Conservation of soil moisture.

(2) Regulation of soil temperature.

(3) Suppression of weed growth.

(4) Prevention of soil erosion.

(5) Control of pest and disease.

## 9.5 Post Harvest Farm operations

### 9.5.1 Harvesting

Cutting or removal of plants after maturity from the field is called harvesting. Crop should be harvested at proper stage to get higher yields (production) with good quality produce. Hence, it is necessary to know signs of maturity in case of various field crops.

(i) Moisture content of grains up to 12 to 14 percent

(ii) Yellowing of leaves and plants

(iii) Change in colour of produce

(iv) Life cycle of annual crop ends

There are various methods of harvesting such as cutting close to the ground level, cutting ear heads picking pods, pulling plants, digging produce from soil with the implements like sickle, plough, kudali, etc.

### 9.5.2 Threshing

Process of separating grains from earheads or cobs is known as threshing. This is done by various methods such as beating with sticks, trampling under bullocks feet, using hand driven machinery, threshing machine (thresher), stone roller, etc.

### 9.5.3 Winnowing

Winnowing means separation of grains from *bhusa* or dirt material. For this purpose the threshed material is held against wind. This is done naturally or artificially for cleaning of grains or produce.

### 9.5.4 Storage

Farm produce is stored either in bulk when it is in large quantity or in containers such as bins, pots, gunny bags, *kangi*, etc. Before storing farm produce should be dried well in sunlight for removing excess moisture from grains.

# Exercise

**Q.1 A. Fill in blanks.**

1. A British scientist ---------- is known as father of tillage.
2. The term ---------- means the physical condition of soil resulting from tillage operations.
3. Some harmful insect pest like ---------- can be destroyed by proper tillage operations.
4. The tillage operations, that are performed before sowing are referred as ----------
5. The practice of covering the soil, to conserve more moisture in soil is called as ----------

**B. Make the pairs.**

| | Group 'A' | Group 'B' |
|---|---|---|
| 1. | Clod crushing | (i) Seed drill |
| 2. | Sowing | (ii) *Khurapi* |
| 3. | Weeding | (iii) Plough |
| | | (iv) Disc harrow |
| | | (v) Ridger |

(OR)

**B. Find the odd out.**

1. Black polyethylene sheet, sugarcane trash, stubbles, wheat straw, dry leaves.
2. Cutting, picking up, uprooting, sowing, digging.
3. Bins, pots, gunny bags, metal *kangi*, plough.
4. Ploughing, clod crushing, harvesting, levelling, harrowing.
5. Seed drill, puneri seed drill, harrow, two bowl seed drill, sugarcane planter.

**C State true or false.**

1. Reducing the number of tillage operations is called as zero tillage.
2. Mulch is a material that is added at too deep in the soil.
3. Harvester is the machine that used for sowing.
4. Tillage helps the irrigation water to infiltrate into soil easily.
5. The ploughing operation turns over the upper layer of soil.

**Q. 2 Answer in brief.**

1. Write short note on preparatory tillage.
2. Complete the flow chart of farm operations.

   Ploughing → -------- → levelling → ---------- → preparation of irrigation system → -------- → covering seeds → --------- → fertilizer applications.

   (Clod crushing, harrowing, sowing, irrigation)
3. Give reasons.
   (a) Deep ploughing should be performed for tap rooted crops.
   (b) Thinning and gap filling operation should be carried out within 10-15 days of sowing.
   (c) Mulching practice should be followed in drought prone zone.
   (d) The crop should be harvested at proper maturity stage.
4. Write purpose of mulching.
5. Enlist the names of operations that are carried out in inter tillage.

**Q. 3 Answer the following questions.**

1. Explain tillage operation with implements, used for it

   (a) Ploughing, (b)Harrowing,

   (c) Sowing, (d) Weeding.
2. Describe farm operations.
3. Give advantages of minimum tillage.
4. Give advantages and disadvantages of zero tillage.

**Q. 4 Answer in detail**

1. Define tilth. Give characteristics of good tilth.
2. Explain objectives of tillage in detail.
3. Explain in detail the types of tillage.
4. Complete the following table on tillage operations.

| SR. NO. | ---------- | SEED BED PREPARATION | INTER CULTURE |
|---|---|---|---|
| 1. | Ploughing | Harrowing | ---------- |
| 2. | ---------- | ---------- | ---------- |
| 3. | Levelling | ---------- | Weeding / hoeing |
| 4. | ---------- | Compacting soil | ---------- |
| 5. | ---------- | ---------- | Mulching |

**Activity :**

Practice tieing and handling of bullock and tractor drawn implements.