

# FARM MECHANIZATION

## Aims:

- ❖ Increasing the productivity of land and labour.
- ❖ Bringing in more area under cultivation.
- ❖ Conserving energy and resources.
- ❖ Sustaining agricultural products.
- ❖ Improving operators comfort and safety.
- ❖ Protecting environment.
- ❖ Increasing farm profit.

## HISTORY:

In 1914 royal British feel requirement the bull use is difficult and out put is low. They launch an agriengineering workshop in Agriculture University in 1914. They use tractor in field and output was maximum. Famin Simon feel need that farm machinery should be available to every farmer so till 1964 farm machinery was available.

## MISSION

"Resources conservation and productivity enhancement through farm mechanization"

## OBJECTIVES OF FARM MECHANIZATION

### BRINGING IN PAKISTAN:

- ❖ Development and reclamation of culturable waste. (what benefit can take from crop residues, correction of unfit soil, incorporation of straw and green manuring, salinity reclamation)
- ❖ Development of hilly areas through terracing. (development of hilly areas by the power of machinery)
- ❖ Execution of emergency work such as defense, desilting, flood control. (flood control by making heavy bunds, defense; making bunds from safety of possible flood)
- ❖ Development or improvement of water storage. (making dams, canals, water channels and cleaning them)
- ❖ Development of ground water resources.
- ❖ Soil conservation.
- ❖ Research, development and promotion of agricultural machinery.
- X❖ Objective of farm mechanization in Pakistan was increasing research in machinery work and making it affordable.

- ❖ Farm mechanization ensure timely water supply.
- ❖ Farm mechanization helps in timely spray application.
- ❖ Farm mechanization ensures the reduction of cost. Due to efficient use of resources through mechanized farming the cost of production of various crops goes down.
- ❖ The use of modern inputs increases the yield of crop.
- ❖ Farm mechanization increases the income (mechanization helps in increasing the income of farmer by minimizing pre and post harvest losses).
- ❖ Farm mechanization provides off farming employment to the population living in rural areas.
- ❖ Mechanization of agriculture helps in achieving self sufficiency and surpluses in food and other crops.

### **ARGUMENTS AGAINST FARM MECHANIZATION:**

#### **1- INCREASE IN UN-EMPLOYMENT.**

- The use of farm mechanization technology replaces labor and leads to un-employment.

#### **2- INCREASE IN URBANIZATION.**

- Migration of labors from mechanized farm sector to cities creates the problem of urbanization.

#### **3- SOCIAL DISPARITY.**

- Farm mechanization is basically capital intensive and have a big farmer bias.

#### **4- DIVERSION OF CAPITAL**

#### **5- CATTLE POPULATION SURPLUSES.**

### **ENGINE:**

*Any device which convert heat energy in to mechanical energy to do work.*

### **INTERNAL COMBUSTION ENGINE:**

*Every engine have internal combustion engine thus an internal combustion engine that is one that burns fuel internally.*

*Basic components of internal combustion engine:*

#### **1- AIR:**

There is also the garden tractor which is a very simple type used for cutting of gardens. They are primarily for the cutting of



#### **4- ROW CROP TRACTOR:**

It is used for performing row crop practices, performing intercultural operations in row crops. Its front wheels are adjustable for different row spacing.



- Air has three major properties:
- 1- It gives oxygen for fast burning.
  - 2- It can be compressed.
  - 3- It gets heated on compression.

## **2- FUEL:**

It can easily ignite and readily breakdown.

## **3- COMBUSTION:**

Burning of fuel and air mixture is combustion.

## **COMPRESSION:**

The air is compressed inside the cylinder. The ratio between original volume of the air and the compressed air is called compression ratio.

Compression ratio =

For petrol engine = 8:1

For diesel engine = 16:1

## **RECIPROCATORY AND ROTATORY MOTION:**

It is a circular motion around the point (rotatory motion).

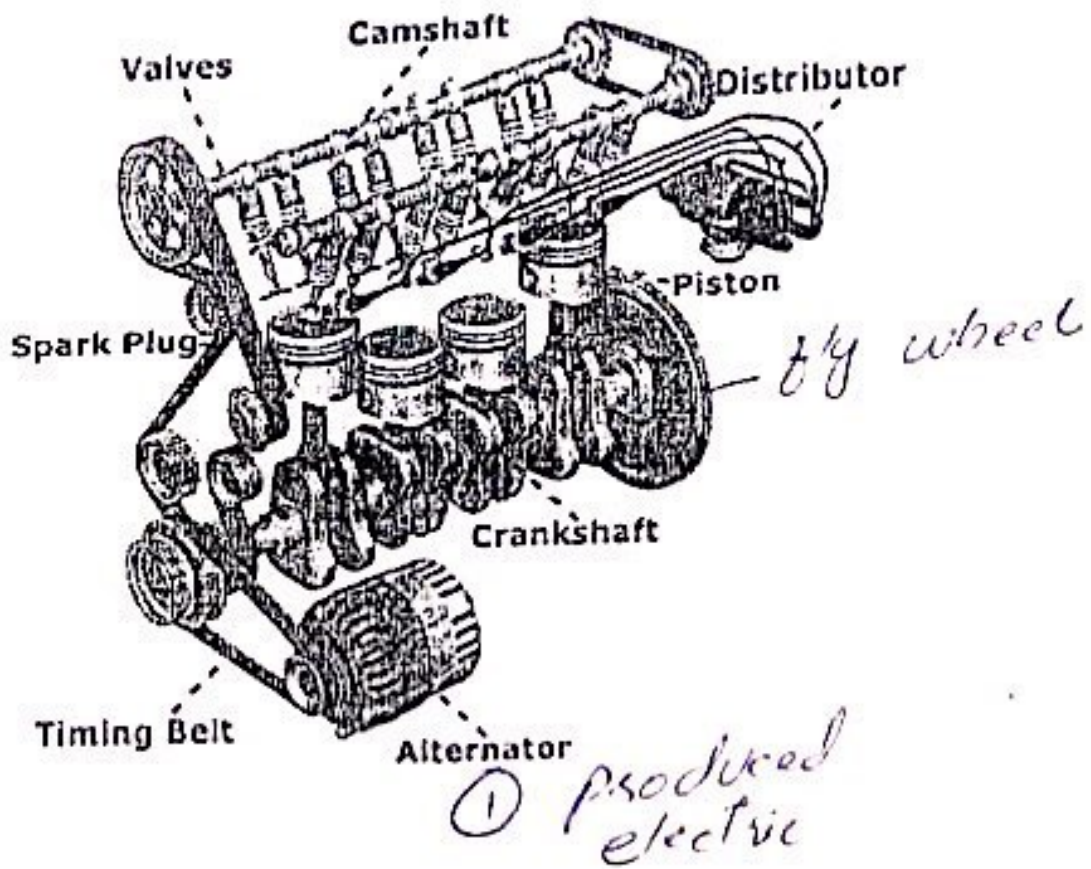
Engine converts the reciprocatory motion of piston into rotatory motion of the crank shaft.

## **TYPES OF ENGINE ACCORDING TO NUMBER OF STROKE:**

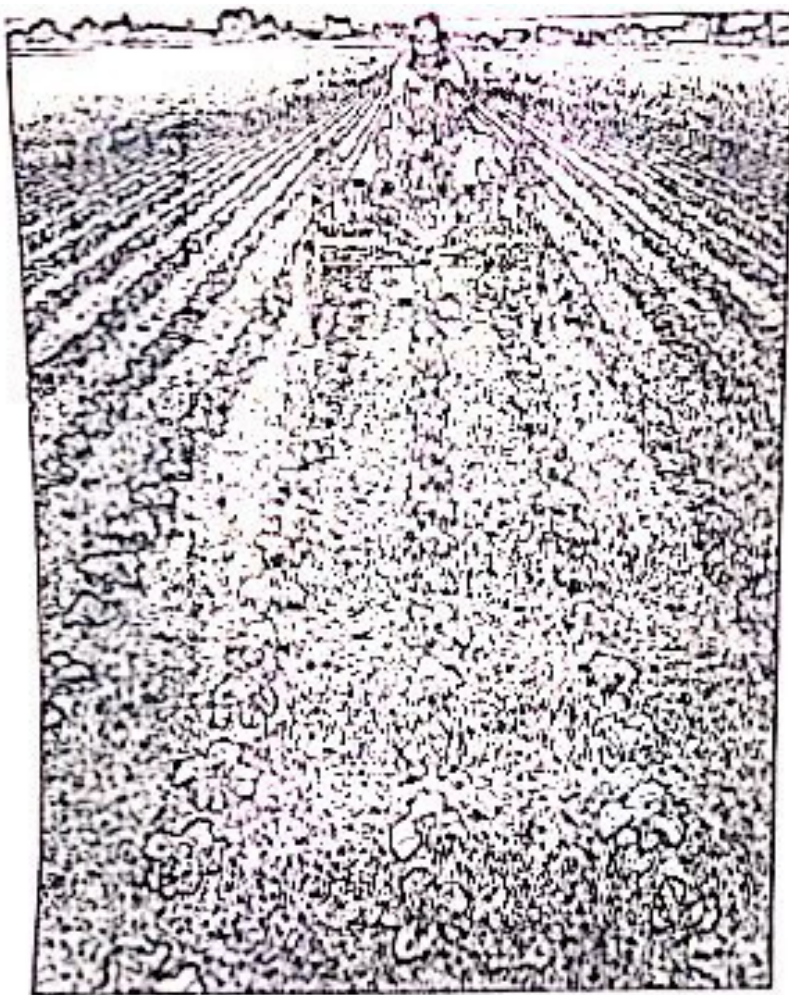
### **1- TWO STROKE ENGINE:**

The two stroke engine employs both the crankcase and the cylinder to achieve all the elements of the otto cycle in only two strokes of the piston.

## ENGINE PARTS

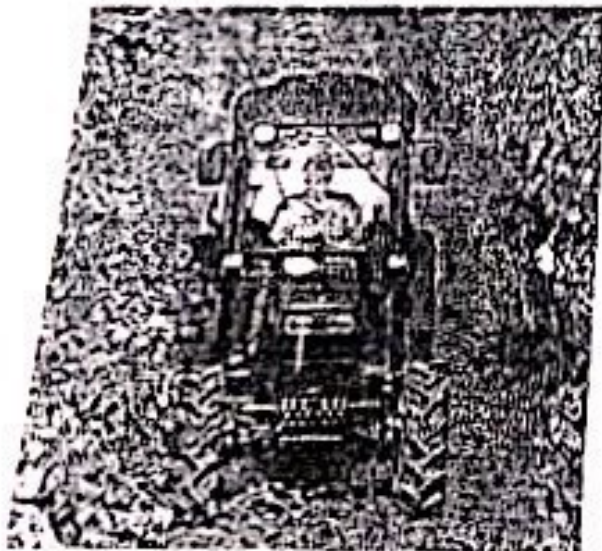






#### 5- ORCHARD TRACTORS:

Tractors tailored to use in fruit orchards typically have features suited to passing under tree branches with impunity.



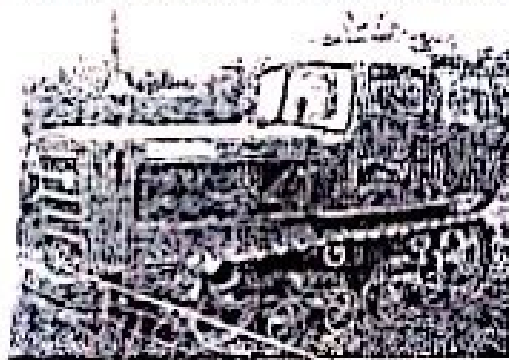
#### 6- TWO WHEEL TRACTOR:

Actually this type of tractor has four wheels but the energy wheels are only two, so it is called two wheel tractor.



### **7- CRAWLER TRACTOR:**

These contain tracks instead of wheels and have a special drive system, they are used on soft soil, can remove dirt and transport to a considerable distance. They have low speed but have greatest tractive forces. It is a very expensive tractor.



### **ARGUMENTS IN FAVOR OF FARM MECHANIZATION:**

- ❖ Farm mechanization increases the volume of production.
- ❖ Farm mechanization encourages multiple cropping, which is not possible under traditional farming.
- ❖ Farm mechanization reduces dependence on animal power, which is expensive and also slow in operation.
- ❖ Farm mechanization saves labor, makes the jobs for leveling and preparation of land and helps in bringing more land under cultivation.
- ❖ Farm mechanization increases the efficiency of farmers and raises the output per worker.



Piston of an engine is made to move back and forth in the cylinder on the explosion of the fuel mixture. This back and forth movement of the piston is transmitted through the connecting rod and crankshaft to the belt pulley, thus power is generated.

### **7-PISTON RINGS:**

These seal the combustion chamber and help to transfer heat.

### **8-CONNECTING RODS:**

These are fitted to piston and transmit the reciprocatory motion of the piston to the rotator motion of crank shaft.

### **9-CRANK SHAFT:**

Crank shaft provide the way of converting reciprocating motion of the piston in to useful rotator motion.

### **10-MAIN BARINGS:**

They support crank shaft.

### **11-FLY WHEEL:**

Fly wheel provides the momentum to the piston during ideal stroke.

### **12-OIL PUMP:**

Oil pump supply lubricating oil under pressure to the frictional parts of the engine.

### **13-ENGINE SUMP:**

Store the lubricating oil and cover it.

## **ENGINE POWER OUTPUT TURNS:**

Horse power is used in measuring the rating of engine:

### **1- INDICATED HORSE POWER(IHP):**

It refers to the theoretical horse power which an engine produces inside the cylinder to maximum extent. The frictional losses neglected in IHP.

### **2- FRICTION HORSE POWER(FHP):**

Power lost esp. in an internal-combustion engine through friction between parts of the machine itself

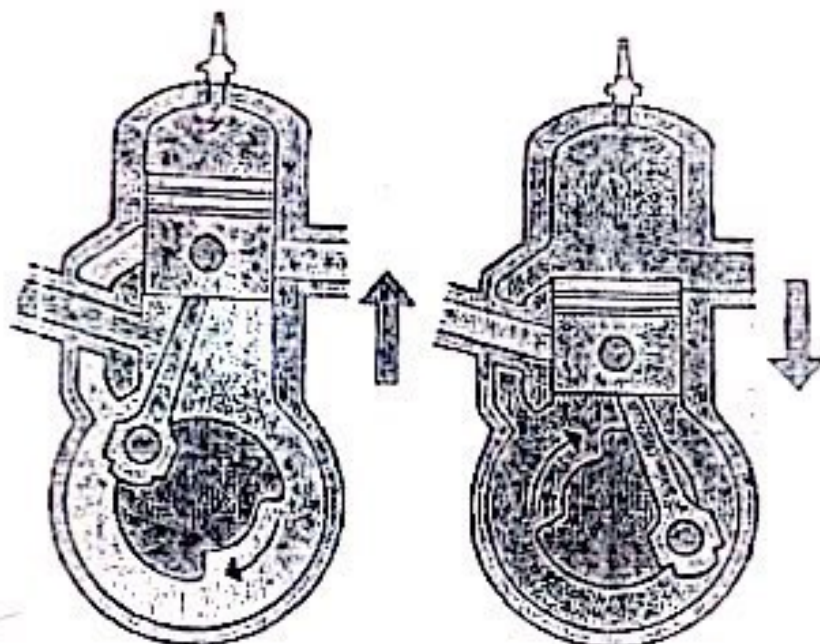
### **3- FLY WHEEL/BRAKE HORSE POWER(FBHP)**

The horse power produces at the engine fly wheel.

### **4- POWER TAKE OFF HORSE POWER(PTOHP):**

### **5- DRAWBAR HORSE POWER(DHP)**



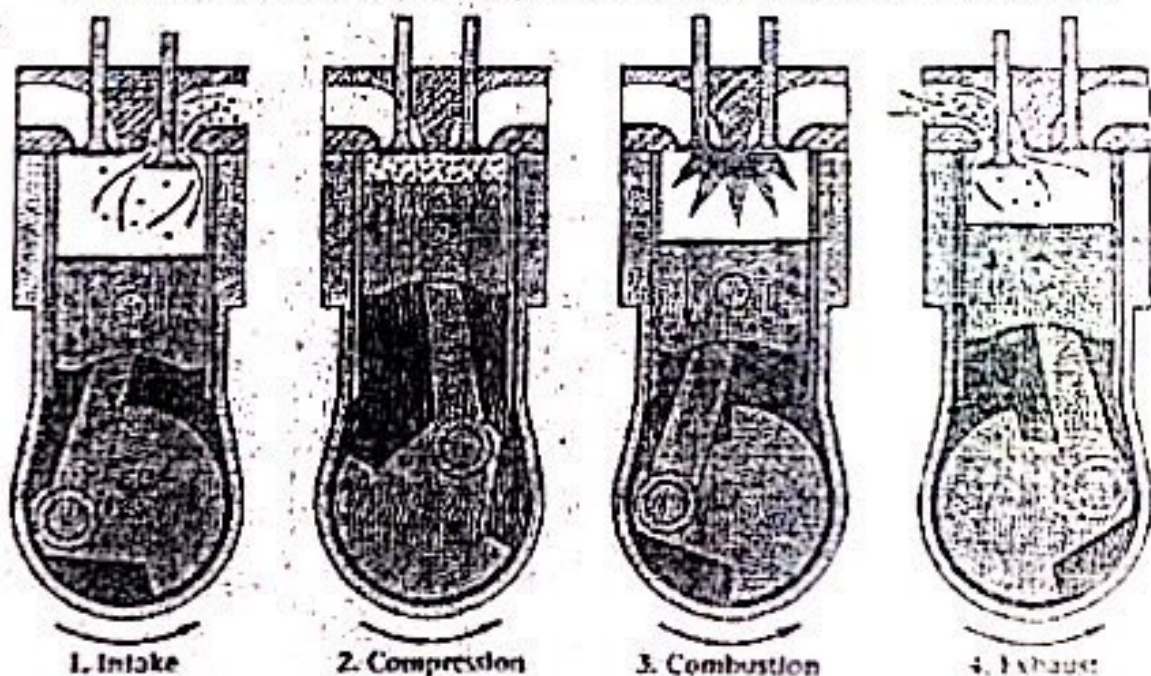


## 2-FOUR STROKE ENGINE:

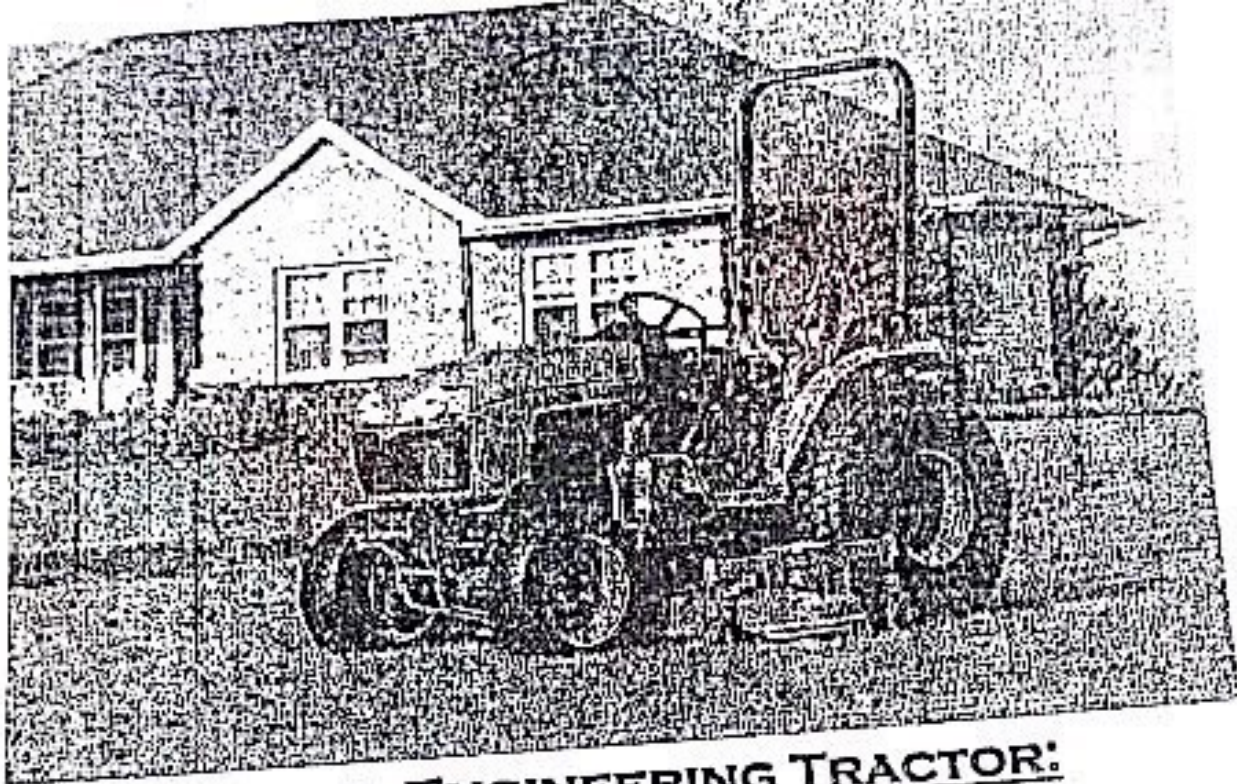
The four strokes of the cycle are intake, compression, power, and exhaust. Each corresponds to one full stroke of the piston; therefore, the complete cycle requires two revolutions of the crankshaft to complete.

### THE 4-STROKE-CYCLE PRINCIPLE

This diagram shows the four steps (strokes) in a complete power cycle in a 4-stroke-cycle engine.

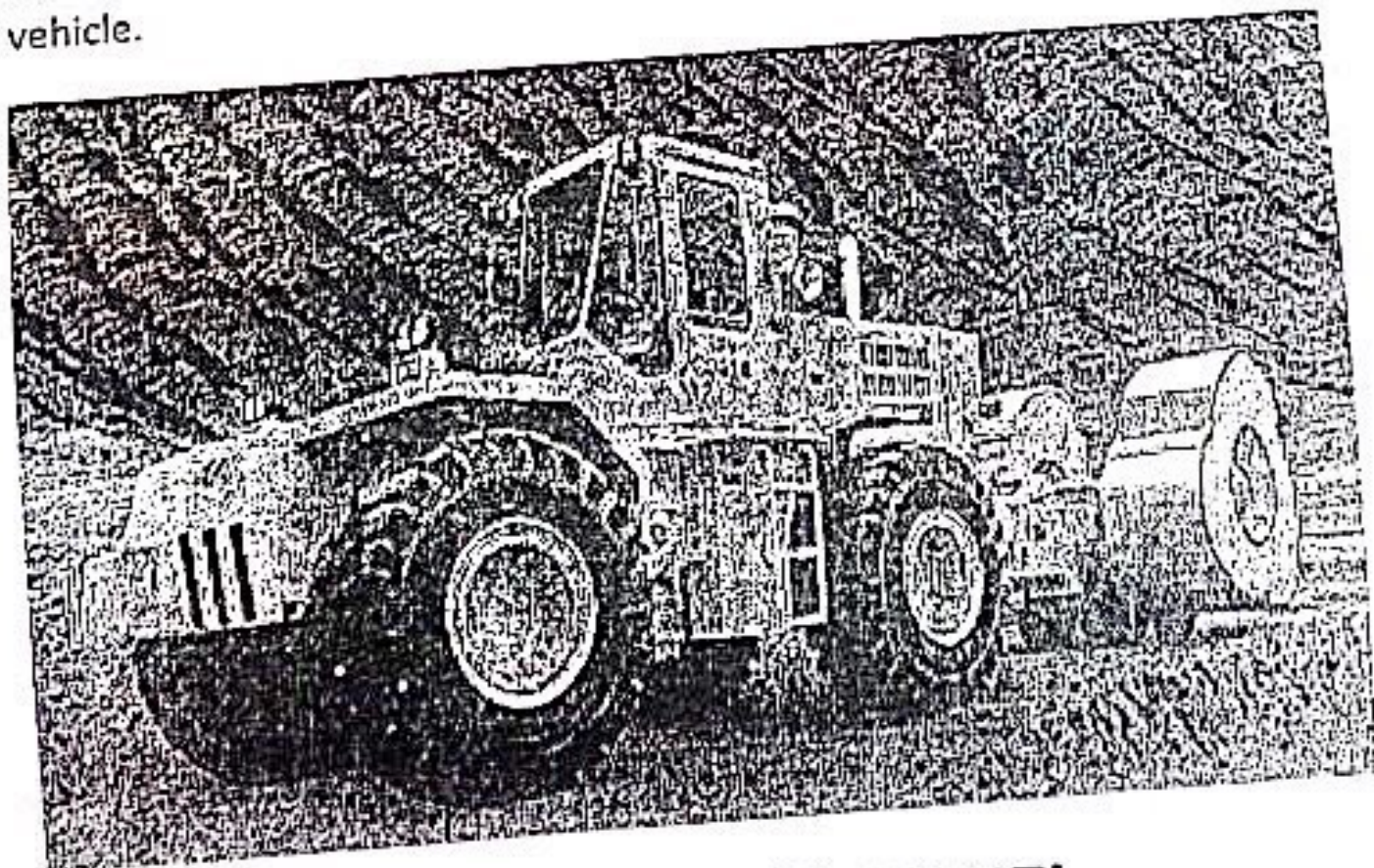






## **2- ENGINEERING TRACTOR:**

Then there's engineering tractors which are suited for engineering tasks. These tractors may be fitted with tools like bucket, hoe, dozer blade, ripper, among others. If attached with engineering tools it is often referred to as engineering vehicle.



## **3- GARDEN TRACTOR:**



## TRACTOR:

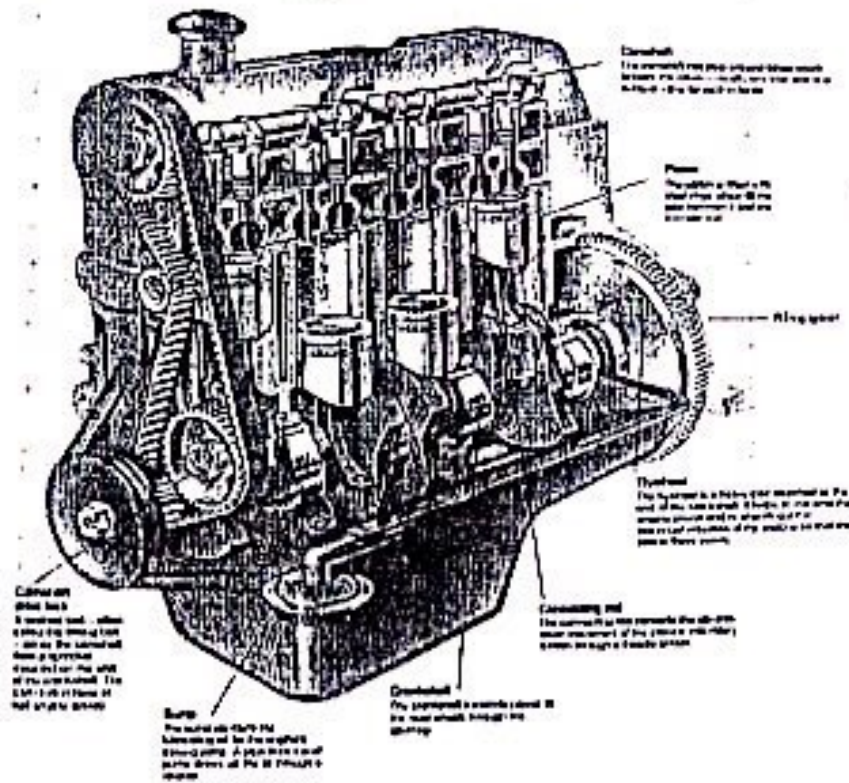
A tractor is a vehicle specifically designed to deliver a high tractive effort at slow speeds, for the purposes of hauling a trailer or machinery used in agriculture or construction.

Most commonly, the term is used to describe a farm vehicle that provides the power and traction to mechanize agricultural tasks, especially (and originally) tillage.

## PARTS OF TRACTOR:

- ✓ Air conditioning
- ✓ Batteries
- ✓ Belts
- ✓ Clutches
- ✓ Hydraulic hose and fittings
- ✓ Water pumps
- ✓ Starter and alternator
- ✓ Oil filter Barings
- ✓ Barings
- ✓ Radiators
- ✓ Air filter
- ✓ Chair
- ✓ Gear box
- ✓ Steering
- ✓ Gear transmission system
- ✓ Brakes (hand and foot brake)
- ✓ Accelerators
- ✓ Indicators
- ✓ Radiator fan
- ✓ Generator
- ✓ Oil tank
- ✓ PTO
- ✓ Four wheels
- ✓ Casing





## **1-BASE OR FRAME:**

The base or frame of an engine is that part, usually made of cast iron, to which other parts of the engine are directly or indirectly attached. It is equipped with holes, usually four in number, by which the engine may be firmly anchored to its foundation.

## **2-CYLINDER:**

It is hollow tubes in which the piston moves up and down.

## **3-CYLINDER HEADS:**

It is fitted at the top of the engine and usually contains inlet and outlet valves.

## **4-VALVES:**

There are two types of valves:

- ❖ Inlet valves
- ❖ Outlet valves

## **5-CAM SHAFT:**

It rotates to open and close inlet and exhaust valve.

## **6-PISTON:**



## 6- RATED HORSE POWER(RHP):

This is the power engine can produce continuously in the normal working condition.

### COMPARISON BETWEEN DIESEL ENGINE AND PETROL ENGINE

Diesel engine	Petrol engine
1- Combustion ratio=16:1	1- Combustion ratio=8:1
2- Compression ignition	2- Spark ignition
3- Operates at low speed with higher torque	3- Operates at higher speed with lesser torque
✓ 4- Big in size	4- Small in size
5- More horse power	5- Less horse power
✓ 6- Air and fuel separately enter in the combustion chamber	6- Air and fuel mixture enters in the combustion chamber
7- It has direct injection system for ignition	7- It has spark plug for ignition
8- Heavier	8- Lighter
9- Better fuel economy	9- Poor fuel economy
✓ 10- Costly	10- Cheaper than diesel engine
11- Fuel = diesel	11- Fuel = petrol

### ENERGY SAVING TIPS IN TRACTOR OPERATION:

- ❖ Race should be normal, not too high nor too low.
- ❖ Use the best lubricating oil and timely change the lubricating oil.
- ❖ Operate at high gear because energy is less used at high gear.
- ❖ PTO and engine power ratio.
- ❖ Engine maintenance should be very good.

- ❖ Do not remove the thermostat.
- ❖ Always use the genuine parts.
- ❖ Air cleaner should be properly and regularly clean the air.

## **ROUTINE MAINTENANCE OF TRACTOR:**

The tractor plays a significant role in mechanized agriculture. To keep it working for a long time at a minimum cost, it requires an adequate and timely maintenance.

### **1-CHECK FLUIDS REGULARLY.**

Tractor usage is measured in hours, not miles, so the amount of use may be deceptive, and leaking components may cause failure of expensive parts. Refer to the owner's manual to determine how each fluid is checked

- ❖ **Check the transmission fluid.**
- ❖ **Check the engine oil.**
- ❖ **Check the cooling in the radiator.**
- ❖ **Check the hydraulic oil.**
- ❖ **Check the battery electrolyte.**

2- **Keep an eye on belts and hoses.**

3- **Watch the gauges.**

4- **Check the filters regularly.**

5- **Check the radiator screen.**

6- **Lubricate your tractor.**

7- **Do not overload your tractor.**

- ❖ Keep your tractor clean this will help you to spot damaged components and leaks, and see if trash or debris is causing problems.

## **ENGINE TUNNING:**

Tune-up is to restore the engine to the performance level recommended by the auto maker. Tune-up involves replacing parts that are close to or have already reached the end of their useful life. Tune-up also involves servicing the parts to reliable conditions. Various engine systems must be adjusted to meet the auto maker's specifications and keep them performing effectively.



## TILLAGE:

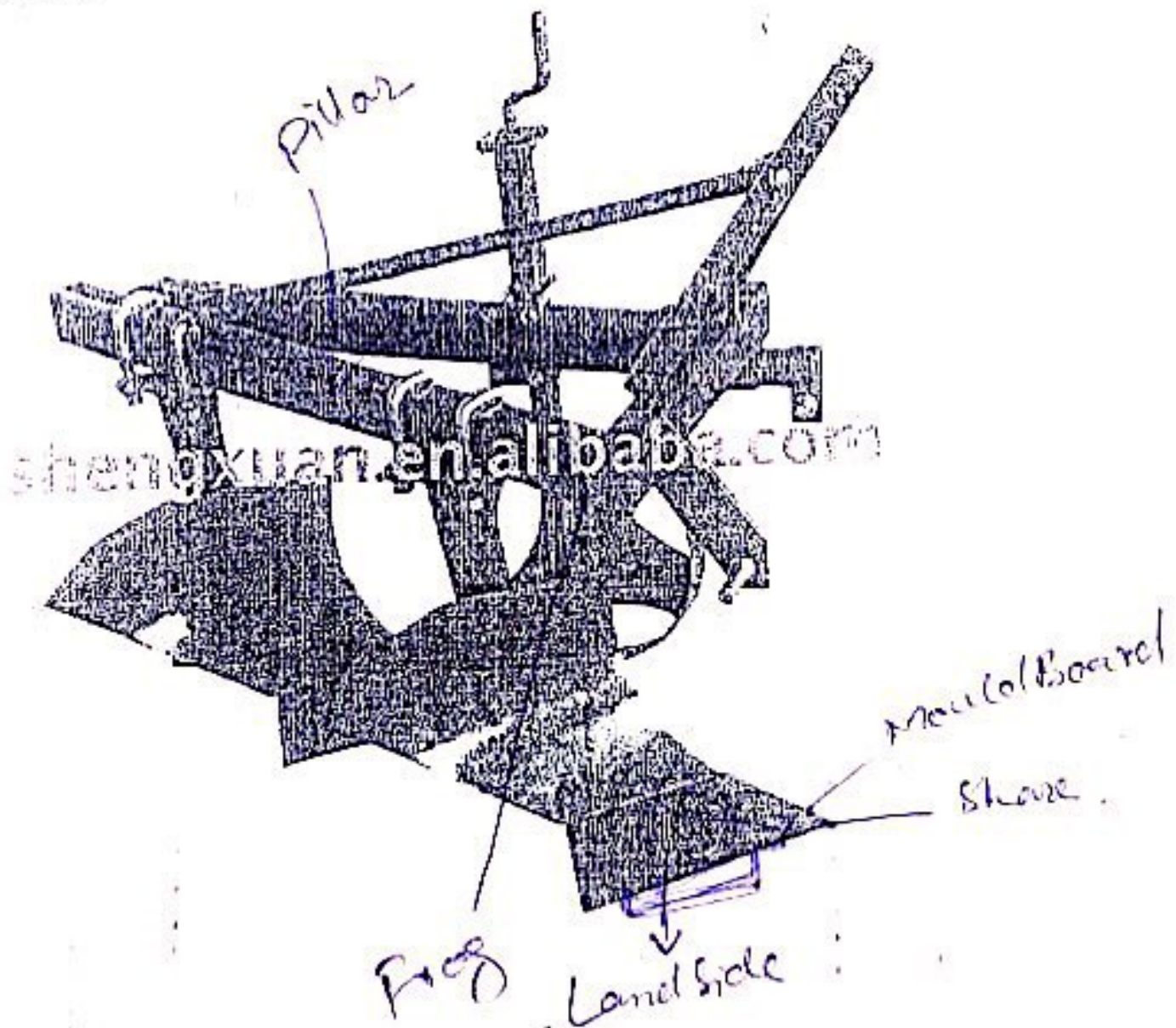
Mechanical manipulation of soil in order to make it favorable for crop growth. Cut, scratch and inverting of soil for the purpose of crop growth and soil conservation.

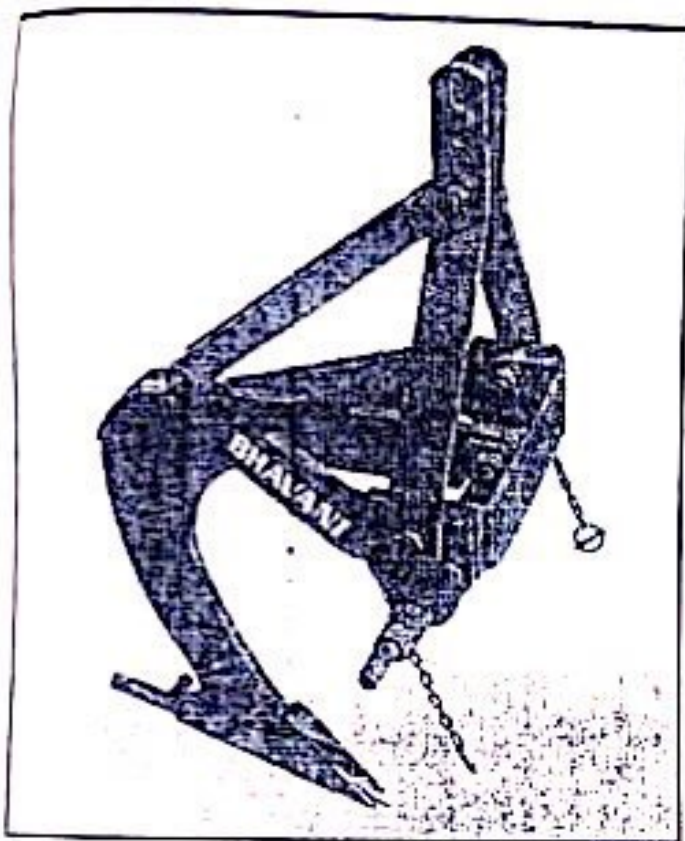
### TILLAGE IMPLEMENTS:

#### 1. PRIMARY TILLAGE IMPLEMENTS:

##### MOLDBOARD PLOUGH:

Moldboard ploughs are designed to invert/turn the soil over in furrows and leave it exposed to air. Fully invert/convert the soil to bury the trash and crop residues. The inversion action also controls weeds, diseases and insect infestation. Moldboard plough is mainly used in highly rainfall and irrigated areas.





### **OBJECTIVE OF TILLAGE:**

- ❖ Develop a desirable soil structure.
- ❖ Control soil moisture.
- ❖ Control or remove unwanted crop plant.
- ❖ Incorporate and mix fertilizer and pesticides.
- ❖ Improve physical condition of soil.

A tillage implement consist of single tool or a group of tools with associated frames, weels, controls and protection devices and another structural and power transmission component.

### **SECONDARY TILLAGE IMPLEMENTS:**

Implements that stir the soil at shallow depth are called secondary tillage implements. In many cases secondary tillage implements follow deeper primary tillage implements. There are several secondary tillage implements that are used for secondary tillage

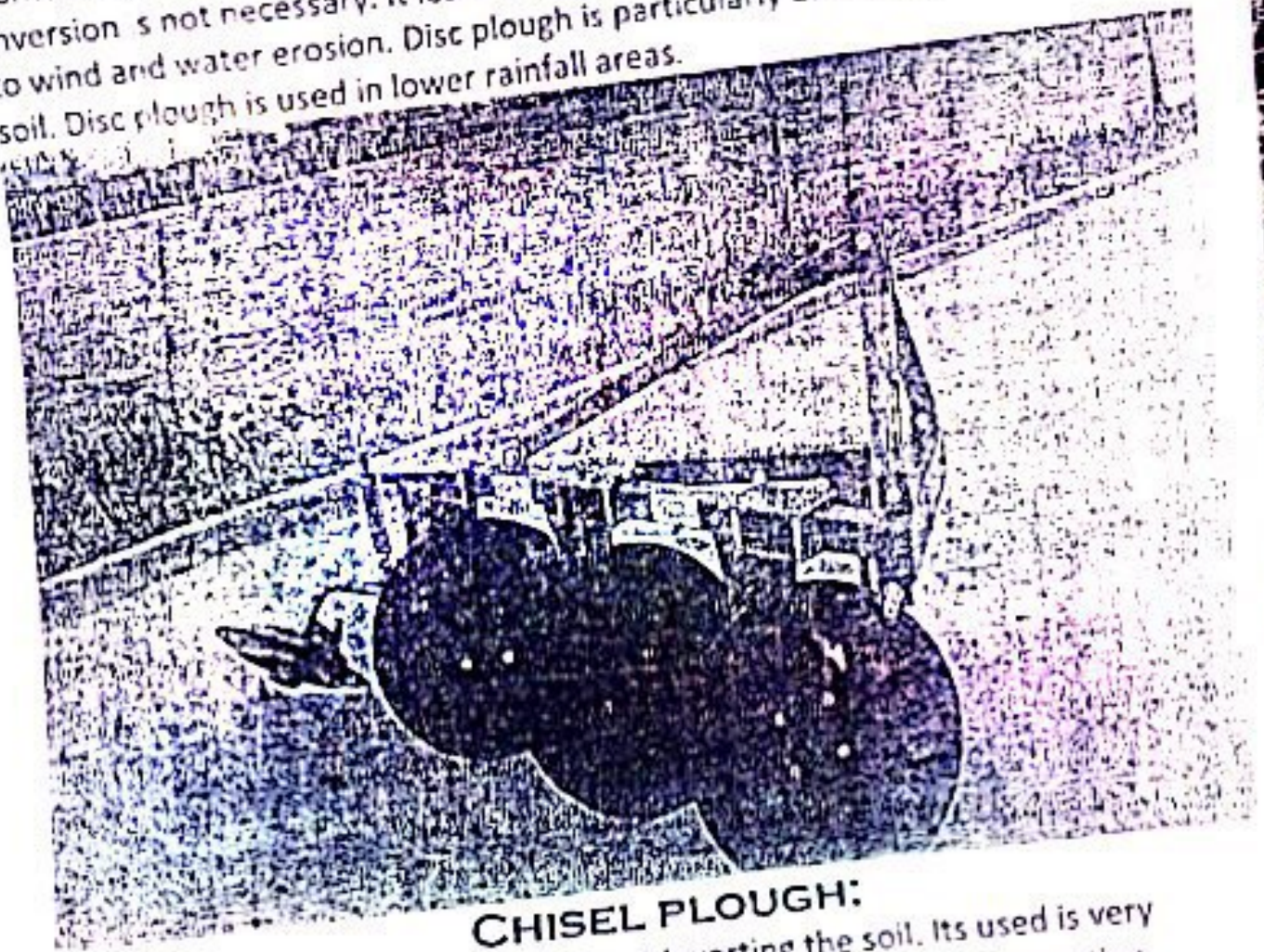
### **CULTIVATOR:**

It is used to loosen the soil and breakup big clods after the land have been ploughed. It also level the soil if we attach planker with it. Its working depth is 5-15cm.



### DISC PLOUGH:

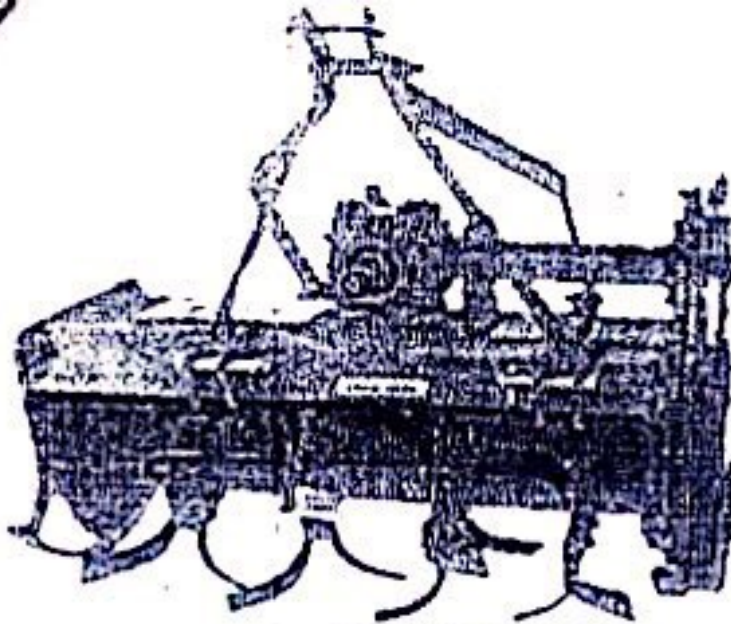
Disc plough have 2,3 disc depending upon horsepower of tractor, it is better for hard, stony, sticky and the soil with more vegetation. Its used also beneficial to plough wheat/rice field which have been harvested with combine harvester. Disc plough used usually hardier dry soil where total soil inversion is not necessary. It leave a heavy cloddy surface which act as a barrier to wind and water erosion. Disc plough is particularly useful for root infested soil. Disc plough is used in lower rainfall areas.



### CHISEL PLOUGH:

It breaks the hard pane without inverting the soil. Its used is very beneficial in barren areas or rain fed areas as it increases the water absorption capacity of soil. Chisel plough up to 20-45 cm depth. Chisel plough effectively stir the soil but do not invert it. Thus any trash, crop residue left on top of ground it retain high percentage of plant material to control wind or water erosion. The vertical and lateral cranking preserve the moisture and surface residue limit. Chisel plough are useful for weed control in fallow land and breaking hard pane which has occur due to constant use of tiller.





### **CROP SOWING IMPLEMENTS:**

- ❖ RABI DRILL
- ❖ KHARIF DRILL
- ❖ PLANTER

#### **RABI DRILL:**

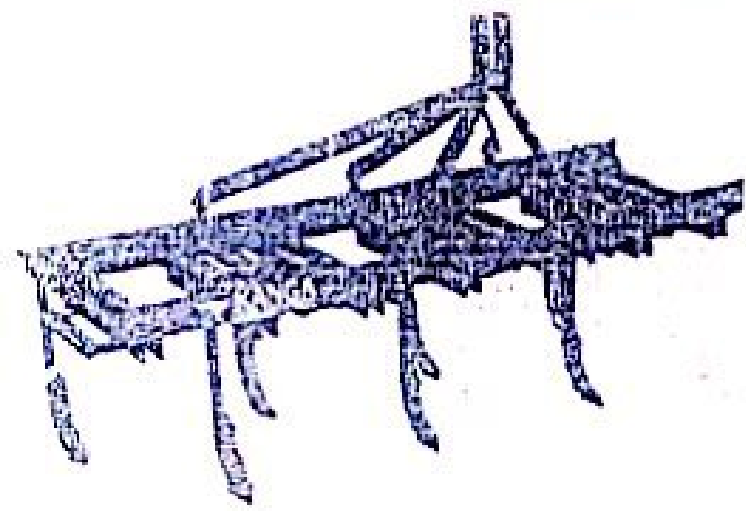
It is used for sowing of wheat, barley, sorghum and other cereal crop.

#### **BENEFITS OF PLANTER/DRILL:**

- ❖ Seed can be sown at uniform depth
- ❖ seed can be sown at fixed rate at proper distance
- ❖ Germination rate and maturity of crop is uniform.
- ❖ Harvesting of crop is easy.
- ❖ Seed drill are fitted with seed box as well as fertilizer box.
- ❖ Seed and fertilizer box are passed the soil through tube and furrow opener.
- ❖ Before using such drill they should be proper calibrated for proper seed and fertilizer rate
- ❖ Constant watch should be kept on the tube to avoid clogging with seed when the drill is in the soil.
- ❖ Seed drill should be properly cleaned after sowing.

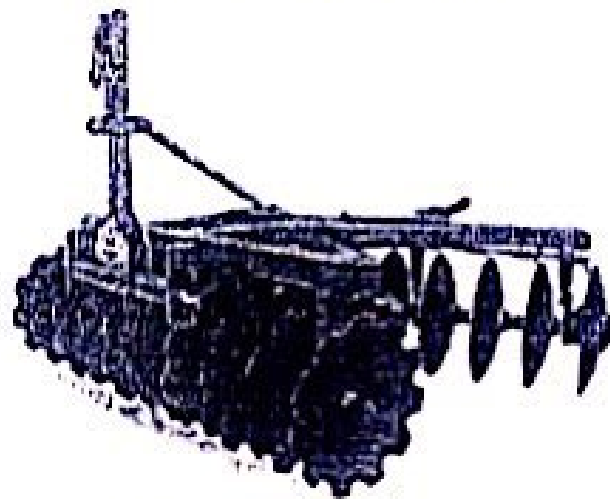
### **MANAGEMENT AND COST ANALYSIS**

- 1- MACHINE CAPACITY UTILIZATION
- 2- CORRECT FIELD LAYOUT IN TERM OF TOPOGRAPHY AND ROW LENGTH



### **DISC HARROW:**

It is used after ploughing to pulverize the soil for preparing the fine tilth for seed bed. Disc cutting is ideal for crop residual to incorporate it in soil. It finally leave a leveled and clean soil surface.



### **ROTAVATOR:**

It is outstanding in its versatility used in rice, wheat and cotton field. It is used for stubble tillage and used seed bed preparation in ploughed field with large clods. It is also used for leveling and fallow tillage. These are used for standing cultivation of cutting and mixing the trash present on the soil. Cotton stick, rice stubbles and wheat straw are also incorporated in the soil and prepare the seed-bed for following crop.

### 3- SUPERVISION AND ORGANIZATION OF LABOUR

#### 4- FIELD CAPACITY OF FARM

##### I. THEORETICAL FIELD CAPACITY:

This is the rate of field work possible if the machine work all the time as recommended speed and utilizes its entire width.

##### II. EFFECTIVE FIELD CAPACITY:

This is the actual rate of covering by machine.

##### III. FIELD EFFICIENCY:

Ratio b/w effective field capacity to the theoretical field capacity.

##### IV. PERFORMANCE EFFICIENCY:

This is the efficiency in terms of %age of crop yield harvested by machine.

Total yield/hectare divided by yield obtained from machine expressed as %age.

#### 5-COST OF USING FORM EQUIPMENT:

I. Cost of using implements

II. Cost of using tractor

III. Cost of using labour

##### TYPES OF COST:

###### 1- FIXED COST:

These are assessed on depreciation which are designed to reflect the reduction in value over period of time. Suppose a machine cost is 1000 and its estimated life is 5 year its annual depreciation cost will be divided according to the year.

###### 2-VARIABLE COST:

Repair cost are v.high in developing countries and contribute significantly to the cost.

###### 3-LABOUR COST:

This can be evaluated from salary paid to the machine operator.

###### 4-FUEL AND LUBRICATING COST:

This cost also vary with the time

#### LAND LEVELING:

##### DISADVANTAGES OF UN LEVELED SOILS:

- ❖ Considerable amount of extra water is require to irrigate the high spots in field. High spots remain under irrigated whereas low spots are over irrigated.
- ❖ Due to uneven distribution of moisture over the entire field the germination of seed and crop growth is adversely affected resulting in poor crop yield.
- ❖ Field size to irrigate uneven field is very small which is not suitable for mechanical cultivation.
- ❖ Fertilizer uptake efficiency by plants is also adversely affected.: