Extract from

Module on Tractor Operator

Laser guided land leveler

Laser land leveler (Fig. 1.14) is used for leveling the field within certain degree of desired slope using a guided laser beam throughout the field. Unevenness of the soil surface has a significant impact on the germination, stand and yield of crops. Farmers also recognize this and therefore devote considerable time resources in leveling their fields properly. However, traditional methods of leveling land are cumbersome, time consuming as well as expensive. A laser-controlled land leveling system consists of the following five major components:

- **Drag scraper/bucket :** The drag bucket can be either 3-point linkage mounted on or pulled by a tractor. This system is preferred as it is easier to connect the tractor's hydraulic system to an external hydraulic by the 3-point-linkage system.
- **Laser transmitter :** The laser transmitter mounts on a tripod, which allows the laser beam to sweep above the field.
- **Laser receiver :** The laser receiver is a multi-directional receiver that detects the position of the laser reference plane and transmits this signal to the control box.
- **Control box :** The control box accepts and processes signals from the machine mounted receiver. It displays these signals to indicate the drag buckets position relative to the finished grade.
- **Hydraulic system :** The hydraulic system of the tractor is used to supply oil to raise and lower the leveling bucket.

Fig. 1.14 : Laser leveler

Working mechanism of laser leveler : The system includes a laser-transmitting unit that emits an infrared beam of light that can travel up to 700 m in a perfectly straight line. The second part of the laser system is a receiver that senses the infrared beam of light and converts it to an electrical signal. The electrical signal is directed by a control box to activate an electric hydraulic valve. Several times a second, this hydraulic valve raises and lowers the blade of a grader to keep it following the infrared beam. Laser leveling of a field is accomplished with a dual slope laser that automatically controls

the blade of the land leveler to precisely grade the surface to eliminate all undulations tending to hold water. Laser transmitters create a reference plane over the work area by rotating the laser beam 360 degrees. The receiving system detects the beam and automatically guides the machine to maintain proper grade. The laser can be leveled or sloped in two directions. This is all accomplished automatically without the operator touching the hydraulic controls.

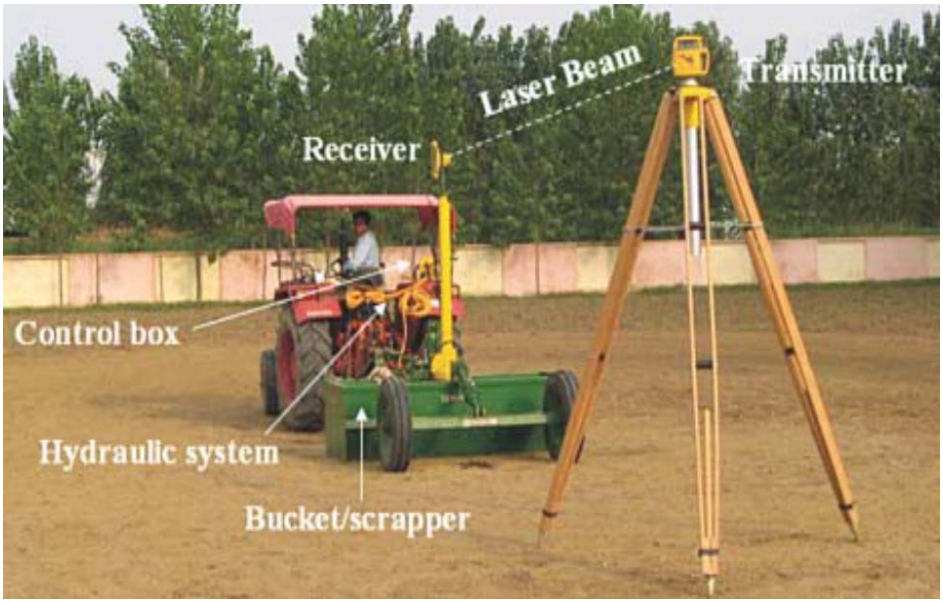

Fig. 1.15 : Working mechanism of laser leveler

REVIEW QUESTIONS

1. What is a land leveler? Describe its general features.
2. What is a terrace blade and how does it work?
3. Explain basic features of a laser guided land leveler.

1.2.6.3 Simple two wheel trailer

The simple two wheel trailer (Fig. 1.16) is commonly used by Indian farmers for shifting of harvested crop from field to threshing yard, for shifting of clean grain from threshing yard to market and for so many purposes in the villages.

Fig. 1.16: Two wheel trailer and hook for trailer attachment

1.2.6.4 Selection of proper implement for a specific function

Tractor drawn implements may be either of the trailed, semi-mounted or mounted type. A trailed implement is one that is attached to the tractor drawbar by a pin joint. A semi-mounted implement is one that is rigidly attached to the tractor and has a wheel or wheels to support part of its weight. A mounted implement is one that is attached to the tractor as an integral part. It is hydraulically controlled and is kept raised during transport.

According to the tillage operations, implements are classified as : ploughs, harrows, cultivators, hoes and clod crushers or levelers.

Mould board plough : To grow crops regularly in less fertile areas, the soil must be turned to bring nutrients to the surface. A mould board plough , which not only cuts furrows with a share (cutting blade) but turns the soil. A coulter could be added to cut vertically into the ground just ahead of the share (in front of the frog), a wedge-shaped cutting edge at the bottom front of the mould board with the landside of the frame supporting the under share (below-ground component).

Two types of mould board ploughs are widely used for farm operations. These ploughs are general purpose mould board plough and high speed mould board plough. General purpose M. B. plough is used where high pulverization is needed . It is used for deep ploughing. But it takes more time & draft to perform the field operation. High Speed M.B. plough is used for shallow ploughing. It doesn't pulverize more soil in comparison to general purpose plough, but it takes less time and draft to perform field operation.

M.B. ploughs may be either single action type or double action or reversible M. B. plough. In a single action plough, the first mould board plough could only turn the soil over in one direction (conventionally always to the right), as dictated by the shape of the mould board, and so the field had to be ploughed in long strips, or lands.

The reversible plough has two mould board ploughs mounted back-to-back, one turning to the right, the other to the left. While one is working the land, the other is

carried upside-down in the air. At the end of each row, the paired ploughs are turned over, so the other can be used. This returns along the next furrow, again working the field in a consistent direction. The two bottom reversible plough is a unique implement, which is directly mounted to the tractor. This is a hydraulically /mechanically operated basic implement for preparation of land. It is very useful for primary tillage in hard and dry trashy land.

Fig. 1.17 : Different types of mould board ploughs

Disc plough : The disk plow (Fig. 1.18) employs round, concave disks of hardened steel, sharpened and sometimes serrated on the edge, with diameters ranging from 20 to 38 inches (50 to 95 centimeters). It reduces friction by making a rolling bottom in place of a sliding one. Its draft is about the same as that of the moldboard plow. The disk plow works to advantage in situations where the moldboard will not, as in sticky no scouring soils; in fields with a plow sole; in dry, hard ground; in peat soils; and for deep plowing. The disk-plow bottom is usually equipped with a scraper that aids in pulverizing the furrow slice. Disk plows are either trailed or mounted integrally on a tractor.

Disc plow field operarion

Fig. 1.18 : Disc plough in operation

Cultivator : A cultivator (Fig. 1.19) is one of types of farm implement used for secondary tillage. Cultivators stir and pulverize the soil, either before planting (to aerate the soil and prepare a smooth, loose seedbed) or after the crop has begun growing (to kill weeds—controlled disturbance of the topsoil close to the crop plants kills the surrounding weeds by uprooting them, burying their leaves to disrupt their photosynthesis, or a combination of both). Unlike a harrow, which disturbs the entire surface of the soil, cultivators are designed to disturb the soil in careful patterns, sparing the crop plants but disrupting the weeds.

Spring Loaded Cultivator Rigid Type Cultivator

Fig. 1.19 : Different types of tractor drawn cultivators

Disc harrow : It is also a secondary tillage implement. It is widely used in the area of loamy soil (like UP, Punjab, Rajasthan etc). It takes very less time to conduct secondary tillage operation A disc harrow is a farm implement that is used to cultivate the soil where crops are to be planted. It is also used to chop up unwanted weeds or crop remainders. Disc harrow may be either trailed type or mounted type. Disc harrow is further classified as single action, double action, offset and tandem.

Fig. 1.20 : Different types of tractor-operated disc harrow

Rotavator : A rotavator (Fig. 1.21) is one type of farm implement used for secondary tillage. It stirs and pulverizes the soil, unlike a harrow, which disturbs the entire surface of the soil. Rotary tillers combine the functions of harrow and cultivator into one multipurpose machine. Rotavator is drawn as an attachment behind a four-wheel tractor. They are usually attached by means of a three-point hitch and driven by a power take-off (PTO). Rotary motion of the PTO is transmitted to the shaft carrying

the blades through gearbox and transmission system. A good seedbed and pulverization of the soil is achieved in a single pass of the rotavator.

Fig. 1.21 : Tractor-operated rotavator

1.2.6.5 Category 1 and category 2 implements

The basic difference between Category 1 and 2 implements refers to the dimensions of three point hitch pyramid. The three-point hitch most often refers to the way ploughs and other implements are attached to an agricultural tractor. The three points resemble either a triangle, or the letter A. The essential dimensions of hitch pyramid is given in Table 1.1 (refer Fig. 1.22).

Table 1.1 : Essential dimensions of three point linkage

Category	Hitch pin size, mm		Lower hitch point span, mm (L)	Mast height, mm (h)	PTO power at rated engine speed, kW
	upper hitch pin hole dia (d1)	lower hitch pin dia (D2)			
1	19.3	22	683	460	Up to 48
2	25.7	28	825	610	Up to 92

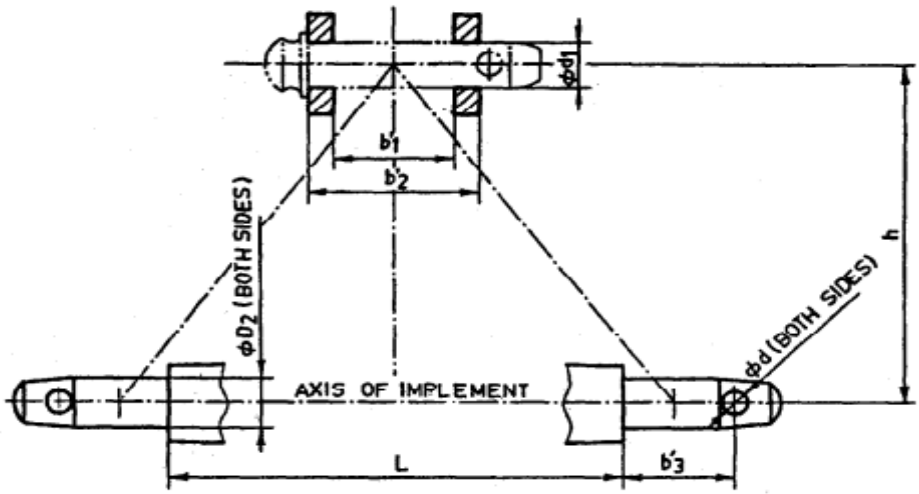

Fig. 1.22 : Implement hitch pyramid

1.2.6.6 Precautions before using implements and trailer

Precautions in use of implements

- In using plough or other implements, it should be properly hitched with the tractor.
- The implement should be set and adjusted properly.
- In the case of tractor drawn ploughs, adjustments are done on rear furrow wheels. When these are properly adjusted, there should be about 6 to 12 cm clearance between the rear side of the landside of the back plough bottom and furrow wall.
- Before using the implements, the implement should be checked for adjustment, sharpening of the cutting edges, repair of broken parts, replacement or repairs of the worn out parts and replacement of the missing parts like nuts, bolts, pins grease nipples etc.

Precautions in use of trailers

- Use an approved trailer for the tractor.
- Maintain correct tyre pressure on tractor and trailer wheels.
- Attach the trailer properly to the tractor by approved hitch mechanism. Before you attach the trailer to the tractor, you must know the different components of trailer and their utility, method of hitching and method of operation. Usually a trailer hitch or hook is provided on rear end of tractor by almost all the tractor manufacturers, where two trailers or four wheel trailers are attached.
- Never keep the drawbar of trailer above the center line of rear axle.
- Use adequate ballast on tractor front/rear to arrest front end lifting/to reduce wheel slip.

- Keep trailer brake in good condition.
- Keep all electrical lights on tractor and trailer in working condition.
- Avoid excessive loading.
- Avoid frequent braking. Anticipate and control with throttle.

REVIEW QUESTIONS

1. Mention difference between primary tillage and secondary tillage.
2. Which types of tractor drawn leveling equipment are commonly available for use?
3. Which type of tractor drawn trailer is mostly used by the farmers?
4. Differentiate between category 1 and 2 implements.
5. Mention difference between trailed, semi-mounted and mounted implements.
6. Name different types of mould board ploughs and mention their salient features.
7. Mention advantages of using disc ploughs.
8. Mention different types of tractor drawn cultivators used in farming.
9. List out different types of tractor drawn disc harrows.
10. What is a rotavator? How is it different from other tractor drawn implements?
11. What precautions are required in use of implements?
12. What precautions are necessary while using a trailer with the tractor?

1.2.7 Land Preparation Requirement and Land Opening

1.2.7.1 Select and suggest the implements as per the need of the farmer

For actual operation in the field, many factors will have to be taken in consideration which will dictate the type of machine as given below :

- Soil type
- Topography
- Hardness of the soil
- Previous cultivation
- Climate
- Size of field land access
- Type of irrigation
- Erosion control measures
- Time available

Brief details of commonly used implements are given under section 1.2.6.4. Selection of implements as per need of the farmer can be made based on the functions and use of these implements.

1.2.7.2 Calibration of seed drill/seed cum fertilizer drill

Almost at the time of manufacturing a seed drill or seed cum fertilizer drill, the manufacturer calibrates the drill and set the seed fertilizer adjusting lever accordingly. But most of the time it has been observed that the calibration is done only for few selected crops for a particular row spacing, which may cause a mismatch of your requirement. However you may calibrate your seed drill according to your requirement by following the method described below.

- First decide what crop you have to sow and accordingly fill the seed box with some quantity of seed and drain it a little by rotating the drive wheel by hand.
- Now confirm the recommended seed rate of the desired crop.
- Confirm the recommended row spacing of the crop.
- First set the row spacing for desired crop.
- Now count the number of rows in your seed drill and spacing of the furrow opener.
- Measure the circumference of the drive wheel of the seed drill (in meters)
- Now calculate the working width of the drill by following method.

  Working width = No. of rows x Spacing of the row (in meter)

  (Suppose there are 7 rows with row spacing of 30 cm (0.3 m) then the working width of the drill will be 0.3X7 = 2.10 m

- If the drive wheel moves 50 times, the seed drill will cover an area of -

  Area covered in 50 run = circumference of drive wheel (m) x drill width (m) x 50

  (Suppose the circumference of drive wheel is 1 m then the area covered by the drill in 50 run of the drive wheel = 1x2.1x50 = 105 sqm)

- Suppose the seed rate of desired grain is 100 kg/ha means 100 kg seed per 10000 sqm. That means for 105 sqm area required seed weight will be (100 X 105) / 10000 = **1.05 kg** (in all the seven furrow).
- When seed drill runs on field surface, then due to uneven surfaces the drive wheel skids about 10%, which means in making 50 run, it will travel a distance of 55 run . That means 10% more seed will be required to obtain the desired seed rate. It means (1.05 kg + 10% of 1.05 = 1.05 + 0.105) = **1.155 kg** seed will be required in 50 run of the drive wheel in all seven furrow openers.
- Now place the drill at clean and plane place (shed or field) . Arrange to lift the drive wheel by means of putting a stick or a rod, in such a way that you can freely rotate the wheel by hand. Put a **mark** by chalk stick, to observe one round.

- Remove the metering pipes from fluted roller end and put small bags on the delivery end of the fluted roller. Tighten the bags by thin pieces of ropes.
- Adjust the seed metering lever on the estimated position.
- Start the rotation of the drive by counting it . Stop the rotation as it becomes **50 rotation .** Remove the bags from fluted roller end and weigh accurately by a balance. If the bags weigh more than or less than desired quantity, adjust the seed metering adjusting lever and repeat the same procedure.
- The procedure will be repeated till you obtain the desired quantity of 50 rotation.
- The same process will be followed for calibrating the fertilizer rate.
- It is not necessary that after calibration of seed and fertilizer you will get accurate seed and fertilizer rate, there may be a difference of (+/-) 3%- to 5% .

1.2.7.3 Land preparation – primary tillage and secondary tillage

Refer to para 1.2.6.1

1.2.7.4 Puddling

Puddling of soil is one of the most common farm operations in paddy growing areas. Puddling usually refers to the churning of soil in the presence of excess water by means of a puddler or any other implement for that purpose. The main purpose of puddling is to reduce percolation of nutrients and water, to kill weeds by decomposing and to facilitate the transplanting of paddy seedlings by making the soil softer and smooth. Puddling is done in a standing water of 5 to 10 cm depth in the field which has already received one ploughing by the mould board plough.

In general, there are four main classes of tractor drawn puddlers, namely, tine tiller, rotating blade puddler, disc harrow and power rotary tiller. Among these implements, the disk harrow and power rotary tiller are in greater use. These equipment are operated by a field tractor which is equipped with cage wheels to reduce the sinkage of the wheels in the field.

(a) Using power tiller (b) Using tractor-operated puddler

Fig. 1.23 : Puddling operation

The peg type puddler is a tractor-mounted implement using the three-point linkage of a tractor of 35 hp or more. It consists of a frame made of mild steel angle sections on which the three cross bars and the cleats for the three-point linkage are welded in place. It is operated when the soil moisture is near the saturation level to obtain a fine tilth and good puddle to facilitate mechanical transplanting. For achieving better performance, the tractor is fitted with cage wheels to improve traction and achieve higher field capacity.