

Salahaddin University
College of Agricultural Engineering Sciences

Soil and Water Department

Second Stage

Lecture – 2 -

Land Levelling

By

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Stages of Land Levelling

Land grading is reshaping of the field surface to a planned grade. It is necessary in making a suitable field surface to control the flow of water, to check soil erosion and provide surface drainage.

When uneven land is irrigated, the high spots are watered too little and the low spots too much. This results in uneven crop growth, yield reduction, and loss of water. A properly graded land surface ensures unobstructed smooth flow of water into the land, without eroding the soil and ensuring uniform distribution of water throughout the field.

Land leveling operations may be grouped into three phases:

- Rough grading
- Land leveling
- Land smoothing

Rough grading

Is the removal of abrupt irregularities such as mounds, dunes and rings, and filling of pits, depressions and gullies.

Land leveling

= land grading = land forming = land shaping

It requires moving large quantities of earth over considerable distance

Land smoothing

Leveling operations leaves irregular surfaces due to dumping the loads. These irregularities are removed and a plane surface obtained by land smoothing which is the final operation in land leveling.

Criteria for land levelling

Land leveling is influenced by

A. The characteristics of the soil profile

- The soil profile is inspected to unveil the following to identify the depth:
 - a. Seem of gravel
 - b. Seems of sand
 - c. Bedrocks
 - d. Grading water
 - e. Alkali spots

B. Methods of Irrigation

a. Surface irrigation

1. Furrow irrigation
2. Basin irrigation
3. Border irrigation

b. Sprinkler irrigation

c. Drip irrigation

C. Slope under steep the depth of cutting will be large (Prevailing land slope)

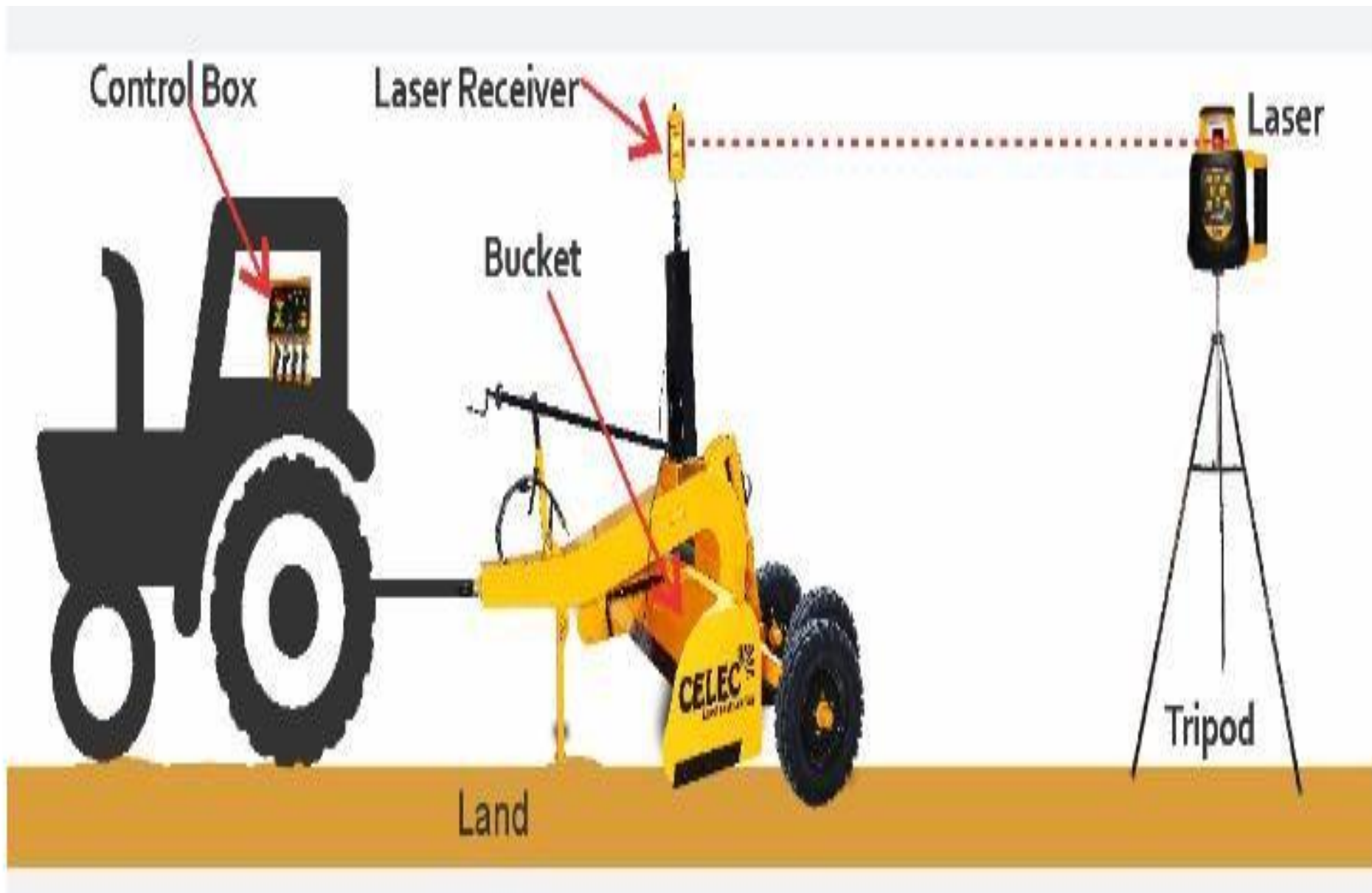
D. Type of crops (cropping pattern)

E. Rainfall characteristics

F. Other consideration

Land Levelling Methods

A precise land leveling improves irrigation and energy efficiency. This also reduces labor requirement for water application. A properly leveled land can be properly irrigated and excess water can be drained out. However, major topographical changes in the process of land leveling may reduce crop production in the cut areas or additional soils may have to be added in cut areas for improving soil fertility. Further farm machineries movement compact soil and disturb soil pores and thereby reduces water movement through side.

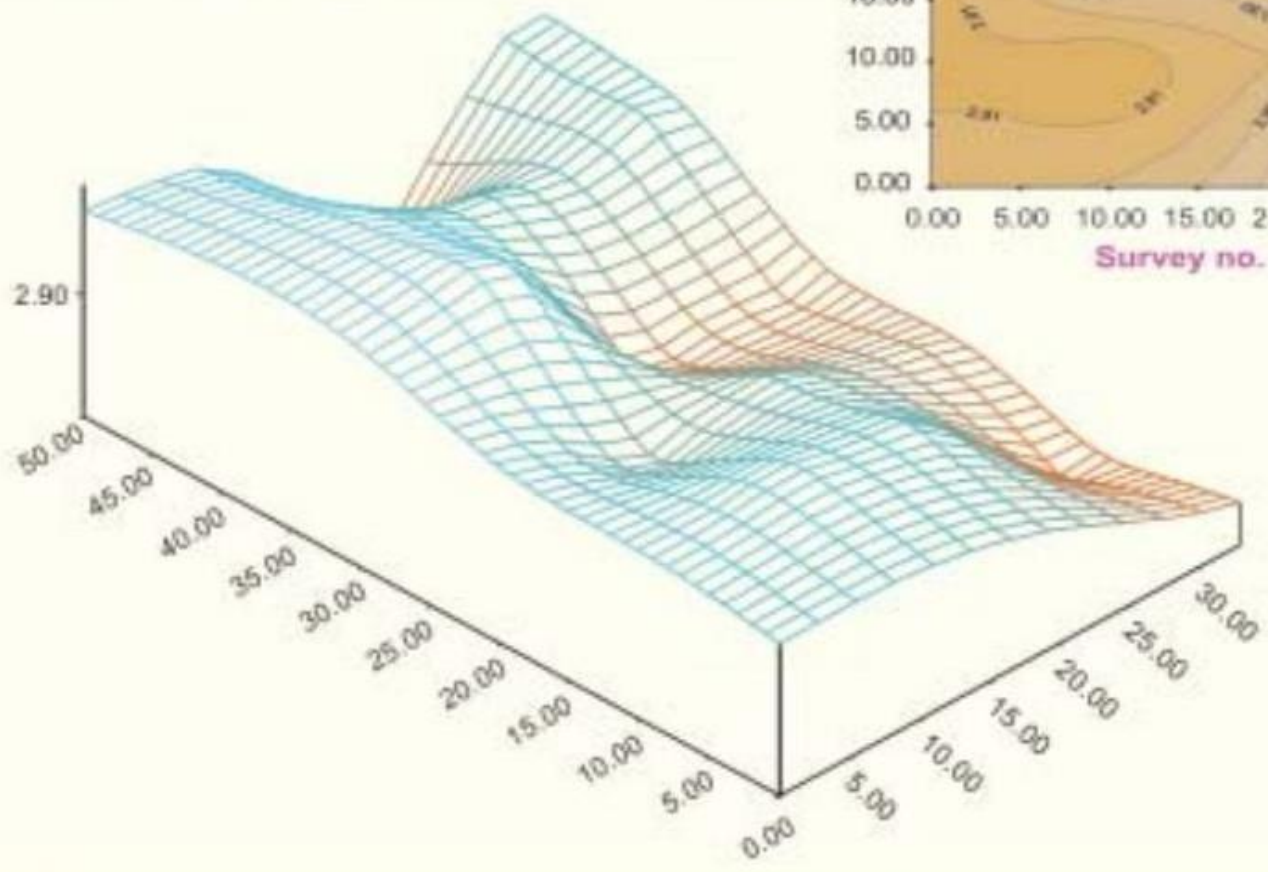
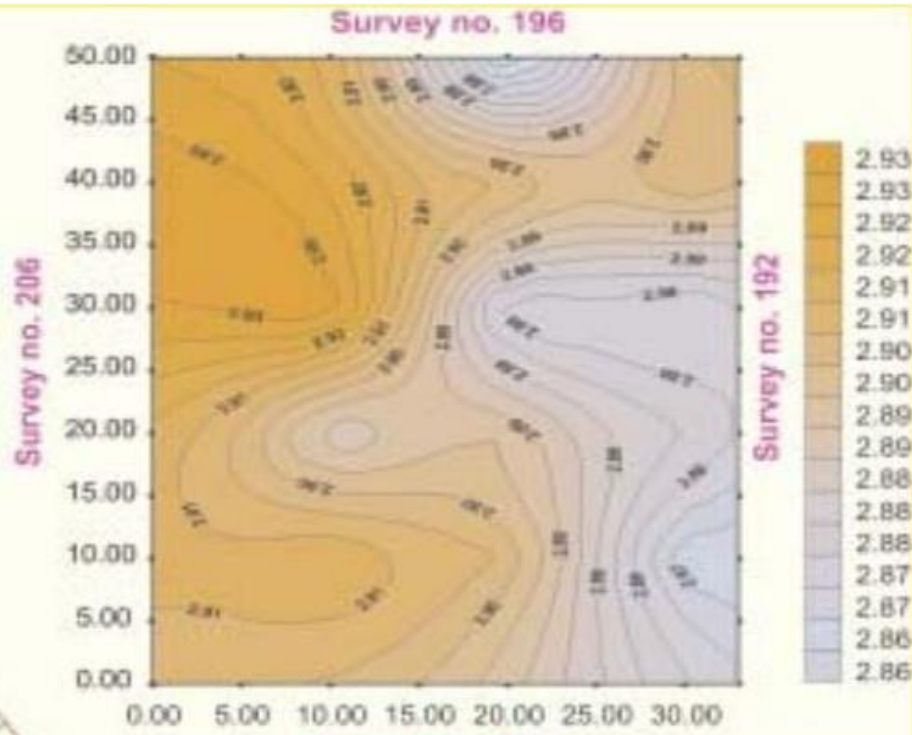


Hence it is essential to estimate locations and volumes of cuts and fills, maintain proper cut-fill ratio by minimally affecting the crop production and at the same time involving the less cost for land leveling. Hence for land leveling design should be done properly. There are several methods for land leveling design. These methods are: Plane method, Profile method, Plan inspection method and Contour adjustment methods..

1. Plane Method

The plane method is the most commonly used method of land levelling design. This method is feasible whenever it is required to grade the field to a true plane. The procedure involves first determining the centroid of the field as per the procedure explained and then determining the average elevation of the field.

This is obtained by adding the elevations of all grid points in the field and dividing the sum of elevations by number of grid points. Any plane passing through the centroid at average elevation will produce equal volume of cut and fill. Based on the longitudinal down field grade and cross field grade required for the field, the elevation of each grid points are computed from estimated centroid.



2. Profile Method

The profile method of land levelling design consists of plotting the profiles of the grid lines and then laying the desired grade on the profiles. With this method, ground profiles are plotted and a grade is established that will provide an appropriate balance between cuts and fills as well as reduce haul distances to a reasonable limit. It is usually well adopted to leveling design of very flat land with undulating topography on which it is desired to develop a fairly uniform surface relief. Using profile method the designer works with profiles of the grid lines rather with elevations.

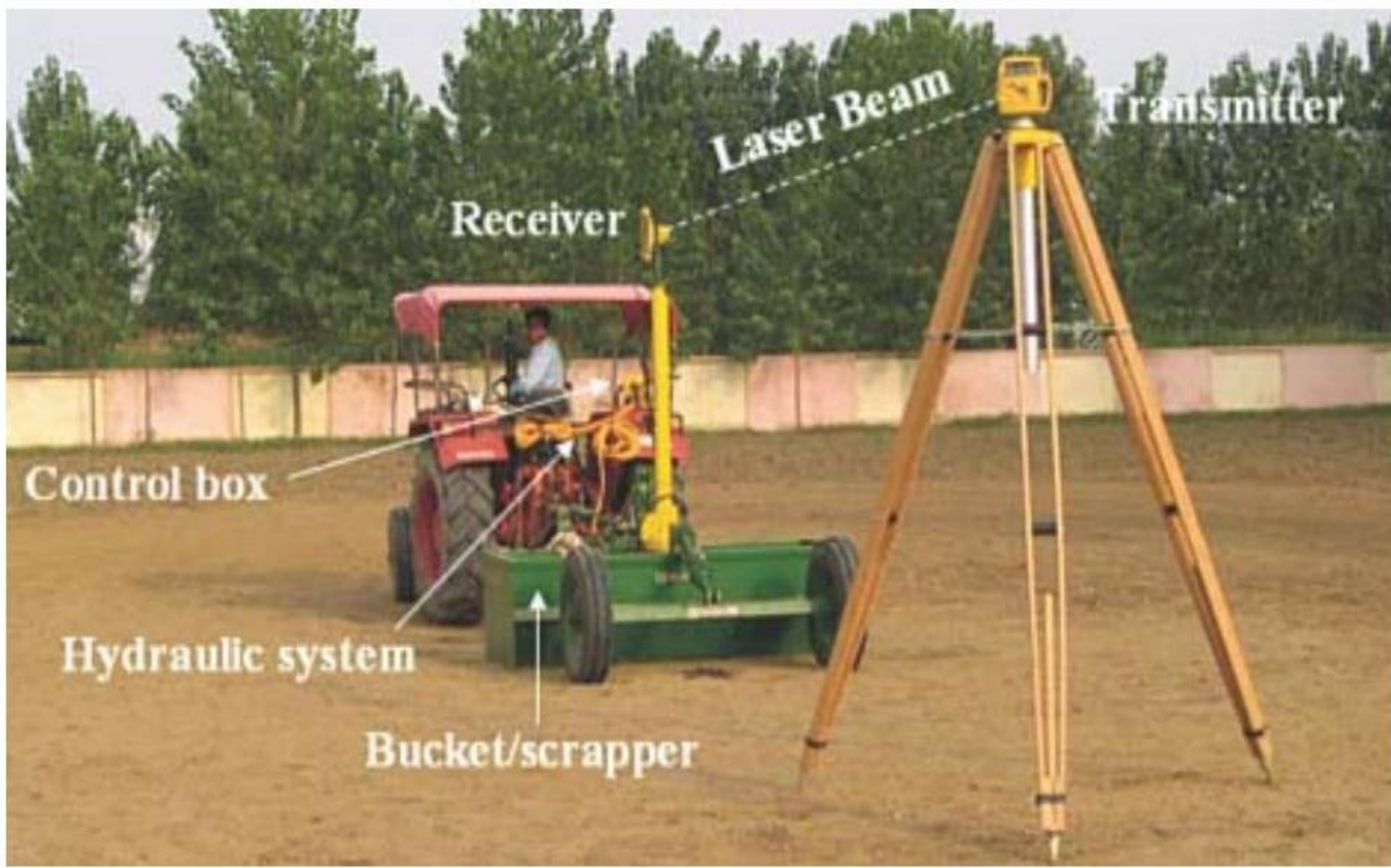
3. Plan Inspection Method

The plan inspection method is **a rapid method**. Although this method does not ensure minimum cuts and fills or the shortest length of haul, however it gives quick estimate.

This method is adapted to moderate flat land slopes. A proposed ground surface map is overlaid on the original contour map. Hence it involves contour adjustment using procedure. New contour lines are drawn using uniform slope and spacing between them.

4. Contour Adjustment Method

A balance between the cut and fill can be approximated by maintaining the proposed contour in an average position with reference to the original contour at the same elevation. Sum of the design cut and fills from the stake points are compared with total and then readjusted to obtain design levels. Contour adjustment method is adapted to smoothening of steep lands that are to be irrigated.



Laser Beam

Transmitter

Receiver

Control box

Hydraulic system

Bucket/scraper

Steps in Land Grading Design

The total design of grading of fields in a farm land generally involves **desk work** as well as **field work**. It may be mentioned that desk work is involved both before as well as after undertaking field survey. The various steps in the overall land grading exercisemay be summarised as follows:

A. Pre-survey Work (Desk Work)

- 1) Selection of irrigation method
- 2) Demarcation of field-plots in the layout
- 3) Selecting slopes appropriate for farming

B. Survey Work (Field Work)

- 4) Staking the plot
- 5) Taking block levels

C. Post-survey Works (Desk Work)

- 6) Topographic map preparation

7) Design of grading

i) Manual methods :

a) Contour adjustment method

b) Profile method

c) Plan inspection method

ii) Analytical method:

Least squares method

8) Finalization of cut-fill ratio and formation levels.

Equipment for Land Grading

A. Equipment Operated with Animal Power

B. Equipment Operated with Mechanical Power

A. Equipment Operated with Animal Power

- 1. Animal Drawn Buck Scraper**
- 2. Animal Drawn Bund Former**



Fig: 1(a)



B. Equipment Operated with Mechanical Power

- 1. Bulldozers**
- 2. Tractor Drawn Scrapers**
- 3. Elevating Scraper**
- 4. Bottomless Scraper**
- 5. Levellers and Floats**
- 6. Crawler Tractors**
- 7. Tractor Drawn Two Wheeled Automatic Leveller**