

Lecture 5 - Processes and Unit Operations in Mechanized Agricultural Land Clearing

5.1 Processes and Unit Operations

The processes and unit operations for mechanized agricultural bush clearing are outlined

As the following:

(a) Notification of availability of land: The first major step is for the farmer to know where land is available. This can be obtained through agents or land owners, In National Agricultural Land Development Authority, it is required that land owners (donors) should notify the authority of the availability of land and their willingness to give such land for mechanized agricultural bush clearing in writing through the Local Government Chairman.

(b) Site visitation and selection: The farmer then visits the site to observe the location, condition and suitability.

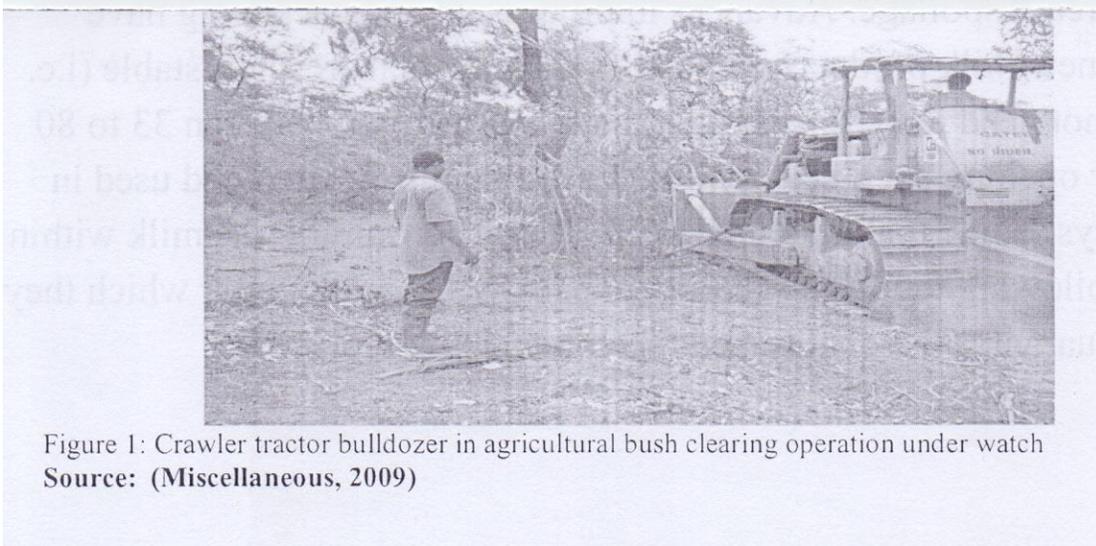
(c) Site evaluation: The site will be evaluated to obtain its suitability for crop production. This will involve surveys (perimeter, contour and soil to determine the nutrient status, to demarcate the farm and map out the roads, indicate permanent features such as rivers, valleys, hills, hanging cliffs, et cetera, show the topography of the land, depth to bedrock, drainage ability, percent slope, percent stoniness, surface stone and rock outcrops.

(d) Acquisition of land: the next step is to acquire the land and then follow necessary and legal steps to register it.

(e) Machinery sourcing and mobilization to the site - After the above operations, the next operation is to source for suitable machinery and then the mobilization to site for the clearing. Machinery can be obtained from road construction companies as is the case in Nigeria.

(f) Bush clearing, monitoring and inspection.

In the field, as bush clearing is going on, the operation is closely monitored by experts to ensure that proposed guidelines are adhered to (Figure 1).



5.2 Guidelines for Mechanized Agricultural Bush Clearing

The following guidelines are observed in bush clearing for crop production

The vegetation should be cleared in such a way that minimum disturbance is caused to the top soil.

In fact, the clearing should limit the loss of top soil from the area being cleared. This is to ensure that the top soil where the nutrients are contained are retained as much as possible.

All standing dry trees must be knocked down and all shrubs, stumps, large stones and other obstacles to the normal operation of farm machinery used for ploughing, harrowing and ridging must be completely removed.

Economic trees must as much as possible be left in place, but they should be at least 20 m apart.

Where there are clusters of such trees, the older ones that are spent should be cleared leaving only the ones that shall be identified by the field engineer or supervisor.

When a bulldozer is used for windrowing, a maximum depth of 80 mm and a maximum lateral movement of 1 m of the soil are allowed.

Windrows should be 120 m apart and the width of each should not be more than 4 m.

Land should not be cleared on slopes above 10%.

A band of between 5 m – 10 m of vegetation must be left along both sides of rivers and streams.

Under no circumstances should felled trees or shrubs be piled across or along water ways.

When uprooting trees using crawler tractor equipped with bulldozer, take care to control the fall of the tree to avoid breaking trees marked as economic or wind breakers.

Protective tractor mounted cabs should be used when extensive clearing operations are anticipated.

This will protect both the operator and the machinery and thus permit greater flexibility and increase operator efficiency.

5.3 Processes of tree felling (knockdown) using crawler tractor bulldozer

In Nigeria and in a number of countries in the tropics crawler tractor bulldozer is the commonest equipment for mechanized agricultural bush clearing. In absence of specialized agricultural bush clearing machinery farmers in these areas source and adopt this category of machinery. The machineries are sourced from road construction firms. Research has shown that under proper supervision, crawler tractor bulldozer can serve as agricultural bush clearing. The greatest challenge is experienced when the equipment is uprooting a tree and during windrowing. In order to ensure good clearing and thus achieve the objective of minimum disturbance to the top soil, the following processes are recommended to be followed.

In thick vegetation with trees that have diameters between 0.15 m and 0.3 m the machinery should be operated with the blade or chain or pusher raised as high as possible to gain added leverage (Figure 2) As the tree falls, the implement is backed up quickly to clear the roots. As the implement is lowered, the machine travels forward again to dig the roots (Figure 3).

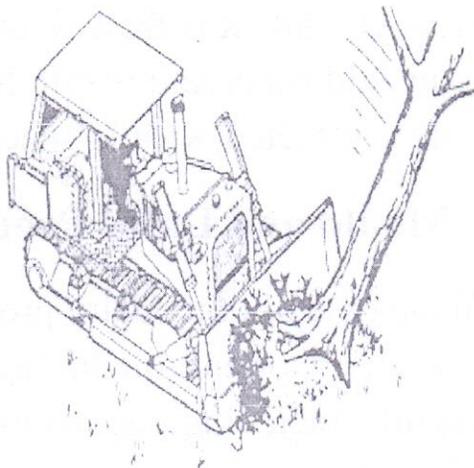


Fig 3: Crawler tractor traveling forward with the bulldozer to dig out tree roots

The process of removing large trees 1.00 m diameter and above is slower and more difficult. First, gently and cautiously probe the tree for dead limbs that could fall and injure the operator or other workers or damage the machine and/or the components. Then, position the implement for maximum leverage. Determine the direction of fall before pushing. The direction of lean is usually the direction of fall. When this is determined, the following steps are followed.

1. Opposite the direction of fall make a cut deep enough to cut some of the large roots as shown in Figure 4(a) (The process of felling a tree step I)
2. Cut side two as shown in Figure 4(b) (The process of felling a tree step II)
- 3 Cut side three as shown in Figure 4(c) (The process of felling a tree step III)
4. To obtain greater pushing leverage, build an earth ramp on the same side as the original cut.

The tree is pushed over as shown in Figure 4(d) (The process of felling a tree step IV) As the tree starts to fall, reverse the tractor quickly to get away from rising roots mass. After fall, fill the hole

created so that water will not collect in it. As the tree starts to fall, the operator should watch to

ensure that the tree does not fall on him and the machine. As these processes are going on, experienced professionals namely, agricultural engineer, soil scientist and technical assistants should be on the watch to ensure clearing including the tree felling operations are done in accordance with laid procedure.

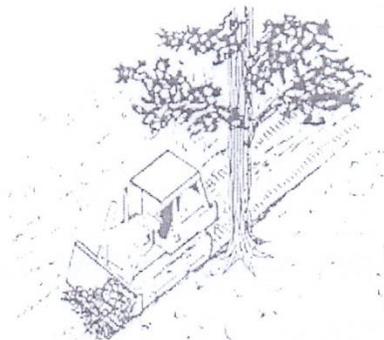


Fig 4a: The Process of Felling a Tree (Step 1)

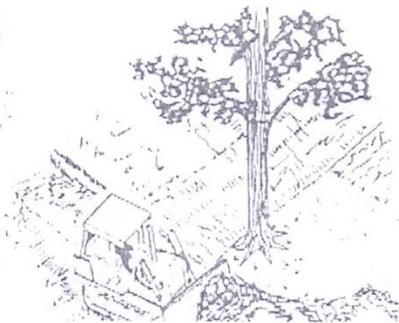


Fig 4b: The Process of Felling a Tree (Step 2):

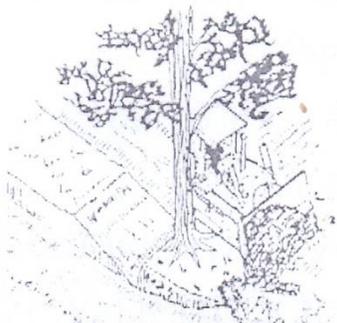


Fig 4c: The Process of Felling a Tree (Step 3): The Bulldozer Cutting Roots at the Side of the Tree

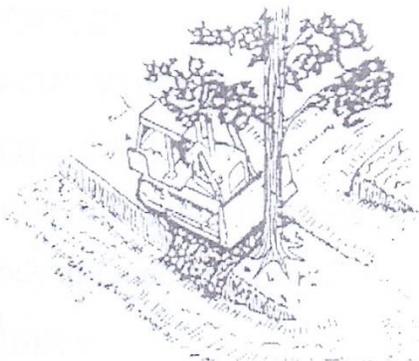


Fig 4d: The Process of Felling a Tree (Step IV)

2

5.4 Factors to Consider in Planning Integrated Land Development Project.

The factors to consider in planning integrated land development projects can be grouped into four

areas, namely: environmental, social or institutional, cost- price and end users.

5.4.1 Environmental factors

The environmental factors can be divided as follows:

- (i) Land: soils, topography, size and shape of land.
- (ii) Temperature: annual extremes and length of growing seasons.
- (iii) Water control: rainfall amount, and distribution, availability of irrigation, water, disruption of natural watersheds.
- (iv) Location: access roads, farm stead, market, electricity load centre and service areas.
- (v) Vegetative cover, type and density and possibility of re-growth after initial clearing.

The type of trees, vegetation, soil, and terrain of the site must be determined as accurately as possible. This could be done through climatic geological maps, intelligent reports, aerial and ground reconnaissance. The density of the trees is determined by conducting a tree count and recording the tree diameters at breast height which is taken at 1.37 m or 4.5 ft above the ground. Record also the species and number of trees.

5.4.2 Social or institutional factors

The social or institutional factors to consider in integrated land development are

- (i) The place accorded land in the overall scope of national development.
- (ii) Willingness and /or ability of the government to support agriculture through fiscal tax policy: adequate transportation facilities: favourable policies; on land tenure, land reform and settlement project development.

(iii) Willingness and /or ability of the government to support research interpret research findings and disseminate information on various aspects of land development.

(iv) Availability and willingness of the government to provide training at all levels to foster extension programme and to use mass media such as radio, television and print in helping to attain these objectives.

5.4.3 Cost - price factors

The cost - price factors referred to as economic considerations to be borne in mind in integrated land development operations are as follows;

(i) Return on investment. That is the price received by the farmer or rancher or processor on the crops or livestock he produces or processes.

(ii) Cost of input required. These include; land development, tools, hired labour, agro chemicals, seeds and seedlings, taxes on land, etcAvailability and cost of credit which may either be long term credit to finance land, construction of major buildings, machinery or intermediate credit to finance establishment of tree crops, major land development such as bush clearing and tillage,

(iii) Availability and cost of transport, storage, processing and market facilities.

(iv) Benefits available from the states such as subsidies, price support and assured markets.

5.4.4 The end user

Another important factor to consider is the ability of the end user (owner or manager of the project)

to make proper use of the developed land. Closely related to the end user's ability is the level of his specialized training in the area, of his venture, (crop production, reforestation programme, highway construction, etc). Moreover, success of a project be it large or small, depends on favourable cost/ price relationships, favourable environment, and owner or managers skills. Since a range of factors must be considered those involved in any land development projects a sufficient amount of information must be gathered before undertaking a project.

The equipment for mechanized agricultural bush clearing should be carefully selected. The selection is based on a number of factors which include availability of the equipment, cost of available machinery, size of land available, type of crop, type and density of the vegetation, tree rooting system, terrain and income level of the farmer.