

**\*SKILLS FOR COST EFFECTIVE  
SAWAH SYSTEMS DEVELOPMENT  
USING HYDRO-POWER TILLER**

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**POWER SOURCES**

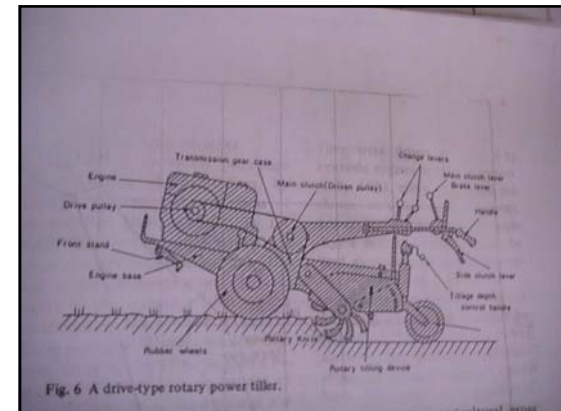
- The selection criteria are based on a number of factors including the following:
- The power requirement of the field operation
- The cost of purchase
- The cost of maintenance
- The cost of purchase of attached equipment
- The life span of the machinery
- Annual hours of operation
- The field capacity and efficiency etc

**POWER SOURCES CONTD.**

- **The source of power and matching tools should be:**
- a) adapted to allow efficient and speedy work with the minimum of fatigue;
- b) not injurious to man or animal;
- c) of simple design, so that they can be made locally;
- d) light in weight, for easy transportation (there are also considerable advantages when threshers, winnowers, and machines such as coffee hullers can be easily moved to where they are needed;
- e) ready for immediate use without loss of time for preparatory adjustments;
- f) made of easily available materials.

**Features Important for Selection of  
Power Tiller**

- Recommended power rating between 12 hp -15 hp.
- Brand testimony of power tiller due to long period of usage in some locality. Some power tiller brand acquires attributes of reliability. In areas where power tiller usage is not yet popular, the advice of mechanization expert is vital.
- Operational safety level and ergonomics. Usage of the machine should cause neither permanent nor temporary damage to the person of the operator and the environment.



- Climatic adaptability of the machine. Power tiller intended for use in a particular locality should match with climatic condition in the area of intended use, such as temperature, humidity and rain pattern.
- The machine must be serviceable and replacement parts must be available locally.
- The machine should be versatile with other machine and accessories.
- Delivery Check: It is important to check the machine and all accessories at the point of delivery to ensure compliance with specification and avoid misfit of implements.

### Selection of Accessories

- Often, manufacturers of single axle tractors design an array of implements to fit the tractor for a variety of use. Depending on manufacturer's design, the single axle tractor has been applied to, among several uses.
- Ploughing
- Ridging
- Puddling
- Leveling, Smoothing
- Water Pumping
- Milling
- Transportation

### SELECTION OF ACCESSORIES CONTD.

- For application in Sawah technology for rice production in inland valley ecosystem in Nigeria, the power tiller should be equipped with:
- Cage wheel that is specially designed to avoid sinking in the swamp.
- Power plough is especially valuable for a new basin and under controlled soil moisture.
- The rotary cultivator is the most versatile accessory applicable to cultivation in Sawah technology

### Skills for Operation Of hydro power tiller

- Experience has proven that crank starting option is preferred for power tiller used in Sawah as there is problem associated with the battery unit maintenance across the off-season. The stages involved in starting the power tiller include:
- Disengaging both movement and rotary cultivator gear
- Set the throttle lever to the "start" position.
- Hold down the decompression lever while simultaneously hand cranking the power unit.
- As the crank speed reaches a threshold for starting, the decompression lever is released, thus the power unit start running. The hand held crank is automatically ejected as the operator hold firmly onto it.
- Care must be taken not to hold the crank lever loosely at the point of starting as failure to eject it could result in the running engine turning it to a missile.

### Appropriate Speed and Gear Selection for Different Activities

- The power tiller often has three sets of forward and one reverse gear in high speed and low speed options. Determination of the right selection of gear is highly subject to the prevailing situation of use of the power tiller. Mastery of this decision can be achieved through practice and frequency of usage.
- A general guide suggests the use of low speed gear (high torque) for cultivation works and difficult terrains while high speed gears are better suited for transportation.
- Gear
- Operation
- 1
- For taking the power tiller out of rest
- 2
- For high torque requiring operation of ploughing, puddling and leveling
- 3
- For less tedious exercise like smoothing
- 4
- For reverse motion

### Conducive Environment: Solid Bodies Obstruction and Depression/Deep Slopes:

- Before embarking on a tillage operation with a power tiller, it is important that the operator carry out a thorough inspection of the field to ensure it is free of solid body obstructions and depressions. |Where such cannot be removed it must be noted or flagged. Careless entry into a field could lead to avoidable damage to the tractor and/or injury to the operator.

### Field Preparation for Effective Tillage

- For effective tillage to occur, the field should be cleared of stumps and herbicides applied to clear weeds. Standard bunds are made. In the case of puddling the field will be flooded with water.
- Basically, field intended for tillage operation must be well prepared to ensure success of this operation this will include;
- Weed clearing: The use of herbicide and crushing of dead weed to hasten decay.
- Physical structures construction, e.g. Building of bunds and irrigation canals.
- Moisture conditioning depending on the nature of operation, there is need to vary water availability in the basin ploughing for example needs no flooding while subsequent operations of puddling, leveling and smoothing need ample supply of water. Basin water level needs has been researched to achieve best results.

### Field Preparation for Effective Tillage

- Water level required
- 
- 0cm
- 5cm
- 3cm
- 2-1cm
- 
- Failure to observe adequate moisture conditioning will result in several difficulties on the field.

Operation  
Ploughing  
Puddling  
Levelling  
Smoothing



### *Ploughing:*

- Ploughing operation is essentially recommended for opening new fields before flooding. The success of this operation depends largely on operators expertise. It is aimed to achieve weed buried and soil inversion.

### *Puddling:*

- This operation involves the pulverization of a mixture of soil and water to create a fine slurry bed for rice transplanting. The rotary cultivator is used for this operation. Recently, a cultivator bar is used for this operation.

### *Levelling:*

- By attachment of a wooden implement made of a plank base and a pair of rising handle attached by a rope to the handle shafts of the power tiller. It is operated by holding the two handles perpendicular to the flooded basin, the plank at the base of the handles does the soil movement to achieve leveling in a basin while the power tiller pulls the implement.

### *Smoothing*

- : This operation is a further improvement of levelling where the leveler is allowed to lie flat and trail behind the power tiller operator to achieve further evenness on the surface where the surface water is evenly distributed.

### Plough Operation and Ballast Weight of the Operator

- Ploughing as a primary tillage operation is important to achieve turning of the top layer of the soil and burial of weed and stubles left over after harvesting. This operation can be achieved by the means of a plough implement attached to the power tiller. This involves the detachment of the rotavator. Effective use of the plough implement can only be achieved when the operator seat and rudder pedals are coupled to the plough implement.
- The weight of the operator provides ballast against the sideways thrust created by the soil cutting action of the plough disc or mould board.

### Clogging of Cultivator Tines and Cage Wheel

- Occasionally the cultivator tines and/or cage wheel get clogged with either weed or heavy soil load. This situation can be due to puddling under inadequate water supply/land preparation overcome this situation by ensuring basin water level is not below 5cm at puddling and depth of cut is adjusted to medium. Tough weeds can be removed by cutting through the mass carefully around the rotavator shaft and cage wheel with a cutlass or knife being careful to carry the mass away from the basin onto the adjacent bunds these interventions can be done only by first putting off the power tiller.

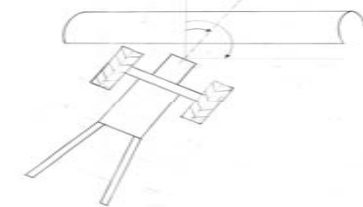
### Depth-of-Cut Adjustment in Rotary Cultivation

- In the application of the rotary cultivator for puddling, the efficiency of the operation can be affected by the depth of cut adjustment. Too deep cut will unnecessarily overlabour the engine and cause the tractor to sink, a superficial cut will prolong the number of passes required to achieve sufficient puddle depth and loss of time and fuel.

### Effective Intra-Basin and Inter-Basin Movement of Power Tiller

- In a properly constructed Sawah field, demarcation basin should not pose barrier for inter basin movement. To effectively cross a well constructed basin;
- Disengage the rotary cultivator gear. This will prevent disintegration of the bunds at crossing.
- Ensure a diagonal orientation of the Power Tiller with respect to the bund at least with an angle of 45° to the horizontal. This ensures that the cage wheels cross the bunds one after the other but not at the same time and also prevent the cultivator getting caught in the bund.
- .

**Fig 1: Power tiller Orientation for crossing of bund**



- This orientation prevents the tractor chassis from getting caught on the bund; prevent loss of traction and digging by the cage wheel.

### **Size of Basin and Efficiency of Power Tiller Operation in Sawah Technology.**

- Fragmentation of a field reduces efficiency of mechanization whereas Sawah development sometimes necessitates reduction of basin size in order to make leveling and water control easier. It becomes necessary to strike a balance between these two extremes. *This is a critical skill that must be developed.* There are no fast rules in the determination of basin size.
- Studies of machinery systems management revealed that the other factors affecting efficiency of mechanization include:
  - Operators expertise level and
  - Soil conditions

### **Clogging of Cultivator Tines and Cage Wheel**

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### **Maintenance And Repair Of Power Tiller**

- This involves:
  - pre-operative check,
  - appropriate application and
  - Post-operation check.

**•THANK YOU FOR  
YOUR ATTENTION**