

Review Article

DIFFERENT ATTACHMENTS OF A POWER TILLER: A REVIEW

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Abstract: Power tillers have been introduced in the country from the 1960s. Most models of the power tiller being manufactured in India, is provided with a front or rear mounted powered rotary unit for forward movement as well as for tillage operation. The power tillers are being used for seedbed preparation and inter culture operation for wide spaced row crops like sugarcane, cotton etc. This paper presents about working of a power tiller and their different attachments.

Keywords: Tiller, Tillage, Seedbed, Tractor, Power.

INTRODUCTION

Agriculture is the backbone of Indian economy as it provides direct employment to about 69 % of the working people. Being the largest source of employment and income to millions of people, it also provides a vast market for our industrial products. The country has made a three-fold increase in food grain production from a level of about 55 million tonnes in 1970-71 to 1930 kg/hectare in 2010-11 primarily on the back of increasing penetration of irrigation facilities, hybrid seeds and farm mechanization (Mandal et al., 2016).

The growing shortage of agricultural labour and rising wage rates are not the only reasons for the accelerated mechanization of farm operations. Factors such as timesaving, efficient input application, transportation of farm inputs and produce, and reducing drudgery also stimulate demand for farm machines. The development and mass production of multi-utility mechanized devices to suit the requirements of farmers important for the growth of mechanization in India.

Power tiller is a prime mover in which direction of travel and its control for field operation is performed by the operator walking behind it. It is also known as hand or walking type tractor (BIS, 2002). Power tiller is walking tractor mostly used for rotary cultivation in puddle soil and can be replace the animal power more effectively and help in increasing demand for human labour. The small and marginal farmers form major user for custom hiring of power

tiller. Power tiller is preferred in small land holding farmer for all farm operations like puddling and preparatory tillage. The machine provides opportunities for self employment in rural areas.

The power tiller is a multipurpose hand tractor designed primarily for rotary tilling and other operations on small farms. While in operations, an operator walks behind to maneuver it. It is also known as a garden tractor, hand tractor, walking tractor or a two wheel tractor. Non-availability of matching equipment for different farm operations limits the versatility of the power tillers. Implements initially offered with the power tillers included rotavator attachment, trailer and in some cases a plough and ridger. The initial introduction of power tillers was without a complete range of matching equipment (Kathirvel et al., 2000).

The adoption of power tillers by the farmers for carrying out farming operations is low when compared to tractors. The concept of power tiller came to the world in the year 1920. The first country to use power tiller on large scale was Japan. The first successful model of power tiller was designed in the year 1947. During the year 1950 to 1965 the production of power tiller increased rapidly. Power tiller was introduced in India during 1963. Power tiller is a walking type tractor. The operator trails behind the power tiller, holding the two handles of tiller in his hands. Power tiller is also called as a single axle walking type tractor, though a seat is provided in some designs.

Now-a-days some models of power tiller have an optional riding facility. Power tillers have been especially designed and developed for use on small or medium farms where four wheel tractors are not easily available. Although power tiller is mainly used for seedbed preparation in low land paddy fields. Power tiller is also used as a power source for other agricultural operations such as seed bed preparation, sowing and fertilizer application. Tillers are also useful in interculture in wide spaced row crops (more than 1.0 m row to row spacing) and harvesting of cereal crops under upland conditions including transportation of farm products and power source for stationary farm operations. Lightweight tillers are being used very recently. The most of the power tillers being manufactured in India is provided with a rear mounted powered rotary unit for giving forward movement as well as tillage operation. Special attention is necessary for maintaining such tillers.

Power tillers occasionally termed as walking tractors or are sometimes called by other names such as single axle tractor, hand tractor, etc have been conceived as an equipment to prepare seedbeds with rotary tillers and for transportation. They have limitations in their use for traction work due to the low drawbar power per brake horsepower of the engine (Mandal and

Maity, 2013). The two-wheel tractor with different attachments can accomplish many kinds of farm work like tillage, harvesting, planting and transportation. When a tillage implement is attached to a two-wheel tractor, it is called power-tiller. Two wheel tractors are categorized either as professional farm use tractors called agricultural tractors, or hobby-use tractors called garden tractors.

Small tractors are suitable to agricultural conditions and farming requirements in most areas. As the small tractors have the advantage in size, light-weight and good maneuverability. Small tractors are suitable to the level of mechanical knowledge and management in rural areas. The structure of small tractors is simple and this makes the operation, maintenance and repair easy (Ademiluyi et al., 2008).

OPERATION

The operation of a power tiller involves walking behind the machine on a tilled or puddle land continuously for hours. During peak seasons of seedbed preparation, farmers operate power tillers even for more than 8h a day. The operator has to guide/control the forward movement of the machine by actuating hand clutches provided on each handle or sometimes by pushing/pulling the handles towards sides. The operator sometimes lifts the rear portion of the machine to take sharp turns at the headlands. The main clutch is a lever on the handle. The lever can be shifted to on or off position while operating in the field. When the lever is shifted to on position, the power from the engine is transmitted through the main clutch to the various parts of the power tiller. When the lever is shifted to off position the power from the engine is cut-off from the rest of the transmission.

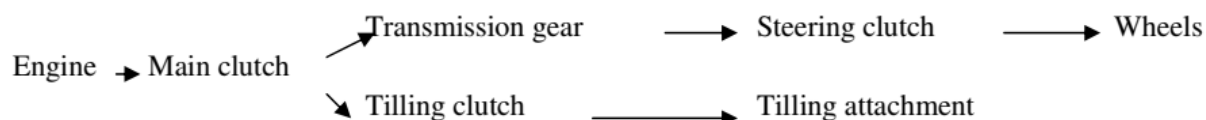
COMPONENTS OF A POWER TILLER

A power tiller consists of the following main parts: (1) Engine (2) Transmission gears (3) Clutch (4) Brakes (5) Rotary unit.

All the power tillers are fitted with an I. C. engine. At present, most of the power tillers are fitted with diesel engine. The makes like Kubota, Mitsubishi, and Sarachi have used diesel engine in India.

POWER TRANSMISSION IN A POWER TILLER

For operation of power tiller, the power is obtained from the IC Engine, fitted on the power tiller. The engine power goes to the main clutch with the help of belt or chain. From main clutch, the power is divided in two routes, one goes to transmission gears, steering clutch and then to the wheel. The other component goes to the tilling clutch and then to the tilling attachment. The flow diagram for transmission of power is as below:



V-belt is usually used to transmit power from the engine to the main clutch, because V-belt has very high efficiency and it works as a shock absorber also. The power tiller remains an essential mode of power for farming operations, especially in land preparations. The machine saves time and improves the land productivity. Wetland tillage in rice land cultivation is the main operation for which this machine is employed.

ATTACHMENTS ON A POWER TILLER

Several attachments are made on a power tiller because this machine provides enormous amount of power at a low cost. The attachments made on a power tiller and their operations are given below:

1. Cage Wheel


Puddling operation is done before transplanting the paddy seedlings. For puddle field operation power tiller is fitted with lugged wheels or drum type cage wheels depending upon the soil conditions after removing the rubber tyres for better traction. Rotary is fitted with curved tynes. Tail wheel is also to be replaced with tail wheel float for adjusting the depth. Minimum two puddling operations are required and at least 8-10 cms of water should be available in the field for best puddle and proper leveling of the field.

	<p>Features</p> <ul style="list-style-type: none"> •Decreases load on tiller •Helps to improve traction performance •Easy to fit •Cage wheel with float is provided
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2. Plough

	<ul style="list-style-type: none"> • Suitable for ploughing virgin land which is not tilled for long period. • Tills the soil which has deep roots, unwanted plants, shrubs and weeds. • Best for land preparation
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3. Extension wheels

	<p>Power tillers fitted with a shorter rotary (340mm) and extension wheel is used for inter-cultivation operation for weeding and loosening the soil in Sugarcane fields</p>
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4. Water Pump

	<p>Domestic Water Pump – To pump water from irrigation canals, rivers and wells, etc., Self-Priming Pump – Self priming pump with tanker can be fitted for cleaning septic tanks, clogged drainage, community wells etc.,</p>
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Technical specification:

Suction Head (Height)	25 feet
Delivery Head (Height)	25 - 30 feet
Discharge	440 ltr/min
Average Fuel Consumption	1.25 to 1.5 ltrs / hr


5. Potato Digger

	<p>A Special attachment used for harvesting potato</p>
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6. Tyne Cultivator

	<p>Five tyne cultivator fitment is commonly used as a secondary tillage equipment mostly in dry land for loosening the soil, removal of crop roots, weeds and for inter cultivation in orchards etc. A little moisture in the field increases the tilling efficiency.</p> <p>Features</p> <ul style="list-style-type: none"> • High strength & rigidity • Tough in construction • Depth control adjustment screw
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7. Seed Cum Fertilizer Drill

	<p>This is an exclusive attachment fitted to the Tiller after removing rotary assembly.</p> <ul style="list-style-type: none"> • It is used for sowing seeds and spreading of fertilizer in a row. • It consists of separate boxes for seed and fertilizer, a shoe type furrower and a spliced ground wheel. • It is suitable for sowing seed of Wheat, Soya Bean, Bengal Gram etc.,
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Technical specification:

Field Coverage / Day	1.25 to 2.25 acres
Average Fuel Consumption	1.25 ltrs / hr
Working Width	660 - 900 mm


8. Sprayer Unit

	<p>The sprayer is used for spraying pesticides and insecticides to avoid pests in following areas:</p> <ol style="list-style-type: none"> 1) Coconut 2) Chiku 3) Pomegranate 4) Grapes 5) Guava 6) Banana 7) Papaya 8) Mango
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9. Slasher cum Insitu Shredder

	<p>For shredding vegetable residues of brinjal, chillies, bhendi, etc. left after harvest and parthenium, etc.</p>
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10. Ridger (Furrower)

	<ul style="list-style-type: none"> • Ridger cuts and turns the soil in two opposite direction for making ridges. The Ridger is used for making ridges for row crops such as Sugercane, Potato, chillies, tobacco, banana etc. as well as for opening furrows for water flow. • The ridger should be used when the soil is slightly moist and used only after tilling the land once or twice. • The Ridger is fitted on the Rotary assembly with the help of a special bolt & nut.
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Technical specification:

Field Coverage / Day	1 to 1.25 acres
Average Fuel Consumption	1.5 to 2 ltrs / hr
Depth of Furrow (adjustable)	250 to 300 mm (10 - 12 inches) max
Width of Furrow (adjustable)	375 to 450 mm (15 - 18 inches) max

11. Axial Flow Thresher

	<p>Key Benefits</p> <ul style="list-style-type: none"> • Ideal replacement for manual method of threshing. • Post threshing the grains can be collected in a tray / bag. • Grains come out cleaned after passing through a sieve and fan. • Threshers are fitted with pneumatic tyres for easy transportation. • A platform is provided for a person to stand and feed. • Blowers are made available on request for very fine cleaning.
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Features:

- Straws are thrown out to 4.6 to 7.6 meter away with the help of a powerful fan.
- These can be collected in gunny bags or directly into a trailer.
- Threshers are fitted with 6x16 pneumatic tyres for easy transportation.
- A platform is provided for a person to stand and feed.

Technical specification:

Grain Output	1500 kgs / hr
Average Fuel Consumption	1.5 - 2.25 ltrs / hr

12. Reaper

	<p>A reaper attachment is used for cutting of crops at harvest time.</p> <p>Key Benefits</p> <ul style="list-style-type: none"> • Reaper fitted with the tiller is the best replacement for manual reaping. • Saves labour & time for cutting the crops. • Very easy to operate the reaper fitted with the tiller. • The cut crops are carried to one side of the tiller operator by a conveyor belt.
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Features:

- Reaper fitted at the front of the tiller is driven through a belt connected to engine pulley.
- Reaper cuts the crop 5 ~ 7.6 cms above the ground level.
- Width of the cut is 120 ~ 150 cms and is very economical in operations.
- Cut crops are collected manually.

Technical specification:

Field Coverage	0.35 to 0.5 acres / hr
Average Fuel Consumption	1.5 - 1.75 ltrs / hr

13. Leveler



14. Seat


	<p>Suitable for long period of operation in field.</p>
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15. Cultivator

	<p>Five types cultivator can be easily attached with Power tiller with help of Hitch bracket. Five tye Cultivator fitment is commonly used as a secondary tillage equipment mostly in dry lands for loosening the soil, removal of crop roots, weeds and for Intercultivation in orchards etc. A little moisture in the field increases the tilling efficiency.</p>
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Field Coverage / Day	2.5 to 3 acres
Average Fuel Consumption	1.25 to 1.5 ltrs / hr
Depth of cut	100 to 150 mm (4 - 6 inches)
Width of cut	600 mm (24 inches)


16. Two Share Plough

	<ul style="list-style-type: none"> • Has two shares to plough tilling in unidirection. • Coverage is twice compared to reversible Mould Board plough. • Suitable for ploughing virgin land which is not tilled for long period. • Tills the soil which has deep roots, unwanted plants, shrubs and weeds.
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Technical specification:

Field Coverage / Day	1 to 1.5 acres
Average Fuel Consumption	1.5 to 2 ltrs / hr
Depth of cut	200 to 250 mm (8 - 10 inches)
Width of cut	300 mm (12 inches)

17. Shorter Rotary (340mm)

	<ul style="list-style-type: none"> • Power Tiller fitted with a shorter rotary (340 mm) and extended lugged wheel is used for inter cultivation operation for dweeding and loosening the soil in Sugar cane fields. • A smaller furrower specially designed for Sugar cane field, can be used for bund formation which also helps in irrigation. • After Sugar cane harvesting, shorter rotary can be used for removing stubbles. • The stubble is pulverised and is mixed with the soil thereby forming organic manure.
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Technical specification:

Field Coverage / Day	1.5 to 2 acres
Short Rotary Width	340 mm (13 inches)
Attachment:	
1. Smaller furrower	1 No.
2. Extended lugged wheel	1 Pair
No. of tynes	10 Nos.
Average Fuel Consumption	1.5 to 2 ltrs / hr

18. Trailer



Trailer of 1.5 tons capacity can be fitted for transport of goods.

Type of Trailers:

- Standard
- Mechanical Tipping
- Hydraulic Tipping
- Garbage trailer for collection of Garbage & Transportation
- Water tanker of capacity 1000 ltrs can also be fitted to
- Power Tiller for carrying drinking water

Technical specification:

Capacity	1.5 tons
Type	Non Tipping / Tipping
Accessories Required	Hitch Bracket Assembly Handle Weight Assembly
Average Fuel Consumption	1.0 to 1.25 ltrs / hr

19. Power Tiller Operated Generator



It can be used as a generator when off season like a prime mover. The Generator can be used as:

- Submersible Pumpsets
- Water Pump
- Domestic Requirements

Generator Capacity-7.5 kVA

Average Fuel Consumption-1.5 to 1.75 ltrs / hr

20. Auger Digger



Attachment used for making holes varying from 6 – 8 inch in diameter and 18 x 24 inch deep in – with 15 – 20% moisture soil. This is mostly used for planting of Banana, Papaya, Mango, Pomegranate, Guava and Chiku.

Technical Specifications

Capacity	12 – 15 holes/hr
Average Fuel Consumption	1 ltr / hr

CONCLUSION

The power tiller is capable of primary and secondary tillage operations and is most suitable for operations in hilly regions, wet conditions and for small holdings. Given the right set of implements and attachments, the power tiller is capable of performing most of the field operations in the intensive cultivation. The light weight of power tiller is a favourable factor for working in wet and dry land conditions. External attachments can be made on the tiller depending upon the nature of work. So, the tiller can be used as a multi-purpose machine.

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