

Original Research Article

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Performance Evaluation of Tractor Operated Ridge Plastering Machine

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ABSTRACT

The decrease of rural population has increased in the recent past which led to feed the growing urban population, for which there is a need to increase the productivity of agriculture has become an essential feature in stepping towards sustainability. Presently, the untilled soil near the bunds and corners of the field are prepared manually which is consuming more time and energy. More over manually made bunds not properly aligned and compacted, and not last for long causing rodent problem. The performance of tractor drawn ridge plastering machine was evaluated in the field conditions at FIM, Scheme, Rajendranagar, Hyderabad, Telangana in sandy loam soil with a moisture content of 13.87 % (db). The machine can be operated with 40-70 hp tractors. The attachment weighs about 390 kg with 1.62 m length, 1.66 m width and 1.13 m height. The hydraulic power of the tractor is used to change the direction of operation. The machine has an eight-tine rotavator, a leveller, a rotating disc of 700 mm diameter and a 20 mm long roller. The rotavator pulverises the soil, the leveller levels the soil, and the rotating disc trims the bund and plasters it with pulverised soil. The roller attached to the rotating disc compresses the soil. During the field study it was observed that, the field capacity of the machine was 1000 m per hour at an average speed of 1.0 km/h with the height and width of bund was 25 cm and 45 cm respectively. The angle between ground and the side wall of the bund is 120°. The fuel consumption of the machine was 4 l/h. The cost of operation of the machine observed was Rs. 712/hr. The cost saving was Rs.2248/- over conventional method. This technology will save the energy and time involved in field preparation. It will reduce the drudgery and labour. it also reduces the rodent problem due to clean, straight and plastering type compacted bunds when cut with the rotary plough for bund side cutting.

Keywords

Ridge plastering machine, Rototiller, Rotating disc and leveler

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Introduction

Agriculture, which is the mainstay of the Indian economy, contributes about 18 percent of the national income and provides

employment to more than 50 percent of the population. Due to the domestic growing population and increasing disposable incomes, there is strong demand for food grains including cereals, fruits and vegetables.

Agricultural mechanization using efficient machines improves the utilization efficiency of inputs like fertilizers and agro-chemicals and reduces negative impact on environment. The use of conservation tillage and minimum tillage methods improves soil health, reduces soil erosion and reduces costs. Thus, the appropriate and sustainable agricultural mechanization plays a major role in making agriculture sustainable.

The decrease of rural population is becoming increasingly responsible for feeding the growing urban population; increase in productivity of agriculture has become an essential feature in stepping towards sustainability. To overcome this problem and to achieve sustainability in agriculture, mechanization of agricultural activities play a major role which could eventually give a better solution to the labour shortage in agriculture. Farm mechanization should be in such a way so as to develop appropriate technologies to suit local condition which are compatible with the socio-economic and field conditions.

Puddling is done with tractor drawn puddler, rotavator, cage wheels and power tiller drawn rotary tillers. But, the untilled soil near the bunds and corners are left unpuddled as there is difference in width between the tractor tread and puddling equipment. The width of the untilled portion may reach about 60-70cm. Presently, the untilled soil near the bunds and corners of the field are prepared manually which is consuming considerable time and energy. Hence, performance of tractor operated ridge plastering machine was taken up.

In mechanized farm, bund is prepared by a bund former either operated by tractor or animals. Tractor operated bund formers are normally either disc or mould board type or forming board type (Srinivasarao *et al.*, 2013

and Bureau of Indian Standard 1999). Singh *et al.*, 2016 concluded that the developed bund former cum- packer is suitable for making and packing the bund simultaneously in the cultivated/pulverized field. The bund former cum- packer can reduce about 96% dependency of farmers on manual labour requirement for packing the bund. Overall use of the equipment is having potential to increase the resource productivity by 38%.

This technology will save the energy and time involved in field preparation. It will reduce the drudgery and labour. It also reduces the rodent problem due to clean and straight bunds when cut with the rotary plough for bund side cutting.

Materials and Methods

Ridge plastering machine

In ridge plastering, field bunds are trimmed and thereafter plastered and compacted. The ridge plastering machine will strengthen the existing ridge without damaging the height of the ridge by adding on the side walls. Redlands ridge plastering machine is suitable for both dry and wet conditions. Reverse ridging is also possible. The minimum tractor power required is 42hp. The water in the field should be drained from the field for a day or two before commencing the ridge plastering operations (Table 1).

The tractor operated ridge machine consists of three major components namely, rotavator, leveler and rotating disc.

Rotavator

A rotary tiller, also known as a rototiller, rotavator, rotary hoe, rotary plough, is a motorised cultivator that works on the soil by means of rotating tines or blades. The purpose of a rotavator is to break up the soil so that

planting (either of crops or plants, mostly seeds) can take place. They do not dig deeply into the soil, but will turn the soil. The rotovator in the Ridge plastering machine consists of 8-tynes and attached to the tractor by means of a three point hitch and driven by a power take off (PTO) shaft.

Leveler

The purpose of leveller in the ridge plastering machine is to prepare the irrigation plot in a way such that no high and or low spots disturb the uniform distribution of irrigation water on the field, and ensuring the optimal slope for water movement across a field when irrigated. Proper levelling leads to more efficient use of irrigation, fertigation and chemicals could be possible in the field. And also results in efficient soil aeration and water uptake by crops.

Rotating disc

The purpose of rotating disc in the ridge plastering machine is to trim the bund and plaster it with pulverised soil so that the bund will be having a smooth finish with the help of roller attached to the disc.

The ridge plastering machine RRM-700 is operated by a 45 hp tractor. The rotary plough for bund side ploughing machine will strengthen the existing bund (ridge) without damaging the height of the ridge/bund by adding on the side ways. This machine is suitable for both dry and wet conditions. The machine is operated using the power of a 40-70 hp tractor upon which it is mounted. The attachment weighs about 390 kg with 1.62 m length, 1.66 m width and 1.13 m height. The hydraulic power of the tractor is used to change the direction of operation. The PTO (power take-off) drive is connected to the transmission unit of the rotary plough bund side ploughing machine from where the power is distributed to the three rotating parts. The

machine has an eight-tyne rotavator, a leveller, a rotating disc of 700 mm diameter and a 220 mm long roller. The rotavator pulverises the soil, the leveller levels the soil, the rotating disc trims the bund and plasters it with pulverised soil. The roller attached to the rotating disc compresses the soil.

The dimensions of the bund, width of the ridge, height of the bund, slant height of the bund and width of the bund formed by the ridge plastic machine were measured with the help of measuring tape.

The RPM of the ridge plastering machine was measured by using tachometer to know the rotational or working speed of the rotovator and the leveller so that the power required in operating the Ridge plastering machine can be evaluated.

Results and Discussion

The tractor drawn PTO operated ridge plastering machine was evaluated in the field conditions to know the exact dimensions of bunds. The ridge plastering machine was attached to 55 HP John Deere tractor and operated at specific speed in the field. Bunds were formed by rotavator by pulverising the soil and levelled the soil by leveler i.e. rotating disc, the rotating disc trimmed the bund and plastered.

The forward speed of the Ridge Plastering Machine was calculated in both black and sandy soils. From the results, the forward speed observed was 1.152 km/hr for black soils and 1.94 km/hr for the sandy soils.

Measurement of bund dimensions

The dimensions of the bund formed by the ridge plastering machine was calculated in the field conditions. The trench width, depth of the bund, slant height and width of the bund are 30.16, 25,28.3 and 21.8. All dimensions are

in cm (Table 2). The RPM of the ridge plastering machine is calculated with the help of tachometer and the RPM of the rotating disc and rototiller were found to be 227 and

238.6 respectively. The field performance of the ridge plastering machine was found to be 1000 m/hour (Table 3).

Table.1 Specifications of ridge plastering machine

S.No	Particulars	Specifications
1.	Purpose	For bund side ploughing
2.	Reverse ploughing	Provided
3.	Tractor power required, Hp	30-70
4.	PTO speed, rpm	540
5.	Operating speed, km/h	0.4 to 1.0
6.	Overall dimensions,(LxWxH), mm	1620 x 1660 x 1130
7.	No. of blades on roto tiller	8
8.	Working width of rototiller,mm	340
9.	Length of leveling roller,mm	220
10.	Dia. of leveling roller, mm	170
11.	Weight, kg	390
12.	Cost of the machine,Rs	3,00,000/-

Table.2 Bund dimensions

Trail	Bund Dimensions (cm)			
	Trench width	Height of the bund	Slant height	Bund width
I	30	25	28	22
II	30	25	29	21.5
III	30.5	25	28	22
Average	30.16	25	28.3	21.8

Table.3 Performance evaluation of ridge plastering machine

S.No	Parameters	Observations
1.	Power source	55 hp tractor
2.	Soil moisture content,% (db)	13.87
3.	Type of soil	Sandy loam
4.	Bulk density,g/cm ²	1.250
5.	RPM of the rotating disc	227
6.	Speed of operation, kmph	1.0
7.	Width of bund, cm	45.0
8.	Height of bund, cm	25.0
9.	Field capacity, m length/hr	900-1000
10.	Fuel Consumption, l/h	4.0
11.	Cost of operation for 1000 m length of bund	Rs. 700-800/-

Fig.1 Rotovator in Ridge Plastering Machine



Fig.2 Rotating disc and Leveler in Ridge plastering machine



Fig.4 Ridge plastering machine in operation



During ridge plastering operation, bunds are trimmed, plastered and compacted. It is usually done manually. A skilled worker can trim and plaster 90-120 m of bund a day. The cost of the bund is Rs.5 per meter.

The ridge plastering machine output was found to be 900-1000 m/hour. Thus, trimming and plastering can be done at Rs.0.9-1.0 per meter. The machine is operated using the power of a 40-70 hp tractor upon which it is mounted. The attachment weighs about 390 kg with 1.62 m length, 1.66 m width and 1.13 m height. The cost of ridge plastering machine is Rs.3.0 lakh.

Hence concluded as follows:

The performance of the tractor drawn ridge plastering machine was evaluated in the field conditions and the following conclusions were drawn.

Ridge plastering machine can be used for making bunds that are trimmed, plastered and compacted.

The mechanization of the bund making process is one of the important tasks to be done to achieve sustainability in paddy cultivation.

Rodents can be controlled by this machine due to its effective trimming, plastering and compaction.

It decreases the cost of operation about Rs.2000-2500/- over traditional methods.

The ridge plastering machine has a output of 900-1000 m/hr.

It reduces the time of operation for making of bunds over traditional manual bunding.

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