RESEARCH ARTICLE

DEVELOPMENT AND MODIFICATION OF BROAD BED FURROW MACHINE WITH WEEDER ATTACHMENT FOR WATER STRESSED CROP

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Abstract: Farmers follow traditional methods for sowing water stress crop. Some farmers used seed drill to sow water stress crops, but the yield of water stress crops was reduced due to improper drainage of the field. To solve these issues, a broad bed furrow machine powered by a tractor has been developed and evaluated. The method of water stress crop sowing is gaining popularity sowing to its main advantages is saving in irrigation water and other critical farm input as compared to sowing on flat fields. Mechanical management of weeds allows farmers to reduce or even eradicate the use of herbicides and contribute to a better climate. Once covered by moving dirt, weeds are mostly killed during mechanical weeding; hence for weeding with the broad bed furrow machine weeders are attached.The actual seed application rate with fluted exposure of broad bed furrow machine was 18 mm and 27 mm,also the actual fertilizer application rate was calculated. Field performance was evaluated by field capacity was 0.37 ha/hr, field efficiency was 68.5%, Weeding index of the machine was 70%. The functional performance of different system of seed drill was satisfactory during field. Seed drill gives fairly uniform row to row spacing.

Keyword: Broad bed furrow machine, Design of weeder attachment, Water stress crop, Efficiency

INTRODUCTION

In Chhattisgarh traditional methods of sowing of water stress crop is adopted by farmers. Some farmers used seed drill for water stress crop sowing, but the yield of water stress crop was reduced due to improper field drainage.Field surface smoothing and forming can improve the surface drainage of a field and should be done properly. *(Verma et al.,2015)* broad bed planting of soybean is one method to plant on broad rows or beds improved drainage *(Singh et al., 1999).* It has also been reported that water stress crop sown on beds is more resistant to lodging than the crop sown on flat fields,*(Shukla et al.,1999).*The Broad bed seed drill has the provision to increase or decrease the depth of the furrows. The furrows are useful to drain out excessive rainwater during heavy storms and for storing rainwater in furrows for enriching soil moisture through percolation in case of deficit rainfall. The soil moisture thus stored sustains the crops during dry spells, *(Singh et al., 2011).* Good agricultural practices are required to achieve a high yield production. The proper management of weeds is one of the most essential practices.Weeds affect crop yield due to competition to acquire plant nutrients and resources *(Slaughter et al.,2008, Weide et al., 2008).* Weeds have very rapid growth rates compared to crops and may dominate the field if they are not handled and controlled. Manual weed control is the earliest and easiest form of weed control. A person bending down and using their hands to pull weeds out of the soil has and is accomplishing this method.This method is advanced to hand tools, from using a stick to using a hand-hoe. The labor required for weeding is expensive, time consuming and difficult to organize *(Weide et al., 2008).* In addition, concerns such as back pain due to constant bending forced manual weed control to be avoided. Mechanical weed control was the best option to address manual weeding issues prior to the existence of chemical weed control. There have been times in mechanized agriculture when weeding tools have been pulled by draft animals such as buffaloes and horses, which are now being developed

Modified Broad Bed furrow machine with weeder attachment:

To meet the seedling requirement of *Kharif* and *Rabi* crops, a tractor drawn machine known as broad bed seed-cum-fertilizer drill has been developed broad bed seed-cum-fertilizer drill is essential for obtaining an adequate stand with limited use of irrigation water or under rain fed conditions. The advantages of sowing on broad bed seed-cum-fertilizer drill is that it makes the dry upper layer soil into ridges and sowing is done in furrows at appropriate depth. It also works efficiently even when the moisture is depth of 15-20 cm for *Kharif* crop, seedling is done on the side of ridge in paired row system and for *rabi* crops seedling is done in deep furrows.Get experience with mechanical weeding on small acreages first and on lightly infested field because it takes a few years to get used to it. Use mechanical weeding as part of a general weed control strategy that includes good crop rotation, competitive varieties and cover crops. Sweep as a mechanical weeder using in this machine, in the lots of advantages of this mechanical weeder, Easily available in the market , Reduce the labour cost, Not

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affect in human health , Aerates soil, stimulates crop growth , Breaks soil crust

MATERIALS AND METHODS

Theoretical consideration

Design Consideration

The existing ridger and seed-cum-fertilizer drill was modified to broad bed furrow machine with weeder attachment as a functional and experimental unit. The design of machine components were based on the principles of operations, tested and compared with the conventional method, to give a correct shape in form of prototype. The mechanical design details were also given with due attention so, as to give adequate functional rigidity for the design of machine.A new design will be initiated either to provide a machine for sowing the water stressed crop, if not existed or to provide an improved design to overcome problems/defects of existing practice of machines. If the forecast for the demand of such a machine is favorable the engineering design process may be initiated and should involve a few selected manufacturers and farmers as co-operators. Basic specifications of machine should be derived from agronomic and operational parameters, source of power, labour requirements and economic condition of farmers.

Selection of materials

Selection of proper materials for the manufacture of various components of machine is very important. Standard, common sizes, sections as well as semi-finished and finished items which are available in local market should be considered when specifying materials. Table 1given the specifications of the materials for different components of modified Broad bed furrow machine.It is therefore, recommended to use standards for fabrication of machines. Selection of machine components should be made keeping in view that with their effectiveness and efficiency. This consideration applies to the uniformity of seeding, no damage to standing crop, controls and adjustments.

Table 1. Selection of material for broad bed furrow machine with weeder attachment

S.No.	Component	Material specification	Size (mm)
1.	Ridger	M.S. Sheet	3 mm thick
		Circular bar	16 mm & 25 mm
		Flat iron bar (W×T)	50×24 & 40×5
		Angle Iron	50×50×5
		Bush	18 mm diameter
2.	Sweep	Flat iron bar (W×T)	50×7

Development of sweep

Sweep of a weeding device are the final modifier of soil environment in a seedbed. Hence, they are one of the most important components of a machine. It has been designed with the following consideration:

1. Ease to attach and detach.
2. Simplicity in construction.

a. Sweep dimensions

The top portion of the sweep was taken as v in shape. The overall dimension of the sweep was shown in the fig 1 front, side and top view shown in this fig.

b. Sweep material

Material of proper strength was used for sweep to bear the desire load. Flat bar of size 50×7 mm were used for developing the sweep.

Fabrication of ridger and sweep

Auto-cad design and drawing was used for the fabrication of ridger and machine. The ridger was made up of 10 gauge M.S. Sheet, Angle iron, 16 mm and 25 mm circular bar, flat bar. In bottom of the ridger share was provided. Wings wereproviding curve shape with the help of hydraulic press. The share slide and cut the soil and with the help of wing the soil lift and turn make furrow. The wing of the ridger is portable and it was assembled with the help of 16 mm diameter circular bar. Beam of the ridger was fixed on the frame with the help if nut & bolts.Sweep was made by 50 mm×7 mm Mild Steel flat bar. Sweep was fitted bottom of the leg with the help of nut and bolts. The beam was connected in frame by the flat plate, nut and bolt and it was adjustable.

RESULTS AND DISCUSSION

The broad bed furrow machine with weeder attachment was evaluated and tested on chickpea crop in the farm and result was successfully obtained.Weight of soil sample was found to be 1.802kg and the bulk density obtained 1764.93 kg/m^3.The moisture content of soil sample determining moisture content was oven drying method. 3 samples were taken from the field from different depth 50 mm, 150 mm and 250 mm. Sample after weighing kept in the drying oven. Moisture content of soil sample was found to be 7%, 16% and 28% respectively on dry basis.

Calibration of machine

The machine was calibrated in laboratory. Chick pea and DAP was used for the calibration. The machine was lift up to height of about 80-90 mm above the ground level.The theoretical application rate of seed for modified broad bed furrow machine was 27.88 kg/ha, 33.41 kg/ha and 40.01 kg/ha at 25, 35 and 45 opening respectively and theoretical application rate of fertilizer was 9.4 kg/ha, 17.44 kg/ha and 22.82 kg/ha at 25, 35 and 44 opening respectively.

Actual application rate for field operation

The actual application rate was determined in the field. The actual application rate of seed and fertilizer for modified broad bed furrow machine given in table 2 & 3.

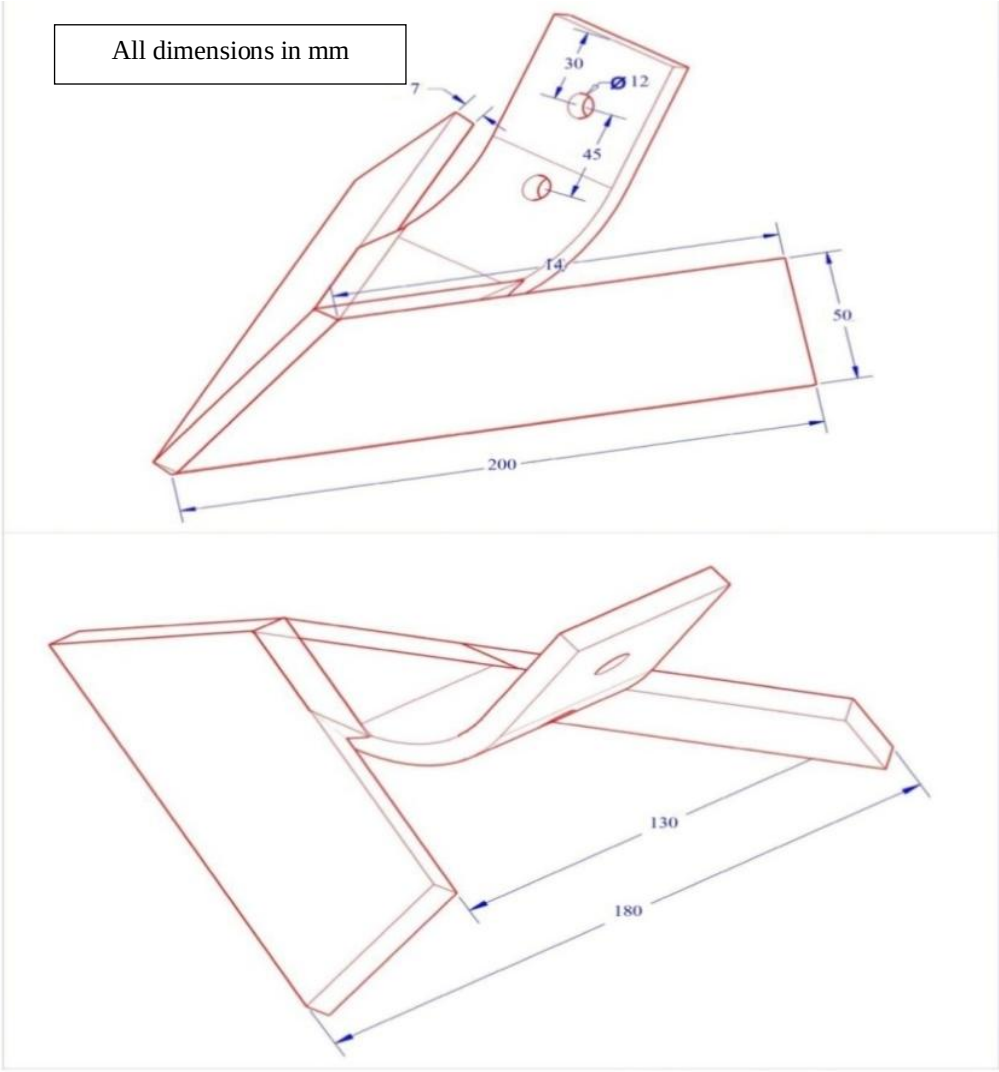

Fig. 1. Design of sweep with dimensions

Table 2. Actual application rate of seed for modified broad bed furrow machine

S.No.	Opening (mm)	Seed delivery rate,kg/sec	Actual width of application, m	Forward travel speed, m/s	Application rate, kg/ha
1.	20	0.009	1.40	1.09	58.97
2.	30	0.013	1.40	1.09	88.46

Table 3: Actual application rate of fertilizer for modified broad bed furrow machine

S.No.	Opening (mm)	Fertilizer delivery rate,kg/sec	Actual width of application, m	Forward travel speed, m/s	Application rate, kg/ha
1.	10	0.0072	1.40	1.09	47.18

All dimensions in mm

Tractor operated at a speed of 3.92 .km/h and the width covered was 1.40 m so Theoretical field capacity of machine was 0.54 ha/h. the machine was operated at 3.92 km/h. the effective field capacity was found to be 0.38ha/h.field efficiency of the machine was 70%.Weeding index of machine was calculated, weeding index of the machine was 70%. During the field, the operational quality of various seed drill system was satisfactory. There is very little seed damage or we can assume that during operations there is no seed damage. Seed drill gives line spacing a fairly uniform row. Compared to other drilling devices, the uniformity of seed level per hectare was also very high. In economic terms, the seed drill quality was also satisfactory.

CONCLUSION

The functional performance of different system of seed drill was satisfactory during field. Seed drill can be successfully used for sowing Chickpea, pea, maize, Soybean etc. Functional performance of Modified broad furrow machine was highly satisfactory in properly prepared field.Modified broad bed furrow machine can be used for small, medium and large seeds satisfactorily. No damage of seed was observed during field operation due to mechanical reason.The field capacity of Modified broad bed furrow machine is quite high(0.38 ha/h) and its field efficiency was impressive (70%).The actual application rate of modified broad bed furrow machine for seed was 58.97 kg/ha and 88.46 kg/ha at

20 and 30 opening (mm) and for fertilizer 47.18 kg/ha at 10 opening.The use of Modified broad bed furrow machine provides a possibility to use mechanical weeding hoe, mix cropping and relay croppingThe developed machine was tested both in Field as well as Laboratory as per BIS standard and found its performance satisfactory. It has a great edge over conventional seed drill. It helps to reduce water logging in field and also reduced cost and losses in field, due to wedder wedding is also done very easily. Mechanical weeder are very advantageous for environment as well.

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