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Small Tractor Drawn Broad Bed Furrow Maker

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During preparation of sowing season, there is an acute shortage of labour, which causes delay in sowing of crop which ultimately results in a reduction in yield Bed making operation is one of the important tillage operations which control water logging problem which reduce the crop yield. There is a need of such machine which overcome the economic constraints of farmer and can perform bed making operation. Another limitation is that about 90 percent of farmers fall in the category of marginal, small and semi-medium land holding. They could not offer heavy price of big tractors and implements. Big tractors operated machineries are not suitable for small and scattered land holdings since it gives low field efficiency in small fields. Field efficiency of Broad bed furrow maker was about 77 %, more than that of manually bed making method. The working of bed making mechanism was satisfactory and desirable height of sowing was obtained.

Keywords: farm mechanization, bund former, bed making device

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1. Introduction

In India for bed making tractor power is not used so extensively, Manual bed making can give clean results but it is slow process and required more labors and due to an acute labor shortage in the peak season results in the delay in bed making. This manual bed making method required 16-17 women labour to make bed from 1 ha field and it is a time – consuming operation. Tractor–drawn bed maker helps in the timeless of operations compared with bullock drawn and traditional method of bed making and is cheaper.

Landholding is going down so the requirement of efficient but less costly agricultural tools and equipment suitable for small farmers and small plots of land will continue to exist either owned or on hired basis. There is an urgent need of development of small tractor operated equipment. The higher economic efficiency of operation may compel farmers for co-operative/contract farming. High capacity, but precision equipment was needed for irrigated and dryland conditions also considering the need of farmers, the research work on Development of small tractor operated broad bed furrow maker" was undertaken. The machine had effective field capacity, theoretical field capacity and field efficiency of implement was found to be 0.30 ha/h, 0.40 ha/h and 76.97 per cent respectively.

Present work was therefore undertaken with the objective to develop a small tractor operated Broad bed furrow maker. The equipment was developed at the Department of Farm Machinery and Power, College of Agril, Engg. & Technology, Dr. PDKV, Akola and tested for its performance.

2. Materials and Methods

Development of Broad Bed Furrow Maker for Small Tractor

It was decided to develop a small tractor operated broad bed furrow maker that will fulfill the following requirements.

1) Machine should be simple in design and it should be easy to operate.
2) Cost of the machine should be low.
3) It should be easily repairable by farmer or village artisans.
4) The total power requirement should not exceed the power available from available small tractors (18 to 25 hp).
5) Machine should be light in weight.

Components of the Small Tractor Operated Broad Bed Furrow Maker

The material to be used for the fabrication of broad bed furrow maker is given as per test code IS12334-1988.The components of the Small tractor operated Broad bed furrow maker are,

1. Main frame,
2. Hitch Assembly,
3. Forming board
4. Cutting blade
5. Hitch pair

1. Main Frame

The whole frame consists of a M.S. L- Angle pipe which is made by welding of size 75 × 60 × 10 mm. The length of the middle frame was 1200 mm and side frame is 509 mm. The complete frame was made with L –section welded at both its sides with a 500 mm long M.S.L- angle**.** The frame shall be capable of sustaining a pull of 9.8 N/mm of nominal size of bund former without any permanent deflection or change in shape.

2. Hitch Assembly

The implement has standard three hitch points; two lower and one upper. The implement was attached to tractor through these three hitch points with the help of link pins. Proper hitching of any kind of tractor operated implement is necessary to maintain quality of work and eliminating the power losses as per IS: 4468-1977 'Specification for dimensions for three-point linkage of agricultural wheeled tractors.

3. Forming Board.

The parts which gather the soil to form the bund. Forming board forms a supporting structure of size of 303 mm × 890 mm which is supported by M.S. flat as per IS: 226-l 975* of size 50mm × 6mm × 10mm. At the bottom of this Forming board soil cutting blade are attached. It forms a supporting structure for the soil cutting blade and provide strength during soil cutting operation.

4. Soil Cutting Blade

The soil cutting blade designed to have proper fixing on the main frame of broad bed furrow maker. The suitable assumption has been considered for designing the blade. The maximum unit draft of the soil has been considered with the factor of safety is 2.0 for collection operations.

Considered the impact load is 2. Edges of the cutting blade shall be beveled to a distance between 5 and 10 mm. The thickness of the edge shall be between 0'5 and 2 mm. The thickness of the cutting edge shall be uniform.

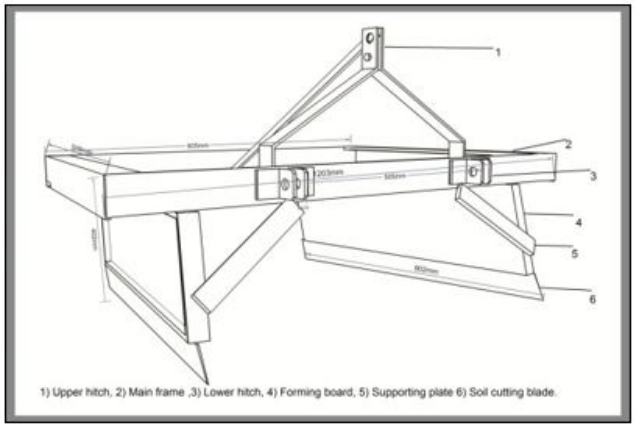

Figure a: Constructional details of broad bed furrow maker

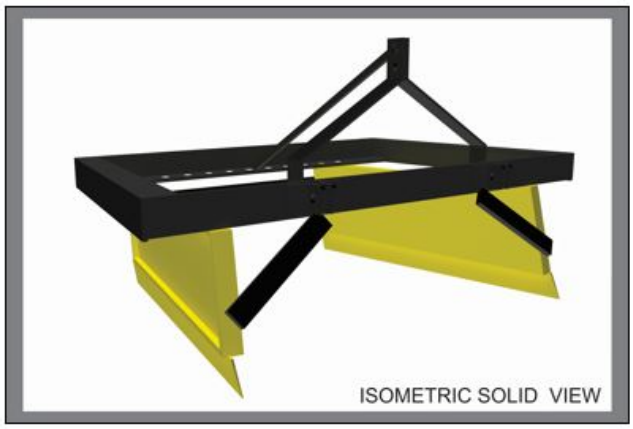

Figure b: Isometric view of broad bed furrow maker

Figure c: Photographic view of broad bed furrow maker

The hardness of the cutting blade edge shall be between 450 and 500 HB or 50f3HRC up to a distance of 50 mm from the front of cutting edge when measured in accordance with IS:1500-I 983 'Method for Brine11 hardness test for metallic materials (*second revision*) or IS: 1586-1968 Methods for Rockwell hardness test (B and C scales) for steel (*first revision)* respectively.

3. Result and Discussion

Table 1: Field performance results of small tractor operated broad bed furrow maker

SN	Particulars	Trial I	Trial II	Trial III	Avg. Result
1	Area covered, m2	4000			
2	Actual operating time, min	67.63	71.01	69.25	69.29
3	Time loss in turning, min	20.50	17.03	19.62	19.05
4	Depth of operation, cm	4.50	5.00	5.00	4.83
5	Forward speed, km/h	2.25	2.15	2.27	2.22
6	Effective field capacity, ha/h	0.30	0.29	0.29	0.30
7	Theoretical field capacity, ha/h	0.40	0.38	0.40	0.40
8	Field efficiency, %	75.74	79.08	76.08	76.97
9	Draft requirement, kgf	158.30	175.50	159.50	164.40
10	Fuel consumption, l/h	3.21	3.25	3.18	3.21
11	Wheel slippage, %	9.29	6.68	8.83	8.26

Table 2: Cost of operation for tractor and implement per hour and per hectare for small tractor operated broad bed furrow maker

SN	Particulars	Cost of operation for tractor	Cost of operation for BBF
A) Fixed costs			
1	Depreciation, Rs/h	36.00	12.33
2	Interest, Rs/h	33.00	6.42
3	Insurance, Rs/h	4.00	Nil
4	Tax, Rs/h	4.00	Nil
5	Housing cost, Rs/h	4.00	0.68
	Total fixed cost, Rs/h	81.00	19.43
B) Operating costs			
1	Fuel cost, Rs/h	73.83	Nil
2	Lubricants cost, Rs/h	7.38	Nil
3	Repairs & maintenance cost, Rs/h	32.00	12.33
4	Operators (labour) wages, Rs/h	43.75	Nil
	Total variable cost, Rs/h	156.96	12.33
C) Cost of operation			
1	Total cost of operation (Rs/h) = Fixed cost + operating cost	237.96	31.76
D) Cost of operation (Rs/h)		269.72	
E) Cost of operation per hectare (Rs/ha)		914.30	

4. Conclusion

The final conclusion was drawn which are as follows. The small tractor operated Broad bed furrow maker can be used for making beds.

1. The average draft requirement of the implement was 164.4 kgf at an average speed of 2.22 km/h for the range of 18.5 hp tractor.
2. Fuel consumption and average tractor wheel slip of machine were found 3.21 l/ha and 8.26 percent respectively.
3. The effective field capacity, theoretical field capacity and field efficiency of implement were found to be 0.30 ha/h, 0.40 ha/h, and 76.97 percent respectively.
4. Wear analysis was found to be 0.387per cent per hour for R.H.S.blade.
5. Wear analysis was found to be 0.273per cent per hour for L.H.S.blade
6. The cost of operation for Broad bed furrow maker was Rs. 269.72/h and Rs. 914.30/ha.

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