Performance Evaluation of Animal Drawn Modification in the Existing Bhoramdav Seed Drill

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A B S T R A C T

The performance evaluation of Animal Drawn Modification in the Existing Bhoramdav Seed Drill was carried out in an area of 0.05 ha at BRSMCAET&RS MUNGELI. It is a low cost line-sowing device in which seed metering is done manually by the operator by dropping the seeds in the funnel. Hence the skill of the operator determines the seed rate applied. It is a four row sowing device. Sowing is prime operation in cultivation practice of any crop which directly affects production. Therefore, timely sowing is necessary with available sources of power. To achieve these a prototype consisting of seed hopper, metering mechanism, power transmission unit, frame, furrow opener and beam for hitching arrangement was developed. The seed drill was tested for its performance of sowing paddy. It delivered desired seed rate of 40.8 kg/ha during field testing and mechanical damage to the seed was found negligible *i.e.* 0.61%. The field capacity of the seed drill was 0.135 ha/h at average operating speed of 2.2 km/h. The field efficiency of seed drill was 70 % and average depth of seed placement was 35 mm, where the average seed spacing was 5 mm. The saving of man-hour drilling was quite substantial and justified with the use of seed drill.

Introduction

Animals are being vised for draught purposes almost from the beginning of Civilization. In India more than 80 million draught animals are available for various farm operations. hence the further prospect of Indian farming largely depends upon the utilization of animal power through different matching implements in efficient work by accepting the ways of farm mechanization which helps in reducing the cost of cultivation or operation and time saving. About 95 percent of agricultural families in India depend on draught animals as main source of power on their farms. Sowing is one of the basic operations needed

to get better revenue from agriculture. Manual sowing has the problem of not giving adequate spacing between row to row and plant to plant leading to less population of crops than recommended by the agronomists. Also there is the problem of placing the seeds at correct depth and correct soil coverage.

Manual sowing is time consuming and costly. Hence, there is a need for appropriate seed drill for sowing. This paper deals the development and testing of a appropriate seed drill for sowing cereal crops like maize, beans and sorghum. The main purpose of farmers in developing countries is to produce more agricultural products with the lowest possible energy input to meet the growing demand for food in the region. Bhoramdev seed drill is a low cost line-sowing device in which seed metering is done manually by the operator by dropping the seeds in the funnel provided for the purpose. Hence the skill of the operator determines the seed rate applied. It is a four row sowing device. The seed drill consists a frame of mild steel box section, furrow openers cum shanks, funnels with two spouts for feeding seed, hoses for connecting funnels with pipes mounted on furrow openers, hitch assembly and handle. The distance between the rows can be adjusted by moving the furrow openers cum shanks. The furrow opener is of angle iron, which is pointed at the end. Since the drill does not have a separate hopper, seeds have to be carried separately in a bag slung on the shoulder or the back of the operator. Specifications of bhoramdev seed drill Overall dimensions (mm):Length x Width x Height (740 x 525 x 1030),Weight (kg):20,Capacity (ha/day):0.8-1.0,Power requirement : a pair of bullocks

Many agricultural operations are performed with the help of draught animals on the small and marginal farms. Animal power contribution in the total power used in agriculture is about 33% . Qasim and Verma

(1995) studies on Indira seed drill and resulted with information that Indira seed drill cover 0.8-1.0 ha/day with draft required was 25-30 kg. In this study it is found that Indira seed drill perform better for line sowing in loam clay soil. Recommended the box capacity for animal drawn seed drill should be 10-16 liter. He set that fluted roller mechanism for all type of seed which would manage seed rate accurately. In study it is reported that the inclination of the seed delivery tube from vertical was kept smaller than 20 degree. Study shows that draft for each of shoe type furrow opener was 20 kgf for light soil and 30-35 kgf for heavy soil. In 1991, Vershney *et al.,* designed power tiller operated seed cum fertilizer drill with chain and sprocket power transmission system. They reported that fluted roller for metering of seed and adjustable opening for fertilizer gave better results for placement of seed and fertilizer. In 1995, Qasim and Verma deliberate on performance of line sowing implement on loam clay soil and started that Indira seed drill, Nari, Datari are suitable for line sowing of paddy in C.G. Indira seed drill cover 0.8-1.0 ha/day with draft required was 25-30 kg.

In 2002, Yadav *et al.,* attempt to develop a manual for zero-till seed-cum fertilizer-drill and zero-till drill-cum-bed planter to provide the essential and relevant information on how to use and maintain these agricultural machines properly for obtaining the optimum performance. In 2006, Rawat and Varma studied the performance evaluation of zero-till ferti seed-drill and observed that there was no effect of stubble on the performance of zero-till ferti seed-drill. It was observed that However, the loose straw spread on the surface offers some hindrance in the working of the drill. The zero tillage sowing was found to be most time (88%) and energy efficient (79%) as compared to conventional method of sowing. Wheat crop can be sown 10-15 days

early as compared to conventional method of sowing. This will result in timely sowing of wheat crop and increase in yield. The zero tillage sowing was more economical (79%) in comparison to conventional method. A bullock drawn seed drill for paddy was developed to minimize time and labours requirement. It was tested for performance.

Materials and Methods

Field experiment were conducted during kharif at BRSM collage of Agricultural Engineering Farm mungeli ,Indira Gandhi Krishi Vishwavidyalaya Raipur (Chhattisgarh). The soil of experimental field was inceptisol having texture as sandy loam, the physio-chemical properties of soil is given in Table 1.

Moisture content

Moisture content (%) on dry basis of soil was measured by oven dry method. The soil samples from different location within plot were taken using core sampler 8 cm diameter and 20 cm length. The collected soil samples from each location were weighed initially and then kept in an oven for 24 hours at 105° for obtaining dry weight of soil and moisture content was calculated at follow.

$$MC = \{(W1-W2)/W2\} \times 100 \quad \ldots\ldots(1)$$

Where,

MC= moisture content in%
W1= weight of the wet soil in gm
W2= weight of the dry soil in gm

Bulk density

Bulk density of the soil is the oven dry mass per unit volume of soil. The bulk density was measured by core sampler. The core sampler of soil of known volume was collected and weighed. The bulk density was calculated by using following formula:-

$$\rho=M/V\ldots\ldots(2)$$

Where,
ρ= bulk density of soil sample in gm/cc
M= mass of soil sample in gm.
V= volume of soil sample in cc

Evaluation of the modified bhoramdev animal drawn seed drill

Parameter such as field capacity, field efficiency, seed rate, Speed of operation and Power requirement of the seed drill was evaluated.

Field capacity

Theoretical field capacity was measured as per following formula. (Bainer *et al.,* 1987),

Theoretical field capacity,
(ha/h): = (W×S)/10 ....(3)

Where,
W = Effective width of implement, m; and
S = Speed of operation, km/h.

Actual field capacity

Actual field capacity was measured by taking an area of 25×20 square meter i.e. 0.05 ha and measuring the time in actual field condition. It includes turning loss, filling time and break down time also. There was continuously operated in the field for 0.05 ha to assess its actual coverage. The time required for complete application was recorded and effective field capacity was calculated.

Actual Field capacity
(ha/h)=A/T………………(4)

Where,
A = Actual area covered, ha
T = Time required to cover the area, h

Field efficiency

From the actual and theoretical field capacity, the field efficiency was calculated (Bainer *et al.,* 1987),

Field efficiency (%):
$$=AFC/TFC\times100 \quad ....(5)$$

Where,
FE= Field efficiency (%);
AFC=Actual field capacity (ha/h); and
TFC=Theoretical field capacity (ha/h).

Operating speed

The speed of operation of seed drill was determined in test plots by putting two marks 20 m apart (A & B). The time was recorded with the help of stop watch to travel the distance of 20 m. The speed of operation was calculated in km/h as given below

$$S = 3.6 \times \text{distance traveled (m)}/T \quad …(6)$$

Where,
S = Speed of operation, km/h
T = time needed to cover 20 m distance, sec

Power requirement

Calculation of power is needed to determine the efficient use of animal power. A man can produce power equal to 0.1 hp. It was the power required to operate the machine pair of bullock with an average pulling force and speed. It was calculated by using the formula.

$$\text{Power,(hp)}:= \text{pulling force(kg)} \times \text{speed (m/s)}/75 \quad ……..(7)$$

Specification of modified bhoramdev animal drawn seed drill

Specification of the four row modified bhoramdev seed drill is as follow:
Length : 1330 mm
Width : 580 mm
Height : 1040 mm
Row spacing : 220 mm
Farrow opener types : furrow openers cum shanks
Metering mechanism : agitator orifice type
Power transmission : agitator lever with wire

Results and Discussion

The seed drill machine was calibrated for the desired seed rate by adjustment of the exposed hole of orifice. Wide range of quantity of seeds dropped through the orifice was collected during the calibration of seed drill. The seed rate was increased within decrease in hopper capacity and increased in orifice exposure diameter of hole.

S.No.	Theoretical field capacity ha/h		Actual field capacity ha/h		Field efficiency %	
	Modified bhoramdev seed drill	Bhoramdev seed drill	Modified bhoramdev seed drill	Bhoramdev seed drill	Modified bhoramdev seed drill	bhoramdev seed drill
1	0.193	0.127	0.135	0.081	70.0	63.7

The effective field capacity was calculated from field. It was observed that the effective field capacity of modified bhoramdev seed drill was 0.135 ha/hr and 0.081 ha/hr for bhoramdev seed drill.

Moisture content and bulk density

Moisture content of soil on dry basis was measured by Oven Dry method. The moisture content at soil depth of 2.0 cm in 11.1 % db

and percent increase moisture content increases as the depth increases.

The percent increase in Moisture content from soil depth of 2.0 cm to 6.0 cm was 30 %. The bulk density was Varies from 1.44g/cc to 1.45 g/cc at 2.0 cm to 6.0 cm soil depth. The percent increase in bulk density from 2.0 cm to 6.0cm soil depth was 11.56 %.

Field efficiency

The theoretical field capacity was determined as 0.193 ha/h, whereas the actual field capacity of planter was found to be 0.135 ha/h. From the actual and theoretical field capacity the field efficiency of the light weight animal drawn seed drill was found to be 70.00% .

Seed rate

The seed rate for different capacity. Maximum seed rate was found to be 40.8 kg/ha for wheat and minimum 10.2 kg/ha for paddy, respectively.

Table.1 Soil condition of experimental field

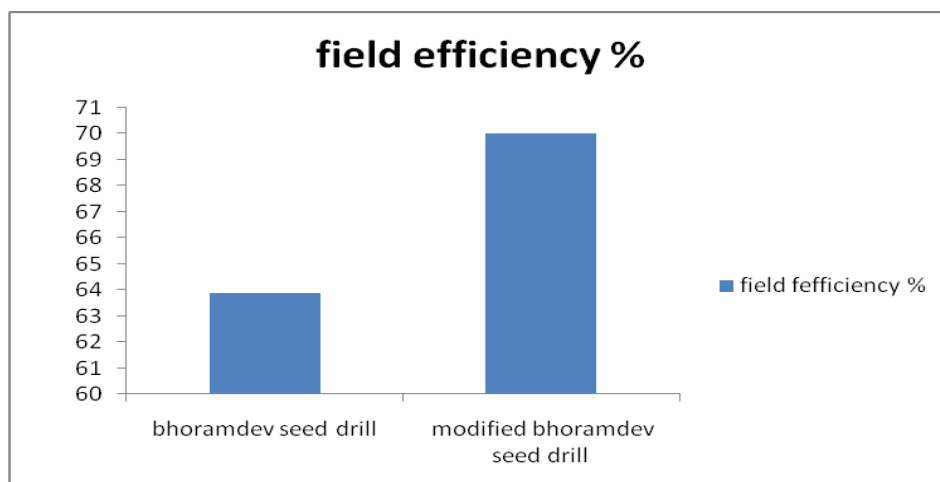| S. No.	Particulars	Composition
1	Texture % Sand :silt: clay	30:40:24
2	Structure	Sandy loam
3	pH(1:2.5)	7.50
4	Electric conductivity	0.20

Fig.1 Bhoramdev animal drawn seed drill

Fig.2 Field performance of modified bhoramdev animal drawn seed drill

Fig.3 Isometric view of developed modified bhoramdev animal drawn seed drill

Fig.4 Developed modified bhoramdev animal drawn seed drill

Fig.5 Comparison in field efficiency between bhoramdev seed drill and Modified bhoramdev seed drill

Measurement of draught

The spring dynamometer was hitched between the yoke and the planter beam during the operation. The draught accordingly computed varied from 21.8 kgf to 25.11 kgf .

Power requirement

The average power required for 4-row with marker animal drawn seed drill was found to be 0.149 kW (0.2 hp) which may be operated by a pair of bullocks with average output of 0.5 hp.

Speed of operation

The speed of operation was found to vary from 1.9 to 2.19 km/h. The average speed of operation of developed seed drill for sowing of selected seeds was found to be 2.2 km/h, respectively, for a distance of 20 m.

The investigation was undertaken in Research Farm of BRSM Collage of Agricultural Engineering, Mungeli IGKV Raipur Chhattisgarh during kharif season. The seed drill was tested for direct sowing of paddy and its performance evaluation was carried out with animal drawn conventional seed drill. This research shows that there was very little variation in yield with both the seed drills but modified seed drill was suitable different implement attachment for number of field operations like tillage, sowing, inter-cultural operation etc. Efficiency of the modified Seed drill was more effective as compare to Conventional.The saving of man-hour drilling was quite substantial and justified with the use of seed drill.

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