A CASE STUDY

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Performance evaluation of bullock drawn planter with low cost metering device

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■ **ABSTRACT :** Sowing the seed is an important practice in crop production. There are various methods of sowing the seeds, but precision planting is highly desirable. Precision planting is defined as the placement of single seed in the soil at desired plant spacing in a row. The spacing of the seed is affected when the mechanism fails to select or drop a seed resulting in large spacing between seeds. Keeping this in mind, the present study was undertaken to develop the bullock drawn planter with low cost metering device. To achieve this objective the planter, consisting of main frame, seed metering and power transmission unit, was developed. The nylon plastic was used for seeding unit. The single seeding unit was used for three furrow openers. The seed plate had the equidistance holes on its periphery. The row to row spacing was adjusted by varying the holes on the seed plate. Tests indicated that weight of machine was 44 kg. Its average field efficiency was 69.44 per cent and the field capacity of 0.175 ha/h with 180 per hectare as an average cost of operation. Machine showed satisfactory results and it was suitable for small and marginal farmers.

■ **KEY WORDS :** Bullock drawn planter, Low cost, Metering device

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India is engaged in commercial production of precision planters which can be used for direct seeding of vegetables. There are several techniques for determining the planter performance (Jasa and Dickey, 1982; Brooks and Church, 1987; Kachman and Smith, 1995; Karayal *et al.*, 2005; Navid *et al.*, 2011). Kocher *et al.* (1998) describes an opto-electronic seed spacing evaluation system that measured time intervals between seeds and detected front-to-back location of seed drop events relative to the planter was used to rapidly determine planter seed spacing uniformity in the laboratory. Raheman and Singh (2003) developed a sensor based on light interference technique for sensing the seed droppings from planter.

With due consideration with the given facts, to hold and carry the seeds along the field, to open the furrow at a pre-determined depth, to meter or distribute the seeds at a required spacing and to close the furrow after placing the seed the use of large power tractors and power tillers are uneconomical for small and marginal farmers. Thus, bullock drawn equipment may prove to be a better solution. Being compact and tidy with ease in operation, better field maneuverability, saving in time and labour, will prove the planter to be very beneficial to the small and marginal farmers.

Functional unit of bullock drawn planter :

The bullock drawn planter consists of following components :

– Main frame.

– Depth adjustment cum transport wheel.
– Ground wheel.
– Seed metering mechanism.
– Power transmission unit.
– Hitch unit.

■ METHODOLOGY

Test procedure :

Testing of bullock drawn planter was carried out on the lines of the procedure suggested by the Regional Network for Farm Machinery (RNAM, 1985).

Calibration of planter :

Before the actual use of planter in the field, it was calibrated to know required seed rate per hectare of crop to be sown. Step wise procedure of calibration was the planter was set on flat and leveled surface. The ground wheel was hinged with the help of spring, such that it could be rotated freely. The seed box was filled with red gram seeds. The plastic boxes were placed at lower end of the furrow openers for collecting seeds. The reference point was marked on ground wheel with chalk. It was rotated for 25 revolutions.

The area covered by planter was calculated theoretically as follows :

$$\textbf{Area covered} = \textbf{circumference of wheel} \times \textbf{number of revolution}$$

– The quantities of seeds collected from each furrow opener were weighed separately on digital weighing balance and total weight of seeds was noted as "X".
– Total number of revolutions required to cover one hectare area of the field were calculated as:

$$N = \frac{100 \times 100}{\text{circumference of ground wheel} \times \text{working width}}$$

– The total amount of seed for N revolution and ultimately for 1 hectare area was calculated as,

$$Z = \left(\frac{X}{25} \times N\right) \text{kg}$$

Z, is rate of red gram in kg/ha.

Readings were taken at different settings and variation along the furrow openers when planter was stationary.

Seed damage determination test :

It was used to determine any mechanical damage done to the seed during calibration. The seeds from each furrow openers were collected after passing through the metering device and sorted out in two lots *viz.*, undamaged and damaged seeds. The percentage of damaged seeds was calculated by following formula :

$$\text{Damaged seed percentage} = \frac{\text{Damaged seeds}}{\text{Total collected seeds}} \times 100$$

Germination test :

The seed sample, which is to be sown was placed on germination paper in such a manner that forming five rows of ten seeds in each row. Five papers were formed in same manner. After that they were placed in incubator where temperature was set at 27ºC and humidity of 90 per cent. After 10 days the observation was taken.

Field test :

Field test of bullock drawn multicrop planter was conducted on the "D" block farm of Mahatma Phule Krushi Vidyapeeth, Rahuri. During the test, various parameters related to soil, crop and machine were studied and the data was recorded. The data collected was analyzed to determine the following.

Soil moisture content :

The soil samples were taken from five places randomly in the field. The oven drying method was used to determine the moisture content. The samples were kept in the clean containers *i.e.* sample boxes and kept in thermostatically controlled oven to maintain temperature at 150ºC in the laboratory of College of Agricultural Engineering, Rahuri. The samples were kept for 24 hrs in the oven for assurance of complete drying. After drying, the containers were taken from oven and allowed to cool. The weight after oven drying was recorded and soil moisture was calculated by formula :

$$W = \frac{W_2 - W_3}{W_3 - W_1} \times 100$$

where,
W = Per cent moisture content (wb)
W_1 = Weight of container + lid.
W_2 = Weight of container + lid + wet soil.
W_3 = Weight of container + lid + dry soil.

Shape and size of field :

Dimensions of the field were measured with help of flexible tape of 30 m length.

Depth of placement of seed :

Depth was measured using metre rule. For this 10 random observations were taken and average was calculated.

Seed rate :

Seed rate was calculated by total seed used for plantation of that area.

Theoretical field capacity :

$$\text{Theoretical field capacity, ha/h} = \frac{\text{Working width, m} \times \text{speed, kmph}}{10}$$

Effective field capacity :

It was calculated by following formula :

$$\text{Effective field capacity, ha/h} = \frac{\text{Actual area, ha}}{\text{Time required, h}}$$

Field efficiency :

Field efficiency was calculated by following formula:

$$\text{Field efficiency, \%} = \frac{\text{Effective field capacity}}{\text{Theorotical field capacity}} \times 100$$

Plant population per hectare :

Its was measured by taking observations at five random spot by using a metal frame and by counting number of plants inside the frame.

Per cent emergence :

The germination percentage was calculated by using the following formula :

$$\text{Per cent emergence} = \frac{\text{Number of plant emerged}}{\text{number of seed sown}} \times 100$$

Measurement of draft requirement :

The draft of machine was calculated by taking observations of pull with the help of suitable dynamometer :

$$D = P \cos\theta$$

where,

D = Draft in kgf.

P = Pull (Dynamometer reading) in kg.

θ = Angle between the line of pull and horizontal in degrees.

RESULTS AND DISCUSSION

Based on the analysis of the results shown in Table 1, the following conclusions are drawn.

The implement can be used for planting of red gram at desired row to row spacing. Plant to plant distance can be adjusted with the help of seed plate having different number of holes on its periphery. The performance of seed metering device was satisfactory. It gave seed rate 7.9 kg/ha during the field trials and seed damage was negligible. The average plant geometry was 90 × 20.17 cm was achieved against the recommended plant geometry of 90 × 20 cm and germination percentage was found to be 80 per cent. The seed singulation was achieved perfectly. This resulted

Table 1 : Results of the performance evaluation of bullock drawn planter with low cost metering mechanism

Sr. No.	Particulars	Value
1.	Size of plot (m)	25 × 40
2.	Area covered (m^2)	1000
3.	Duration of test (hr)	0.57
4.	Speed of operation (km/ph)	2.80
5.	Effective working width (cm)	89.80
6.	Depth of seed placement (cm)	4.36
7.	Recommended seed rate (kg/ha)	11-12
8.	Obtained seed rate (kg/ha)	7.9
9.	Emergence percentage (%)	80
10.	Theoretical field capacity (ha/h)	0.252
11.	Effective field capacity (ha/h)	0.175
12.	Field efficiency (%)	69.44
13.	Plant count (No./m^2)	4
14.	Obtained plant population (No./ha)	40,000
15.	Recommended plant geometry (cm)	90 × 20
16.	Obtained plant geometry (cm)	90 × 20.17

Fig. 1 : Bullock drawn planter with low cost metering device

in saving of valuable seed and also the labour charges required for thinning operation was eliminated. The actual field capacity was found to be 0.1754 ha/h. The average field efficiency of the machine was 66.05 per cent. The draft requirement for implement was 61.42 kgf. The cost of operation was Rs.35.5 per hour and Rs. 180 per hectare. The overall weight of the machine was 44 kg. The cost of implement is about Rs. 6000. The separate seed metering device is costing about 3000; which can be attached to any three tyne cultivator to make it affordable to small and marginal farmers. Similar results obtained were supported by Baloch and Mughal (1985); Kadu (1996); Karyal *et al.* (2006); Khetmalas and Varma (2003) ; Nirala (2011); Veerangouda *et al.* (2014) and Wanjari and Sawant (1968).

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REFERENCES

Baloch, J.M. and Mughal, A.Q. (1985). Modification and testing of bullock drown single row crop planter. *Agricultural Mechanization in Asia, Africa & Latin America*, **16**(3) : 31-34.

Brooks, D. and Church, B. (1987). Drill performance assessments: changed approach, *British Sugar Beet Rev.*, **50** (3) : 13–15.

Jasa, P.J. and Dickey, E.C. (1982). Tillage factors affecting corn seed spacing. *Trans. ASAE,* **25** (6) : 1516 -1519.

Kachman, S.D. and Smith, J.A. (1995). Alternative measures of accuracy in plant spacing for planters using single seed metering. *Trans. ASAE,* **38**(2): 379–387.

Kadu, V.M. (1996). Development of tractor drawn multicrop planter. *Agric. Engg. Today*, **20**(4) : 16-18.

Karayel, D., Wiesehoff, M., Ozmerzi, M. and Muller, J. (2005). Laboratory measurement seed drill seed spacing and velocity of fall of seeds using high speed camera system. *Comp.& Electro. Agric.*, **50**(2) : 89-96.

Khetmalas, S.E. and Varma, G. (2003). Refinement of bullock drawn Jyoti Multicrop planter. B. Tech. Thesis, Dr. A.S.C.A.E., Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar, M.S. (INDIA).

Kocher, M.F., Lan, Y., Chen, C. and Smith, J.A. (1998). Opto-electronic sensor systems for rapid evaluation of planter seed spacing uniformity. *Trans. ASAE,* **41** (1): 237-245.

Navid, H., Ebrahimian, S., Gassemzadeh, H.R. and Mousavi nix, M.J. (2011). Laboratory evaluation of seed metering device using image processing method. *Australian J. Agric. Engg.*, **2** (1) : 1-4.

Nirala, Sanjay Kumar (2011). Performance evaluation of bullock drawn multi crop inclined plate planter. *Internat. J. Agric. Engg.*, **4**(2) : 193-199.

Raheman, H. and Singh, U. (2003). A sensor for flow seed metering mechanisms. *IE (I) J.-AG,* **84** : 6 - 8.

Veerangouda, M., Prakash, K.V., Ram, Jagjiwan and Neelakantayya, G. (2014). Development and evaluation of bullock drawn engine operated high clearance sprayer for pigeonpea crop. *Internat. J. Agric. Engg.*, **7**(1) : 207-211.

Wanjari, S.S. and Sawant, S.D. (1968). Design and development work for the planter. A.S. College of Agricultural Engineering, Poona. 29-31pp.

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