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*Research Paper :*

# Performance evaluation of bullock drawn seedrill for groundnut

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## ABSTRACT

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 groundnut variety SB-XI. It delivered desired seed rate of 36.8kg/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 0.0612 ha/h at average operating speed of 2.4 km/h. The field efficiency of seed drill was 76.5% and average depth of seed placement was 55 mm, where the average seed spacing was 12 cm. The cost of drilling / planting with the help of this seed drill was estimated as Rs. 473.75 per ha. The saving of man-hour and cost of drilling / planting was quite substantial and justified with the use of seed drill.

**Key words :** Groundnut, Bullock, Seed drill., Performance

India has 85 million of draft animal 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. Farm mechanization is necessary to increase production with less investment and less time of operation.

Sowing is a prime operation in cultivation practice of any crop. Sowing is an art of placing seeds in the soil to have good germination in the field, the perfect seedling gives;

– Correct amount of seed per unit area.
– Correct depth at which seed is placed in the soil.
– Correct spacing between row-to-row and plant-to-plant.

Seed drill or seed cum fertilizer drills (bullock drown or tractor drown) facilitate line sowing and proper application of seed and fertilizer in the field. Thus there is saving of 10-15% input.

The animal drown dufan (two row), tifan (three row), and FESPO plow (all local sowing devices) have been adopted as these cover more area and costless. These however required skilled labour to regulate seed rate. For precise application of seed and fertilizer, mechanically metered seed drill and seed cum fertilizer drill, operated by animal and tractor have been developed and are being manufactured to suit specific crop and regions for sowing /planting of wheat, paddy, course cereals, pulse, oil seeds, maize and potato.

Groundnut (*Arachis hypogyea* L.) is a major cash crop in India. In India, total area under this crop is about 61.41lack ha. India ranks second in groundnut production. Average yield is about 4.08q/ha having 66,00,000 ton production. Groundnut production of India contributes about 19% of world production. (Indian Economic Survey, 2006). In India sowing of groundnut is carried out with four tyne seed drill (pabhar), tifan, or at some places by dibbling. But during sowing with seed drill and tifan only row spacing is maintained. To maintain plant-to-plant and row-to-row spacing dibbling method is generally employed, to increase groundnut production. It is necessary to maintain the correct plant-plant and row-row spacing. Sowing by dibbling is labour and time consuming.

A bullock drawn seed drill for ground nut was developed to minimize time and labours requirement. It was tested for performance.

## METHODOLOGY

Development in the seed drill was made by changing the seed metering mechanism and provision of drive to the metering mechanism. The fabrication work was carried out in the workshop of Farm Machinery and Power Department, Aditya Agriculture Engineering and Technology College, Beed. Developed seed drill was evaluated as per RNAM test code in which laboratory and field test are carried out.

Seed drill as shown in Fig. 1 mainly consists of following functional units;

### *Seed metering hopper with bottom plate:*

This unit consisted two plates, one as bottom plate

**Fig. 1 : Bullock drawn seed drill for groundnut**

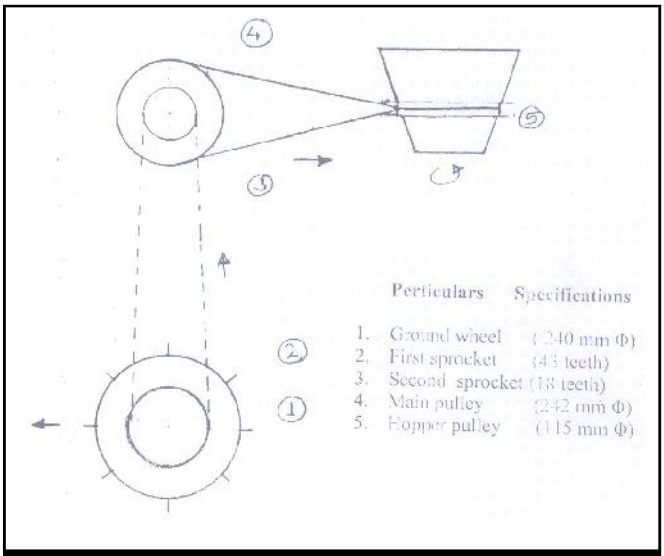


**Fig. 2 : Flow of power transmission**

and other as hopper plate. The bottom plate was fixed on frame and delivers the seeds to the seed tube. Where as the hoper plate forms bottom of the hoper. Conical shaped hoper had to performed two functions; to meter the seeds and reservoir for the seed. The hoper was rotated by a pulley fitted over it.

Both the plates were 114.5mm in diameter and kept 1mm apart . The plate has two metering holes of 17 mm on the periphery. The dimensions of each hole was decided by taking into account the geometric dimensions of ground nut seed.

The M.S. hopper was having following dimensions,

- Height = 210mm.
- Top diameter = 229.1mm.
- Bottom diameter = 114.5mm

At center of plate hopper revolved around axis of shaft fixed to the lower horizontal plate. In between these two plates there was clearance of 1mm, provided to avoid friction between them. The complete metering system was attached to the handle through the rod welded to lower plate.

***Power transmission unit:***

Power transmission unit are shown in Fig. 2 consisted of ground wheel, chain and sprocket arrangement, large pulley and hoper pulley.

The diameter of power transmission wheels used for seed drills/planters ranges from 30 to 70cm Verma (1986) suggested diameter of power transmission wheels as 22.5 to 40cm for bullock driven seed drill/planter and 40 to 60cm for tractor driven planter. In order to adjust the number of cells and plant spacing, ground wheel of 24 cm was taken in present case. On the periphery of ground wheel 16 pegs were provided to avoid slippage during operation.

Chain was selected for transmitting power from ground wheel to the sprockets on the shaft on which pulley was mounted. The arrangement was such that it had two sprockets; one had 43 teeth provided on ground wheel shaft and another of 18 teeth on the shaft on which pulley was mounted to give drive to metering mechanism through belt.

Ground wheel drive the sprocket on the ground wheel shaft, which in turn gave drive to large pulley which is mounted on driven sprocket above it. Large pulley of 242mm diameter was made of mild steel material. This pulley runs in vertical plane and gave drive to the hopper pulley(115mmΦ) with the help of v-belt in horizontal plane.

***Seed tube:***

Transparent PVC tube with inner diameter 18mm was used as seed tube. One end of the seed tube was fitted to bottom fixed plate of metering unit and the other was fitted to the boot of furrow opener.

***Frame:***

The frame was made strong enough and convenient for proper assembling of various parts over it with 400 x 80 x 50 mm hollow square pipe. It supports a handle and a beam. The handle was 25mm in diameter and a hollow sectioned mild steel pipe was used for it.

The beam was fitted for pulling the seed drill in the field with a pair of bullock. It was made of 2.75m length hollow pipe of 40mm inner diameter having 2mm

thickness.

***Principle of working:***

– One revolution of ground wheel covers distance = π x D=75 cm

– revolutions made by metering hoper were = 5

– *i.e.* on 75 cm length on ground 5 seeds were droped.

– hence spacing between the seeds were = 75/5 =15cm

## RESULTS AND DISCUSSION

The seed drill was tested for seed rate, mechanical damage, spacing between seed, depth of seed placement in the soil, field capacity, field efficiency and cost of operation.

***Seed rate:***

Speed of the implement was 2 km/hr, all the trends of treatment; full hopper, ¾ hopper capacity and ½ hopper capacity were observed to be not much vary from its average value of seed rate *i.e.* 36.8 kg/ha (Fig. 3).

But variation in all trends were observed to be deviating as the speed of seed drill increase to 3km/ hr. It can be said that operating range of this implement is 2-2.5 km/hr

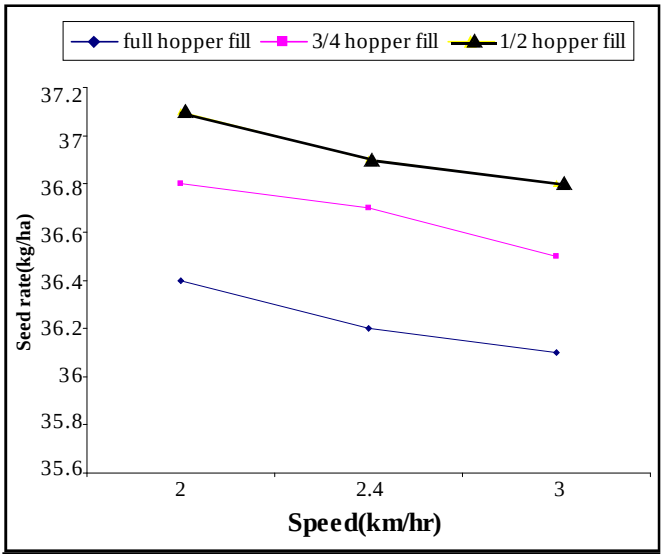


**Fig. 3 : Seed rate vs. travel speed at different hopper fill**

***Mechanical damage:***

Fig.4 indicates; as the working speed of implement increased from 2km/hr to 3km/hr the mechanical damage for all the treatments also increased. But the damage to the seeds for three speeds was within the acceptable limit *i.e.* 0.62%.

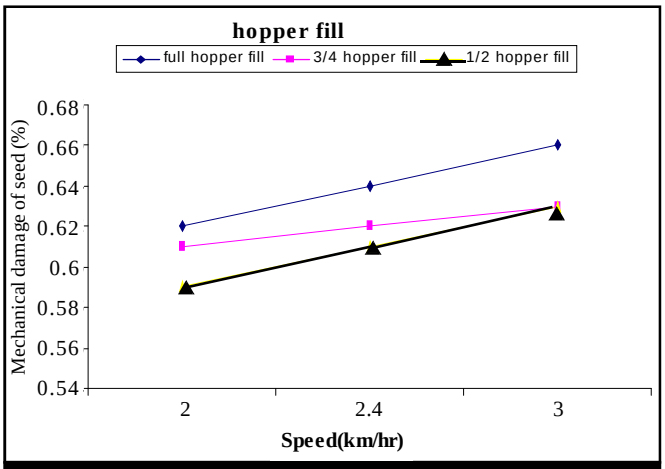


**Fig. 4 : Mechanical damage of seeds vs. travel speed at different Hopper fill**

***Seed spacing and depth of seed placement in the soil:***

Observations regarding the seed spacing during the field test are shown in Table 1. The average of five observation recorded for seed spacing was 15.08 cm (which was within the acceptable limit *i.e.* 15cm. for mentioned variety).

Depth of seed was observed to be 5.5cm (Table 1). According to Ram (1975), depth at which the seed must be planted to enable it to get contact with sufficient moist layer, in order to ensure germination was generally 50-100mm. Hence, it can be said that depth of seed placing was quite satisfactory in this case.

***Field efficiency and labour requirement:***

Well prepared plot of 10x10m size was selected for testing the seed drill in the field of Aditya College of Agricultural Engineering and Technology, Beed.

Table 2 shows the data collected during field test keeping 40cm tyne spacing, theoretical field capacity at operating speed 2km / hr was computed to be 0.08 ha/hr. The effective field capacity of the machine considering the time losses during the operation like turning the implement, hopper filling varied from 0.56 to 0.67 ha/hr where as the field efficiency varied form 70.00 to 83.75%.

The average values of effective field capacity and field efficiency were 0.0612 ha/hr and 76.50%, respectively. An average energy requirement was 16.45 man- hr/ha.

***Cost of operation:***

The cost of the seed drill was worked out to be Rs. 2080/-. Operational cost of machine was estimated to be Rs. 473.75 /- per hectare.

**Table 1 : Seed spacing and depth of seed placement in the soil**

| Sr. No. | Observations | Furrow-1 | | | | | Furrow-2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Seed spacing(cm) | R1 | R2 | R3 | R4 | R5 | R1 | R2 | R3 | R4 | R5 |
| | | 14.9 | 14.8 | 15.2 | 15.3 | 15.2 | 15.3 | 15.4 | 14.9 | 15.0 | 14.8 |
| | | Average = 15.08 | | | | | Average = 15.08 | | | | |
| 2. | Depth of seed placing in soil (cm) | 5.4 | 5.5 | 5.4 | 5.5 | 5.7 | 5.6 | 5.5 | 5.4 | 5.6 | 5.5 |
| | | Average = 5.5 | | | | | Average = 5.5 | | | | |

**Table 2 : Field efficiency and labour requirement**

| Sr. No. | Starting time, h :min | Ending time, h :min | Total time, h | Theoretical field capacity, (ha/h) | Effective field capacity (ha/h) | Field efficiency, (%) | No. of labour used | Labour requirement, (man-h/ha) |
|---|---|---|---|---|---|---|---|---|
| 1. | 9:15 | 9:25 | 0.167 | 0.08 | 0.06 | 75.3 | 1 | 16.67 |
| 2. | 9:30 | 9:41 | 0.18 | 0.08 | 0.056 | 70 | 1 | 17.86 |
| 3. | 9:50 | 9:59 | 0.15 | 0.08 | 0.067 | 83.75 | 1 | 14.93 |
| 4. | 10:10 | 10:21 | 0.18 | 0.08 | 0.056 | 70 | 1 | 17.86 |
| 5. | 10:30 | 10:39 | 0.15 | 0.08 | 0.067 | 83.75 | 1 | 14.96 |
| | | | | | 0.0612 | 76.56 | | 16.45 |

***Conclusion:***

The performance of seed drill was satisfactory giving seed rate of 36.80 kg/ ha, Seed spacing was 15cm, depth of seed placement in the soil was 5.5 – 6 cm and seed drill required 16 hours to cover one hectare of land

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