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Design and Development of Bullock Drawn Groundnut Planter Suitable for Scarce Rainfall Zone of Andhra Pradesh

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ABSTRACT

A bullock drawn groundnut planter can be used for sowing groundnut has been designed, fabricated and tested for its performance at Agricultural Research Station, Anantapur during the years 2009-10 and 2010-11. The planter was tested in both laboratory and field conditions. The planter was a 4-row covered one with row to row spacing of 30 cm, seed to seed distance maintained in a row about 10.34 cm and depth of sowing 4-5 cm. The average field capacity of the planter was 0.37 ha h^{-1} with field efficiency of 69%. Seed rate obtained was 103.6 kg ha^{-1}. The weight of planter was 55 kg and cost per unit was about Rs. 8,500. The field performance obtained was quite satisfactory.

Key words : Planter**,**Seed rate, Seed to seed spacing,Trough feed seed metering mechanism

Groundnut is one of the important oilseed crops in India and it is grown in an area of 8.4 million ha with a production of 8.2 million tons annually. Groundnut is the major crop cultivated in an area of 8.5 lakh ha in Anantapur district, Andhra Pradesh under rainfed conditions. The average rainfall of Anantapur region is 550 mm. Nearly 80% of the farmers of this region fall under small and marginal category and they depend upon bullocks for sowing of groundnut. A 4-row bullock drawn seed drill (local name: *eddula gorru*) is commonly used for sowing of groundnut seed immediately after receiving rains in the months of June and July. This seed drill consists of a bowl (local name: *jadigam*) having four holes under its bottom connected with seed tubes, furrow openers, boots and tynes attached to body. At the time of sowing one man controls the two bullocks and one woman drops the seed in the bowl, from there the seed dropped in the furrows opened by the furrow opener through seed tubes. Main disadvantages with this seed drill is uniform seed to seed distance (10 cm) is not maintained in a row and more seed rate (150 – 180 kg ha^{-1}) than recommended quantity used (100 kg ha^{-1}) due to manual dropping of seed.

Abdul Wohab (1999) reported that sowing by a planter provides uniform placement of seeds in a row at a recommended spacing, depth, seed rate and with optimum plant population per unit area. There by a bullock drawn groundnut planter suitable for scarce rainfall zone of Andhra Pradesh was designed, fabricated and tested in both laboratory and field conditions.

MATERIAL AND METHODS

A bullock drawn groundnut planter was (Fig, 1, 2 and 3) was developed with main components such as body, draw bar pipes, furrow opener, seed tube, seed hopper, seed hopper holding pipes, seed metering device and power transmitting unit. Each part description and experimental procedure is given below.

Body and drawbar pipes

The body of the 4-row bullock drawn planter is made of 8.0 cm inner diameter light weight MS pipe of length about 110 mm. All the other parts of planter were attached to this body by welding with suitable bolts and nuts. Two light weight MS pipes attached to this body of size 3.75 cm as inner diameter of length 3.2 cm were used as draw bar pipes to connect planter with bullocks.

Furrow opener

A shoe type furrow opener was used as furrow opener and which was made of MS flat of 2.5 cm width, 5mm thickness and length 25 cm. It was attached to one end of tyne with bolts and nuts. One end of the furrow opener was given a sharpened edge to penetrate into soil and to open the furrow. A boot made of 3.75 cm diameter MS pipe of length 5 cm welded on top end of tyne for seed tube connection.

Fig 1. Front view of bullock drawn 4-row groundnut planter

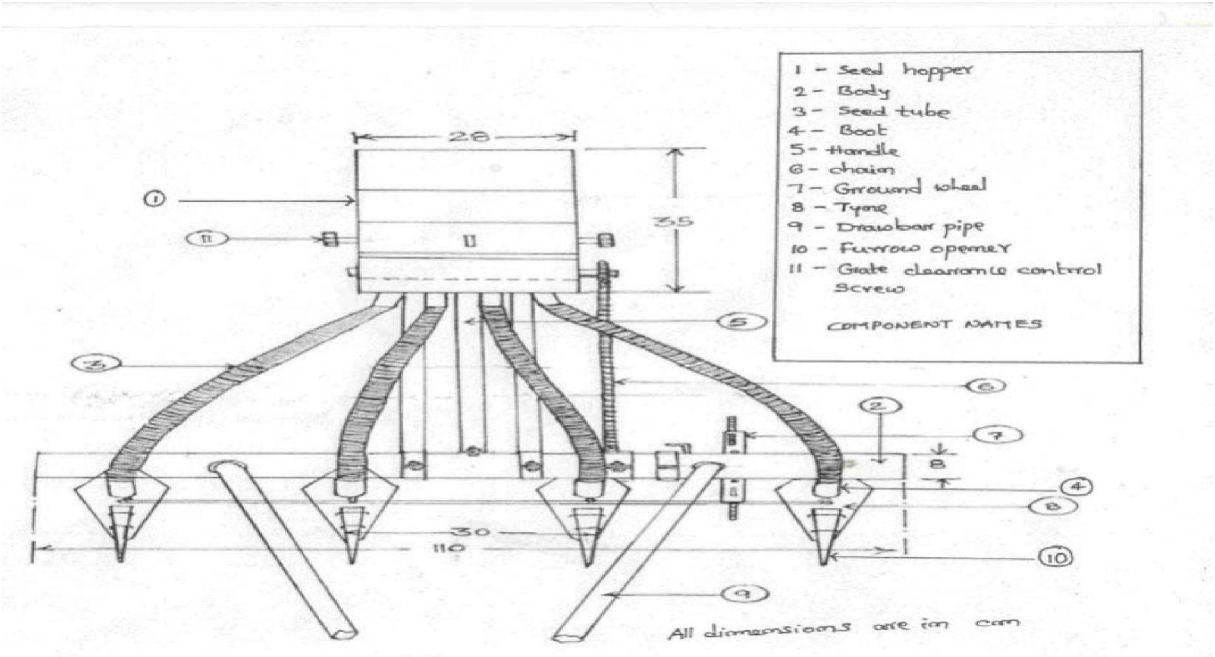

Table 1. Seed rate at different gate clearance for developed planter

S.No.	Gate clearance (cm)	Seed rate (kg ha^{-1})
1.	1.0	62.90
2.	2.0	101.20
3.	3.0	160.50
4.	4.0	212.70

Seed tube

Four seed tubes of each diameter 4.45 cm made of plastic were used for passing of seed from metering device to boot.

Seed hopper

The hopper of the planter was divided into seed box and feed box and made by using MS sheet Bachan Singh and Singh (1995) reported that it. It was fabricated taking into consideration the capacity required, bulk density and angle of repose of groundnut seed. The overall dimensions of the hopper were 28 cm X 26 cm X 35 cm with total capacity of 8 kg groundnut seed. A gate under the seed box allows the seed into the feed box. Required gate clearance can be set in between seed box and feed box.

Seed hopper holding pipes

Two MS pipes of 1.9 cm diameter and 73 cm length were used for the support of seed hopper on the body of the planter.

Seed metering device

A trough feed type metering device was used to meter the seed. It was provided with 4 numbers of vertical rotors made of plastic having cells on periphery. All the vertical rotors are rotated by the feed shaft getting power from ground wheel. Diameter of each rotor is 9.0 cm with thickness of 13 mm and having 10 cells around its periphery. The dimension of cell was in such a way that, it picks only one seed from feed box and drops into the seed tube.

Power transmitting unit

The power required to operate the seed metering device was provided from a peg type ground wheel, 250 mm in diameter, through chain and sprockets. Lugs were provided, 10.5 cm height, on periphery of the wheel for better traction. A motor cycle roller chain of 12.70 mm (0.5 inch) pitch with 19 and 12 number of teeth on the mild steel sprocket were selected for power transmission from ground wheel seed metering device shaft or feed shaft.

All the components were assembled by suitable bolts and nuts and welding in the work shop of Agril. Research Station, Anantapur. Total cost of planter came to around Rs. 8,500.

Laboratory test

During the laboratory test, a groundnut variety of K6 bold size seed was used for the seed rate calibration. Calibration process was done as per the standard procedure. Seed rate was calibrated at 1 cm, 2 cm, 3 cm and 4 cm gate clearance in between seed box and feed box. A normal speed of 2.5 km h^{-1} was maintained.

Field performance test

Developed planter was tested for its performance in a plot size of 30 m X 30 m at Agricultural Research Station, Anantapur during the years 2009-10 and 2010-11 in comparison with local practice method of sowing as per the RNAM test code procedure for seed and fertilizing machinery.

In bullock drawn groundnut planter, a gate clearance of 2.0 cm was set in between seed box and feed box. Initially hopper was filled with 8 kg of groundnut seed and one men labour controlled two bullocks. As the planter moves forward, seed get delivered from the seed hopper through seed metering device and placed in the furrow through the seed tube and furrow opener. Different parameters like row to row spacing, seed to seed spacing in a row, depth of sowing, seed rate, speed of operation, field capacity and field efficiency were taken into consideration during field performance test.

By local method of groundnut sowing, a bullock drawn seed drill was selected and done sowing. One men labour controlled the two bullocks and one women labour dropped the seed in the bowl attached to seed drill. All the parameters taken for bullock drawn planter were considered and noted.

After sowing, plant population per square meter after 15 days of sowing, final plant population per square meter at the time of harvesting and pod yield were taken as crop data for analysis in both methods of sowing.

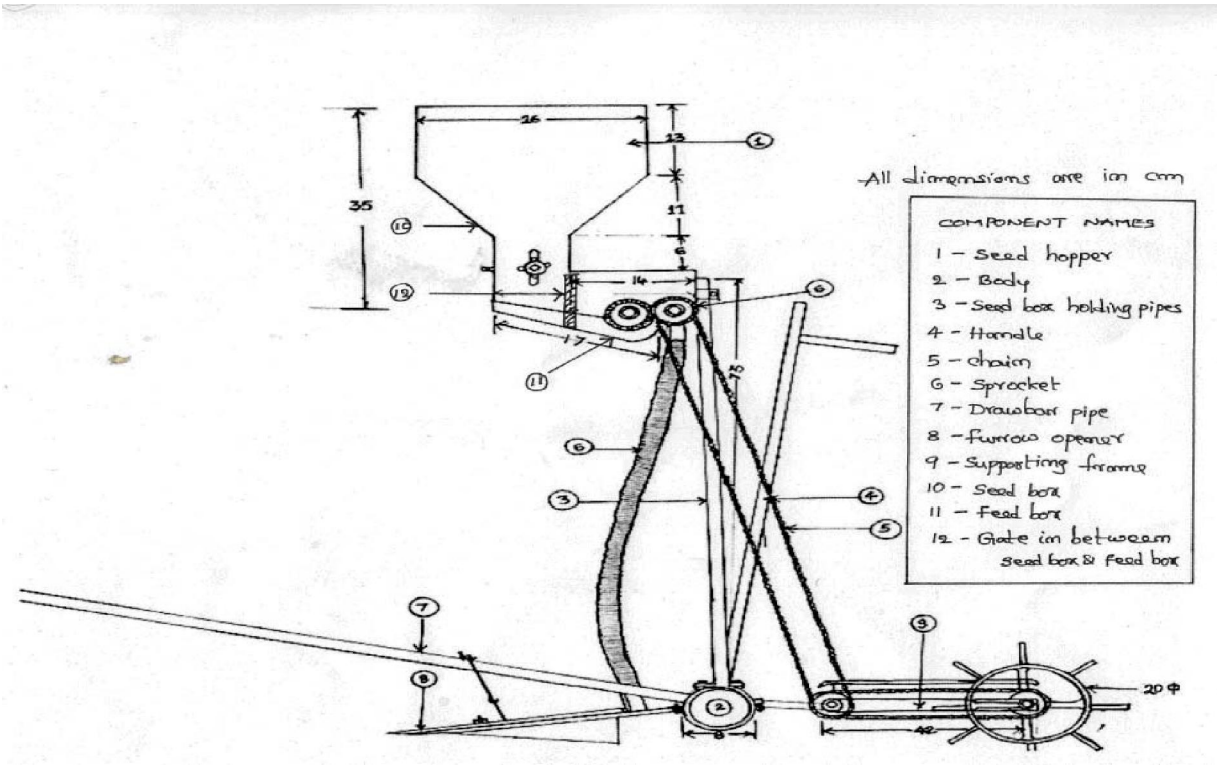

Fig 2. Side view of bullock drawn 4-row groundnut planter

Fig 3: Isometric view of bullock drawn 4-row groundnut planter

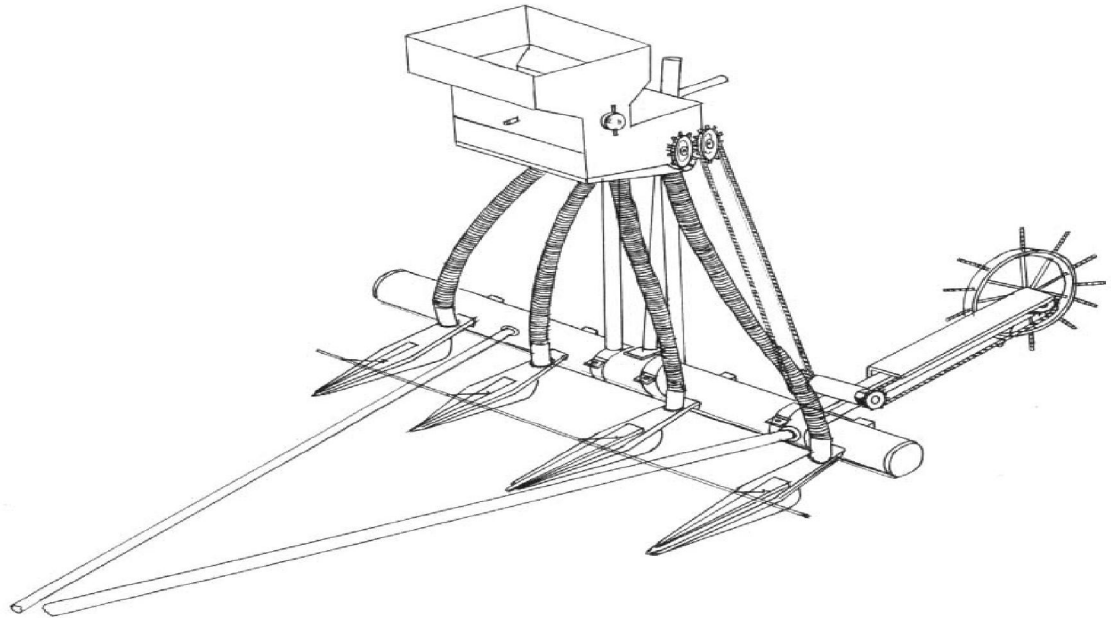

Table 2. Field performance of developed bullock drawn groundnut planter as compared to local seed drill

S.No.	Parameter	Sowing with developed planter	Sowing with local seed drill
1.	Width of operation, cm	120.00	120.00
2.	Row to row spacing, cm	30.00	30.00
3.	Seed to seed spacing in a row, cm	10.34	5-7
4.	Depth of sowing, cm	4 - 5	4-5
5.	Seed rate, kg ha^{-1}	103.60	176.00
6.	Speed of operation, km h^{-1}	2.63	2.66
7.	Field capacity, ha h^{-1}	0.37	0.34
8.	Field efficiency, %	69.00	67.00
9.	Initial plant population per m^2	33-35	50-55
10.	Final plant population per m^2	30-31	45-50
11.	Pod yield, kg ha^{-1}	1282.50	1230.00

RESULTS AND DISCUSSION

During laboratory test, it was observed that with increase in gate clearance from 1.0 cm to 4.0 cm, the seed rate was increased from 62.90 kg ha^{-1} to 212.70 kg ha^{-1}. This was due to increased flow rate of seed from seed box to feed box. At the gate clearance of 3.0 cm, seed rate of 101.20 kg ha^{-1} for groundnut was noted which is nearly equal to recommended seed rate (100 kg ha^{-1}) for groundnut (Table 1).

The field performance of developed bullock drawn groundnut planter was quite satisfactory and results are shown in Table 2. The average seed to seed distance in a row and seed rate obtained in case of developed groundnut planter were 10.34 cm and 103.6 kg ha^{-1} respectively and in case of local seed drill they were 6.40 cm and 176 kg ha^{-1} respectively. Seed to distance obtained in a row and seed rate obtained by using planter were nearly equal to the recommended quantities and also 73

kg of groundnut seed can be saved without wastage. The average field capacity of groundnut planter obtained was 0.37 ha h^{-1} at the speed of 2.63 km h^{-1} with the field efficiency of 69%.

Initial and final plant population per m^2 in case of crop sown with developed planter observed were 33-35 and 30-31 respectively and incase of crop sown with local seed drill, were 50-55 and 45-50. Therefore, it was proved that by using this planter, recommended plant population per m^2 for groundnut crop can be maintained. There was not much difference in yield of crop sown with developed planter and local seed drill.

CONCLUSIONS

The following conclusions are drawn from the study

1. Seed to seed spacing obtained in a row was 10.34 cm which is nearly equal to recommended seed to seed spacing i.e. 10 cm in a row for groundnut.
2. Seed rate obtained was 103.6 kg ha^{-1} which is nearly equal to the recommended seed rate i.e. 100 kg ha^{-1} for groundnut.
3. Wastage of seed and one labour for dropping of seed can be avoided.
4. Recommended plant population per m^2 i.e 33 for groundnut crop can be maintained.
5. Cost per unit was Rs. 8,500.

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