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Development and performance evaluation of semi-automatic gap filler*

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Improper placement of seeds, damage during planting, less viability of seeds, unfavourable environment or physical condition of soil are possible causes of gaps left within the rows in the field. This leads decreased plant population, which consequently reduces the yield of crops. It is, therefore, required to fill up the gaps with fresh seeds at a desired depth to maintain the required plant population. Presently farmers are filling these gaps by placing 2–3 seeds in the crop rows manually, sometimes using sickle. For every gap to be filled up, the operator has to bend down to dig the soil for proper placement of seeds, drop the seed in depression and finally cover the seed with soil. This traditional method of planting is time-consuming, tiresome and ergonomically unsuitable for human health due to constant bending of a person while dropping the seeds. The stooping posture during planting leads to backache, fatigue and reduced work output (Ladeinde and Varma 1994). The dibbler developed at the Central Institute of Agricultural Engineering, Bhopal, having verticle rotor-type seed-metering mechanism, is suitable for cereals and pulses crops. In case of groundnut (*Arachis hypogaea* L.) seeds get damaged due to improper size of groove provided in the rotor. Frequent clogging of soil-opening unit was noticed due to sticky, medium black soil of the Saurashtra region. The manual drawn automatic multicrop planter developed at the Birsa Agricultural University, Ranchi, found suitable for soybean [*Glycine max* (L.) Merr.], maize (*Zea mays* L.) and pigeonpea [*Cajanus cajan* (L.) Millsp.] but cannot be used for groundnut seeds which is very susceptible to damage. In order to eliminate the negative side-effects of the traditional method of planting and to overcome the above-mentioned difficulties, a semi-automatic gap filler was developed at Research, Testing and Training Centre, Junagadh, and its performance was evaluated for its possible adoption.

The study relates to performance evaluation of semi-automatic gap filler developed on the basis of functional requirments, such as depth of seed placement and anthropometric data of the farm workers of this region. It comprises a seed funnel, seed tube, handle, compression spring and soil opener (Fig 1). The main seed-conveying pipe is made of 25 mm ϕ conduit having length 930 mm. A funnel made of 20 gauge GI sheet of 120 mm ϕ based on the average width of the palm is welded to the top of the pipe for manual seed placing. At the bottom of the seed tube channel-type soil opener made of 20 gauge GI sheet is welded. An 'L' shaped flap made of 18 mm × 3 mm MS flat is attached with a bushing and drive is provided from hand-operating lever to make sufficient opening for seed dropping. A compression spring is also provided near the lever to keep flap in closed position.

While working, the unit is held in one hand and seeds are dropped by the other hand. Thus, the seed metering is manual and one can drop one or more seeds in the seed funnel to plant at a given spot. The opener is thrust into the ground by holding the gap filler verticle. Thereafter, seeds are put in the funnel and flap is opened by hand-operating lever for seed placement in the soil. Immediately the gap filler is lifted keeping flap opened and then lever is released for closing the flap and seeds are covered with the soil by foot. Then next mark should be approached for further planting. With this semi-automatic gap filler, one can drop the seeds in the seed tube while shifting the unit from one planting spot to another and unit is operated in standing posture.

Comparative performance of channel-type semi-automatic gap filler along with traditional method of planting was evaluated for different crops, viz groundnut, castor (*Ricinus communis* L.) and cotton (*Gossypium* sp), commonly grown in the region (RNAM 1983). The soil parameters such as type of soil, moisture content, bulk density of soil, and plant parameters such as variety of seeds, row-to-row spacing average plant-to-plant spacing were recorded during the study. By using semi-automatic gap filler, the average depth of planting was recorded as 6.0, 5.6 and 6.3 cm for groundnut, castor and cotton, respectively, whereas in case of traditional planting it was found 4.8, 4.1 and 5.25 cm respectively. Thus, required depth of seed

* Short note

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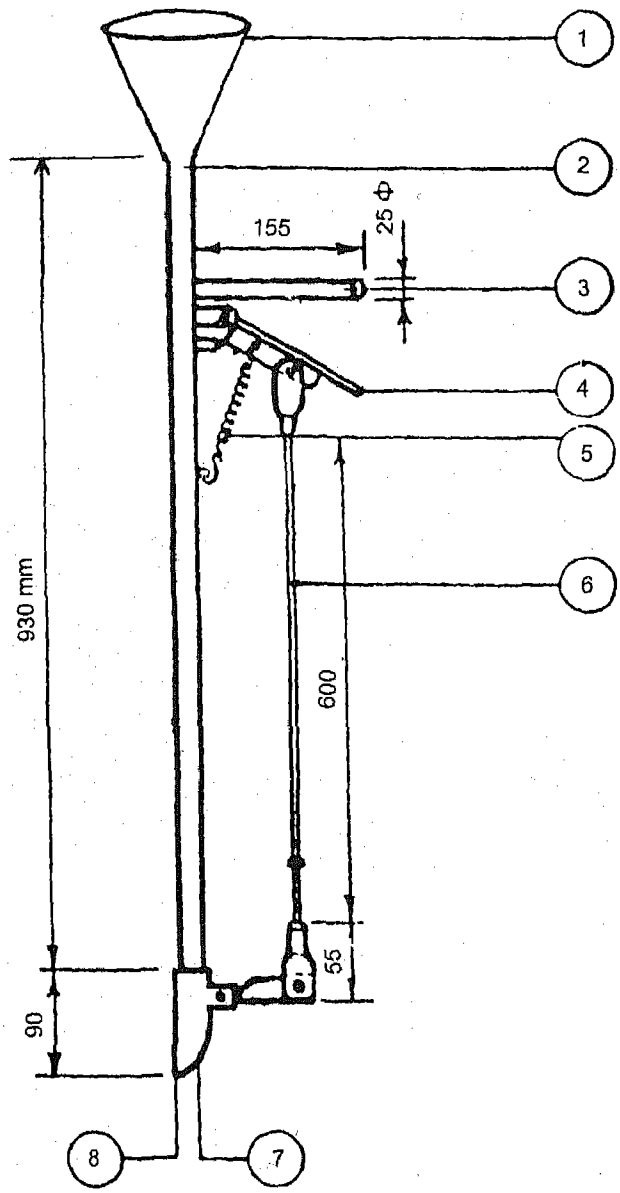

Fig 1 Semi-automatic gap filler. *1*, seed-recepticle funnel; *2*, seed-conveying pipe; *3*, handle; *4*, flap-operating lever; *5*, compression spring; *6*, lever arm; *7*, flap; *8*, hole opening unit

placement could be achieved by gap filler with little variation, whereas the traditional method resulted in shallow depth of planting with greater variation in depth. It was also recorded that for all the crops considered for trial, rest pause was required. The planting capacity of gap filler was found higher (473, 750 and 483 seeds/hr for groundnut, castor and cotton respectively) which was about twice compared with traditional method of planting. The cost of planting was also worked out, being 0.09, 0.06 and 0.08 Re/plant for groundnut, castor and cotton respectively for planting by gap filler which is about just half the cost of planting by traditonal method, requiring 0.18, 0.10 and 0.15 Re/plant. Thus, it was found that semi-automatic gap filler was easy to operate and continuous operation was possible without requiring any rest pause and that too at cheaper rate and maximum output.

Semi-automatic gap filler was found suitable for majority of crops and soils of Saurashtra region, as 50% time and labour can be saved compared with manual gap filling. Required and uniform depth of seed placement was achieved. It has advantage of eliminating the backache problem encountered in traditional method of gap filling.

SUMMARY

An experiment was conducted during 1999–2000 to study performance of semi-automatic gap filler in groundnut (*Arachis hypogaea* L.), Castor (*Ricinus Communis* L.) and cotton (*Gossypium* sp). The average depth of planting recorded was with semi-automatic gap filler 6.0, 5.6 and 6.3 cm compared with 4.8, 4.1 and 5.25 cm with traditional planting for groundnut, castor and cotton respectively. The cost of planting was less in case of semi-automatic gap filler than in the traditional method. The semi-automatic gap filler was found easy to operate.

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