



Sweep seed drill for intercultural operation along with sowing of soybean (*Glycine max*) crop

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ABSTRACT

A field experiment was conducted to study the effect of planting by tractor-drawn sweep seed drill, on growth and yield performance of soybean, weed population and economics. A Tractor drawn sweep seed drill, attachable on 30 PTO hp tractor was conceived, fabricated and validated for facilitating weeding along with sowing operations on the field prepared for soybean crop. The use of developed seed drill leads to saving of one pass tillage and one weeding operation in the initial growth period. In this way, approximately ₹ 3 000/ha/season could be saved from the total expenditure. The simultaneous tillage and sowing operation by the machine helps to maintain higher plant population (25.22–34.55%). This also leads to reduction of weeds (59.91– 68.37%) as compared to flat sowing method. Thus, the use of sweep seed drill curtails the cost on post sowing weedicides along with seed bed preparation as one operation of cultivator. Result of the study indicated that crop planted by the sweep seed drill showed yield increase from 7.78 to 16.46% as compared to normal seed drill. It is suggested to get tractor-operated sweep seed drill manufactured with an adjustable frame which could hold sweeps at the rear end of the frame of the seed drill and the tines for dropping seeds on the front of the seed drill frame to ensure better field operation.

Key words: Shank, Soybean, Sweep seed drill, Sweeps, Weeding.

Soybean (*Glycine max* Merrill) has major importance in Indian agricultural and oil industry and remarkably contributed to yellow revolution. At present, soybean ranks first among the major oil seed crops both in the world and India and presently regarded as high protein containing functional food. Soybean being an export-oriented crop fetches on an average ₹ 20 000 million/year by the export of de-oiled cake to other countries. This constitutes almost 65% of the total oil meal export of India. Moreover, it supplements more than 10% of edible oil produced in the country (Joshi 2003). To achieve global competitiveness, it is necessary to limit the cost of cultivation. Farm mechanization is one of the important avenues that offer good opportunity in this endeavour, not only in case of soybean but other crops also. In addition to limiting the expenditure on manual labour, it helps in executing farm operations timely in limited time available, particularly in Vertisols and associated soils.

In central India, seedbed preparation for sowing both winter and summer crops consumes considerable time and

energy (Prasad 1996). Seedbed preparation for winter crops following summer crops poses a serious problem, particularly in Vertisols where timeliness is important. In crops like soybean which are planted in *kharif* season, straight line sowing with simultaneous weeding are of paramount importance and crucial for better performance of the crops as well as for future mechanized operations during the crop season. After planting, the success of soybean crop to a greater extent depends upon inter culture and weed management. The weed management chemically or mechanically results in preventing significant crop losses (Oerke and Dehne 2004). This weed management part can be handled efficiently by usage of tractor-operated sweep seed drill. No such seed drill available in India has weeding ability. Therefore, to give impetus to mechanization in soybean with added advantage of weed management and to reduce cost of cultivation, a simple but effective Tractor-operated sweep seed drill, was developed at the Directorate of Soybean Research, Indore and evaluated for its effectiveness.

MATERIALS AND METHODS

The tractor-operated sweep seed drill (Fig 1) was conceived and developed which can efficiently perform weeding operation along with sowing. This sweep seed drill has been made of combination of mild steel and high carbon

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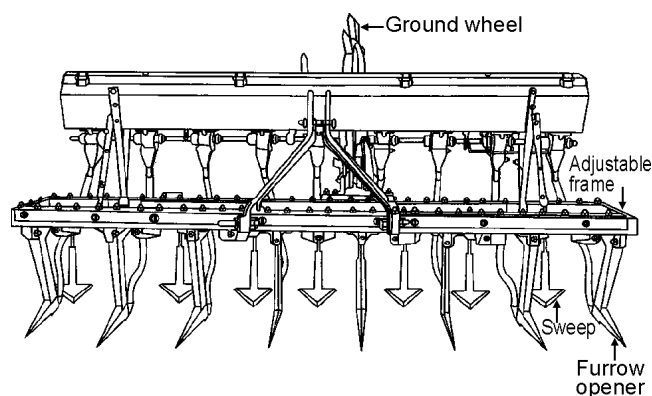


Fig 1 Sweep seed drill for soybean crop

steel depending on the strength of part to withstand extreme soil conditions (approximate cost of the machine ₹ 52 000). This machine is capable of uprooting weeds simultaneously with sowing operation and mountable on tractor of suitable power. The seed drill was developed with provision of sweeps for uprooting the weeds has a provision of changing the angle of penetration. In this seed drill furrow openers are placed at the front of the frame and the sweeps are placed in the rear part of the frame. These sweeps are placed in such a way that the land between the two furrow openers is tilled and the weeds are uprooted. The distance between the front and the rear of the frame of the seed drill is kept such that weed plants don't get obstructed. It is suggested to always get sweeps manufactured for individual seed drill which could be removed after usage as and when required. The same sweep seed drill can be used for sowing of other crops in *rabi* as well.

The sweep seed drill saves two stage weeding operation which are pre-emergence weeding operation and post-emergence weeding operation. The above mentioned two stages are generally accomplished by chemical weedicides.

Both the operations are crucial for the health of soybean crop as it involves germination and initial growth stage of the seed/plant. It is relevant to mention here that weeding operations by tractor or manual intervention is often not possible as soybean is rainfed crop in black soils due to erratic rainfall pattern.

The said tractor-operated sweep seed drill was tested for its efficacy for three consecutive cropping seasons in soybean cropping season (*kharif* 2007–09) at Research Farm of Directorate of Soybean Research, Indore. The Directorate is situated at 22° 4'37"N latitude, 75° 52'7"E longitude and altitude of 540 meter above the mean sea level. The experiments were carried out on deep black cotton soils with pH 7.6 to 8.1, low to medium in organic carbon and available phosphorus and high in potassium (Typical Chromusterts and Lithic Vertic Ustochrepts). Tillage was done with two passes of rigid tine cultivator followed by planking 10 days before sowing with tractor-operated sweep seed drill, The

soybean crop was sown using this tractor-operated sweep seed drill with continuous drilling, to ensure row planting at 45 cm row-to-row distance with seed rate of 70 kg/ha. Major criterion considered for design of sweep seed drill was to till the land between rows of crop without affecting simultaneous sowing of seeds. The sweeps were of 25 cm wing width. Sweep sharpness angle 15 degrees. Sweep blade thickness was 0.8 cm. Approach angle was 80 degrees. For data analysis, the plant population/m² from 10 randomly selected places from ten replicated plots (each plot- 50 m × 2.25 m) for each of the above two treatments were counted. The yield data from each plot was recorded and expressed as kg/ha. The data was subjected for 't' test following Singh and Chaudhary (1985).

RESULTS AND DISCUSSION

The calculated 't' value was found greater than the 1% table 't' value with 18 degrees of freedom indicating treatments were highly significant. The use of developed sweep seed drill (Fig. 2) led to significantly lower weed count as compared to use of normal seed drill at 15 days after sowing soybean during all the three years of experimentation (Table 1). The reduction in weed population ranged from 59.91% to 68.37% with a mean value of 64.65%. This can be explained as the sweeps attached to developed seed drill could destroy emerging weeds and exposed the weed seeds during sowing operation. In this way, the expenditure on one pass tillage and one weedicide spray (approx. ₹ 3 000/ha/season) could be saved from the total expenditure. It has been reported that first 40–45 days are crucial for weed management to optimize yields (Chhokar and Balyan 1999). Several workers (Priya 2009, Kushwah and Vyas 2009, Yadav *et al.* 2009) already reported low seed yield due to infestation of weeds hindering the uptake of nutrients and reducing photosynthesis by shading of the main crop. Singh *et al.* (2007) also concluded that yield and N uptake in maize were negatively correlated with that of weeds. Elimination of weeds during early stages of crop growth had been thereby



Fig 2 Crop sown with sweep seed drill

Table 1 Resultant weed population (no./m²), plant population (no./m²) and seed yield (kg/ha) in field plot

Treatment	Weed population (no./m ²)				Plant population (no./m ²)				Seed yield (kg/ha)			
	2007	2008	2009	Mean	2007	2008	2009	Mean	2007	2008	2009	Mean
Sweep seed drill	48.70	37.60	44.90	43.73	45.30	44.00	42.50	43.93	1 251	1 150	1 351	1 250.66
Flat tillage and sowing method	121.5	118.9	130.8	123.73	34.4	32.7	33.94	33.68	1 088	1 067	1 160	1 105.00
Calculated 't' value	14.65	16.12	13.28	14.68	7.42	7.11	5.92	6.82	15.55	5.92	13.91	11.79

enabled the plant to grow and better yield. Thus we agree with Kushwah and Vyas (2009).

Another impetus to enhance the seed yield of soybean was provided by offering adequate plant population by the use of tractor operated sweep seed drill (Table 1). As compared to plant population (32–34 plants /m²) observed by using the normal seed drill for seeding soybean, the developed seed drill could offer plant count between 42–45 plants/m².

Consequent upon lesser weed competition and appropriate plant population, the yield expressed by using tractor-operated sweep seed drill was significantly higher as compared to seeding through normal seed drill. There has been 7.78 % – 16.46 % increase in seed yield with an average of 13.07 % (Table 1).

It is concluded from the data that the newly developed tractor-operated sweep seed drill has remarkable edge over the normal seed drill. The former is capable of providing support in weed management, maintaining appropriate plant population and thereby enhancing the seed yield of soybean. It is advisable to use tractor-operated sweep seed drill to ensure advantage of tillage, weed management and reduction in cost of cultivation effectively.

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