

Development of power tiller operated seed drill for rice and pulse crop

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ABSTRACT

A power tiller operated five row multi crop seed drill was developed which can be used for sowing paddy, green gram and black gram etc. The seed drill consists of a seed box, fluted roller type seed metering mechanism, ground wheel, two support wheels, shoe type furrow openers and hitching brackets. The machine is mounted at the back side of power tiller. It is attached to the power tiller through side hitching bars. It also remains attached with rear wheel shaft of power tiller through clamp. It can be easily attached and detached from power tiller. It can be raised or lowered by rotating the rear wheel height adjusting lever of power tiller. Depth of sowing of machine is adjusted by raising or lowering the two side support wheel. Flaps provided below the fluted rollers are kept in downward position while sowing paddy seed and are kept upward when machine is used for sowing smooth seeds. The machine was tested for sowing paddy, green gram and black gram. Metering ground wheel skidding was 24 percent. The field capacity of machine observed was 0.15 ha hr⁻¹.

Agricultural operations are highly time bound and every farmer wants to complete his job in time to reduce yield losses. Power tiller suitable for an individual farmer of small holding is a good alternative for this purpose. Power tiller use in India has been mainly in areas where wetland paddy cultivation has been the major in small land holdings. Manufacturing of power tiller in India have been undertaken by a number of firms over years. Farmers particularly for rice growing areas are gradually accepting the power tiller as source of power in their farm as this machine is better suited for puddling operation. It could also be used for multifarious jobs comprising of tillage, ploughing, intercultivation and haulage. Power tiller use is accelerating due to increased need of timely completion of field operations, better utilization of costly inputs and improved quality of work (De *et al.*, 2000). Farmers having power tiller and who grow paddy in wet season and pulse in dry season need power tiller operated sowing machine. Power tiller operated seed drill developed by different institutions is very heavy, bulky and complicated and have not reached to farmer's field. Specifications and working features of power tiller driven seed-cum-fertilizer drill developed by Central Institute of Agricultural Engineering, Bhopal, India is very heavy (120 kg) and complicated (Singh *et al.*, 2002). A 8 row direct paddy seeder developed by Asian Institute of Technology,

Bangkok had some operational and mechanical problems. Hence an attempt was made to develop a simple, easily attachable power tiller rear mounted, 5 row multi crop seed drill, particularly for rice and rice based crops like green gram, black gram etc.

MATERIALS AND METHODS:

Five row power tiller operated seed drill consisted of a seed box, fluted roller type seed metering mechanism, frame, furrow openers, ground wheel, power transmission system, ground wheel lifting mechanism, transport wheels and hitching mechanism (Fig. 1). The diameter of metering wheel and sprockets teeth ratio of power transmission system from ground wheel to seed metering fluted roller shaft was decided, so as to deliver about 100 kg ha⁻¹ seed rate for rice sowing. Speed ratio from ground wheel shaft to fluted roller shaft was kept 0.54 through chain and sprocket. This speed ratio was obtained in two steps through sprocket. Seed rate adjusting lever was provided on the back side of seed box. Different seed rate for different crops can be adjusted by shifting the position of this lever. Hitching mechanism consisting of support bars was provided horizontally at two places. Two side support bars were provided at the seed drill main frame level and other two at higher level, connecting seed drill frame and power tiller. Upper height bars were provided to

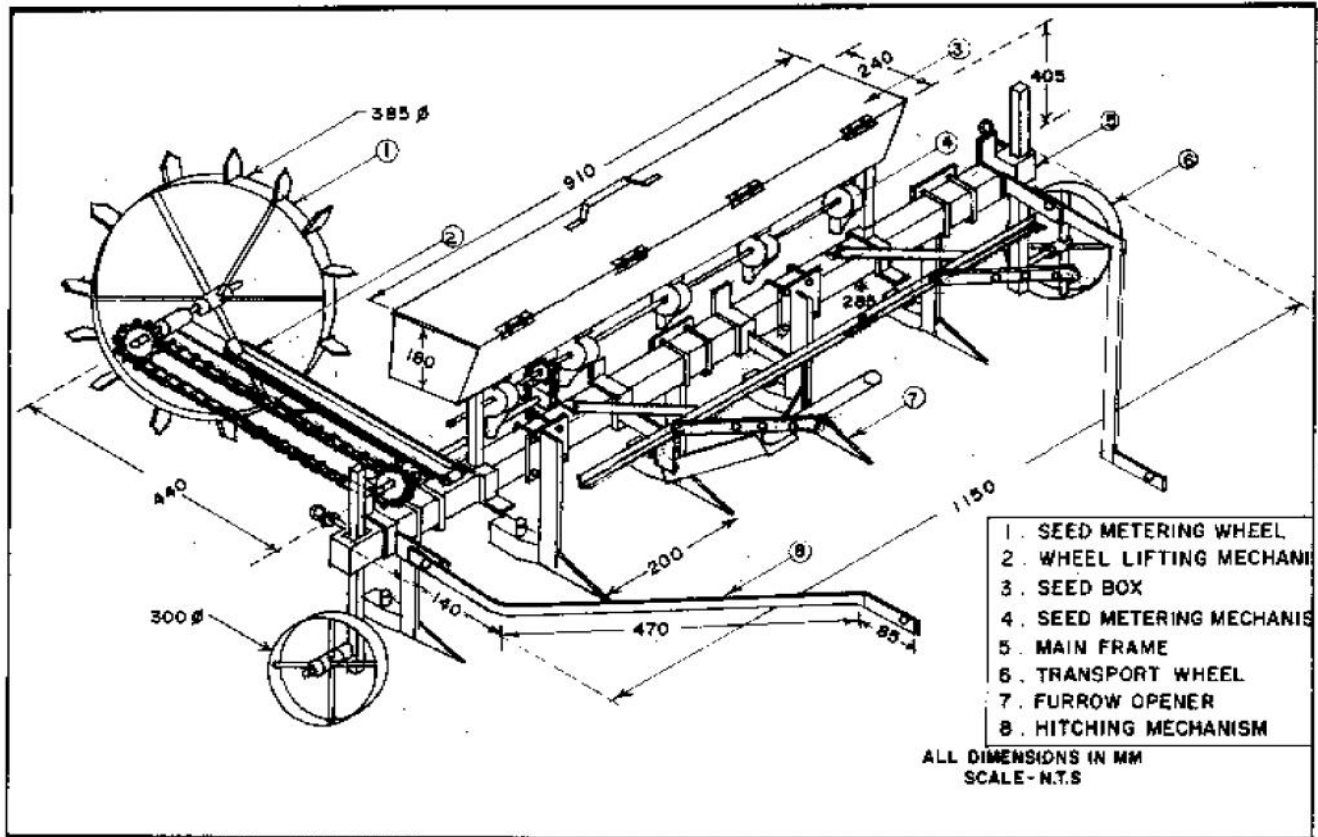


Fig.1. Power tiller operated five row multi crop seed drill

prevent front side tilting of seed drill during operation. Central portion of seed drill frame was attached to the screw rod of rear wheel of power tiller. Seed drill front portion can be raised or lowered by rotating the handle of rear wheel of power tiller to give proper angle to furrow openers. Two side support wheels were provided to control the depth of sowing. Depth of sowing can be controlled by raising and lowering these wheels and seed can be placed at desired depth. These wheels also act as transport wheel during transport. Machine was kept in sufficiently raised position on these wheels above the ground so that furrow openers do not touch the ground during transport. Shoe type furrow openers were used in the machine. A frame was also attached with the chassis of power tiller at the front to keep the balancing weight. Balance weight of 70 kg was kept to balance the weight of seed drill. Mild Steel sheet flaps were provided toward the delivery side of fluted roller by providing support through pin. The machine was fabricated based on certain specifications for efficient functioning (Table 1).

Table 1. Technical specifications of the power tiller operated seed drill

Type	: Back Mounted
Source of power	: Kamco power tiller
Overall length (cm)	: 145
Over all width (cm)	: 123
Over all height (cm)	: 80
Weight of machine (kg)	: 67.5
Seed box capacity (cm ³)	: 34580
Number of furrow opener	: 5
Type of furrow opener	: Shoe Type
Length of furrow opener (cm)	: 18
Row to row Spacing (cm)	: 20
Diameter of ground wheel (cm)	: 39
Diameter of transport wheel (cm)	: 30Cm
Working depth (cm)	: Adjustable
Seed rate (kg ha ⁻¹)	: Adjustable (0 to 100 kg ha ⁻¹)
Transmission system	: Chain and sprocket System.
Speed ratio (from ground Wheel to metering Shaft)	: 0.54

The seed drill was mounted on the rear side of Kamco-Power tiller and tested for sowing rice, green gram and black gram at the Central Rice Research Institute farm Cuttack in loamy soil. Two plots each of 1600 square meters were used for testing of the machine, one for rice and other for green gram and black gram, respectively. While calibrating seed drill, skidding of metering wheel was also taken into consideration, to get accuracy in seed rate. Seed drill was calibrated for seed rate of 60 kg ha⁻¹, 25 kg ha⁻¹, and 25 kg ha⁻¹ for rice, green gram and black gram, respectively. Variety of rice, green gram and black gram used for field testing were Naveen, PDM 139 and PU 30, respectively. Flaps were kept in downward position, when machine was used for sowing rice and in raised position when it was used for sowing seeds of green gram and black gram. When side support wheels are completely removed out, seed drill goes very deep. So it is very essential to attach support wheel at proper height for achieving desired depth of sowing (5.0 to 6.0cm.).

Field capacity of machine was determined by dividing the actual area covered by machine to time taken to cover that area. Skidding percentage of metering wheel was determined by dividing the actual number of revolution made by metering wheel to the theoretical number of revolution of metering wheel for the given length in the field multiplied by hundred. Observations on actual number of revolution made by metering wheel were taken during sowing operation in the field. Actual length traveled by wheel was measured with tape and skidding percentage was calculated. Fuel consumption of machine was determined by top filling method.

RESULTS AND DISCUSSION

Seed drill performance was found to be very satisfactory for sowing rice, green gram and black gram. There was no damage to rice seed in fluted roller when flaps were kept in down position. Seed damage of 5 to 7 percent was observed when flaps were kept in lifted position. This is due to rubbing action between seed grain. Hence it is very essential to keep flaps in downward position while sowing rice to prevent any damage of seeds. It was possible to obtained accuracy in seed rate of green gram and black gram when flaps were kept in upward position. Accuracy in seed rate of green gram and black gram got disturbed if flaps were kept in down position. It was mainly because of small and smooth seeds of green gram and black gram. Seed falls simply by gravity due to jerk on seed drill during operation. So it is essential to keep the flaps in upward position while sowing smooth small size seed like green gram, black gram, wheat etc.

It was observed while sowing rice that seed drill placed the seed very deep, when depth adjusting wheels were lifted up. This affects the germination seriously. So proper depth adjustment of depth adjusting wheel are essentially required. Average field capacity of machine observed was 0.15 ha hr⁻¹ to 0.20 ha hr⁻¹ depending on forward gear speed used and field condition. Fuel consumption of power tiller recorded was 0.8 lit hr⁻¹. Average skidding percentage of ground wheel of seed drill (metering wheel) during sowing operation recorded was 24 percent. This reduces the actual seed rate. So to get correct seed rate, seed drill should be calibrated for 24 percent more seed rate than the recommended seed rate. Balancing weight at the front is essentially required to facilitate the turning of

Table 2. Comparative performance of different methods of sowing rice, wet season 2008–09

Treatments	Time required for sowing(hrs ha ⁻¹)	Yield of rice (cv. Pooja) t ha ⁻¹	Cost of sowing Rs ha ⁻¹
Broadcasting and covering by bullock plough	20.8	5.49	1104
Five row power tiller operated seed drill	8.5	6.50	935
Broadcasting and covering by cultivator	2.0	6.42	721
Nine row tractor drawn seed drill	2.5	6.36	840
Three row bullock drawn seed drill	10.8	6.88	648
Three row manual seed drill	25.0	5.41	413
Manual hill drilling	232	6.72 NS	3828

power tiller. It was observed that without balancing weight at front, there was no effect of pressing the hand clutches of power tiller for turning the machine.

Yield of power tiller operated seed drill sown rice, green gram and black gram crop was found to be 3.16 t ha⁻¹, 1.05 t ha⁻¹ and 0.86 t ha⁻¹, respectively under rain fed condition. Cost of sowing with power tiller seed drill was Rs 1058 ha⁻¹. Power tiller seed drill sown rice crop saved 30 percent labor in weeding as compare to farmer's practice as it facilitated mechanical weeding.

Performance of power tiller rear mounted five row seed drill for sowing rice and rice based crop like green gram and black gram was found very satisfactory. Flap setting in down ward position for sowing rice and in upward position for sowing smooth seed like green

gram and black gram was require before sowing. Field capacity of machine was one hectare per day. Rice sown with power tiller operated seed drill saved 30 percent cost of weeding as compare to farmer practice. This seed drill is light in weight, simple in construction and easy to attach, detach with power tiller.

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