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Development and performance evaluation of equipment for intercropping

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■ **ABSTRACT :** A tractor drawn seed- cum- fertilizer drill for intercropping has been developed at ARS, Durgapura, Jaipur. The machine has eight furrow openers for separate delivery of seed and fertilizer. It has provision for sowing the seeds of different sizes at their desired rates in variable row spacing. The equipment is suitable to be fitted on a tractor drawn cultivator. The machine is use full for intercropping of pearl millet + moong bean / urd bean / cluster bean or maize + moong bean and others. The developed machine gave 8.9 per cent and 11.3 per cent higher grain yield of pearl millet and cluster bean over local method of intercropping. The field capacity of the equipment is 0.65 ha/h.

■ **KEY WORDS :** Intercropping, Seed-cum fertilizer drill, Metering device, Field capacity

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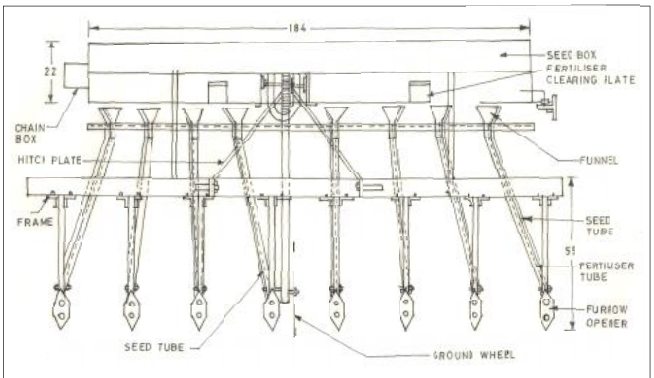
Real India lives in villages and the villages hold 143 million hectares of arable land; of which around 108 million hectares depend solely on the mercy of Rain God for the production and the productivity. In spite of several constraints the rain fed cultivation alone contributes 42 per cent of annual food grain production (Kumar, 1987). Intercropping is, none the less, the most important system aiming to garner the maximum produce from the rain- fed agriculture (Sharma and Kulhari, 2005). The system of intercropping is not only responsible for enhancing the yield but is quite helpful in maximum utilization of interspaced area, well distribution of spatial light, air and micro-environmental conditions besides up keeping the soil nutrients equilibrium and balanced moisture consumption (De, 1989). In an intercropping system sowing of one row of cluster bean distance at 30 cm between the two paired rows of pearl millet (row to row spacing 30 cm) or any *Kharif* pulses sown between two rows of sorghum in the same pattern have been found advantageous over an individual crop grown in an uniform row system (Package of Practices, *Kharif*-2001).

Management of plant geometry and fertilizer application in an intercropping system plays an important role in balancing the competition among the various crops for their productivity (Srivastava *et al.*, 2004). The productivity in intercropping system can be increased substantially if precised relationship between the placement of seed and fertilizer is maintained accurately (Kumar, 1987). In general, there are many types of seed- cum- fertilizer drill machines available in the market but their performance is confined only to proper row spacing for particular seed of equal size with single regulated rate of seed and fertilizer. But two types of unequal seeds or even more than two is having vast difference in their sizes and rate of sowing with varying rate of fertilizer requirements. Keeping this problematic fact in mind it was seriously attempted to design and develop a simple and low cost machine to overcome the difficulties faced in real practice of intercropping system.

■ METHODOLOGY

A seed cum fertilizer drill for intercropping was designed and developed at Agricultural Research Station, Durgapura, Japur. The machine consists of seed and fertilizer box, metering device, seed tube, furrow opener and ground wheel (Fig. A and B). The box was made of 1.0 mm thick mild steel sheet and divided into two compartments one for seed and another for fertilizer. Each of these compartments was further divided into four compartments (Fig. C), so that different types of seeds and fertilizer can be placed separately and drilled accordingly. Agitating device made of rubber washer for regular feeding of seed and fertilizer were also



(All dimensions are in cms)

Fig. A : Front view of equipment for inter cropping

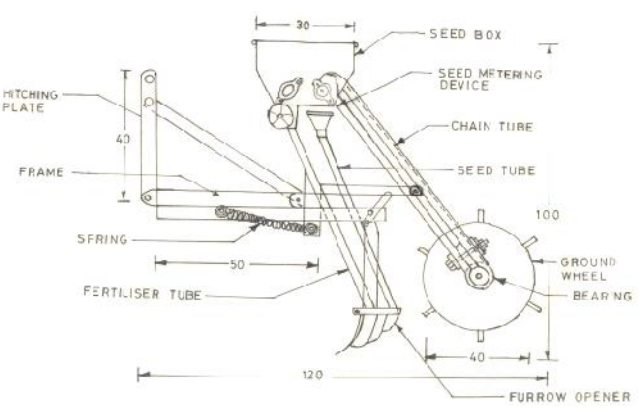


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Fig. B : Side view of equipment for inter cropping

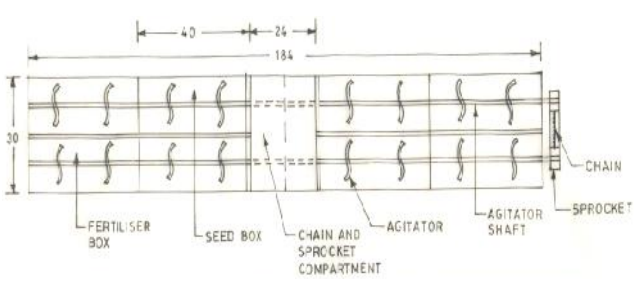

Fig. C : Different components of seed and fertiliser boxes

provided in seed and fertilizer boxes. The agitator shafts were driven by ground wheel with chain and sprocket (Fig. B). Fixed opening type metering device was used in the machine for regulating the seeds and fertilizer. Mild steel plates, each having 17.0 x 8.0 x 0.4 cm length, width and thickness with holes of different sizes (Fig. D) was fixed with nut and bolt at the bottom of boxes for metering seeds and fertilizer in each furrow opener. The seed and fertilizer rates can be maintained by adjusting the holes of the plates. The hoe type furrow openers having reversible shovels were used for making the furrows. The seed and fertilizer unit was mounted on tractor drawn cultivator where row spacing was adjusted according to requirement.

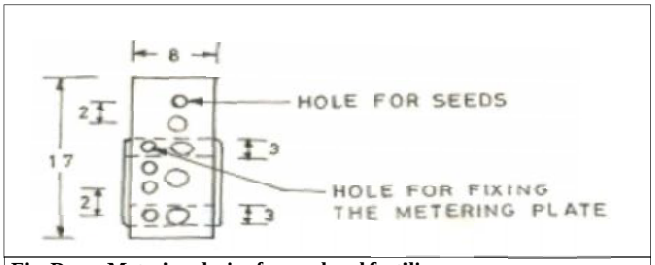

Fig. D : Metering device for seed and fertiliser

The machine was tested for intercropping of one row cluster bean in between the paired row of pearl millet at Agricultural Research Station (ARS), Durgapura, Jaipur; simultaneously at Adoptive Trial Center (ATC), Ajmer, Rajasthan for consecutive three years. A field day demonstration of the newly developed machine was conducted for its successful performance with regard to the drilling pattern and placement of seeds and fertilizers. Agricultural officer, agricultural scientists, local manufactures and the advance formers of the state appreciated the performance of the newly developed machine. The comparison between the so developed machine with the conventional method of intercropping (drilling the seed and fertilizer behind bullock drawn plough) was also done. The data of yield, field capacity and field efficiency was recorded.

■ RESULTS AND DISCUSSION

Average yield data obtained from both, the developed machine and local method of intercropping for the three consecutive years are presented in Table 1. The data revealed that the machine intended for the purpose has given the outstanding performance over the conventional method at both the centers. The grain yield of pearl millet and cluster bean was 13.2 and 11.7 q/ha in the intercropping pattern

Table 1 : Comparative performance of developed machine for intercropping and conventional method of intercropping

Sr. No.	Method of intercropping	Yield obtained (q/ha)		Yield increase (%)	
		Pearl millet	Cluster bean	Pearl millet	Cluster bean
1.	Equipment for intercropping	13.2	11.7	8.9	11.3
2.	Behind bullock drawn plough	12.1	10.5	-	-

Table 2 : Specification and working feature of the equipment for inter- cropping

Overall dimension (mm)			Working width	Operating speed	Weight	Field capacity	Field efficiency	Price
Length	Width	Height	(cm)	(km/h)	(kg)	(ha/h)	(%)	(Rs.)
2200	1220	1020	240	3.0-4.0	135	0.65- 0.75	62-67	6500

undertaken by developed machine where as it was 12.1 and 10.5 q/ha under the conventional method of intercropping. Conclusively, there were 8.9 and 11.3 per cent higher yield of both the respective crops over local method of intercropping. The increase in yield of pearl millet and cluster bean was due to proper placement of seed and fertilizer, efficient use of fertilizer and accurate geometry of plants of pearl millet and cluster been.

The specification and working feature of the equipment for intercropping is also presented in Table 2. It is tractor mounted equipment and there are eight furrow openers fitted in the machine. Thus, the machine covered 240 cm width at a time. Actual field capacity of the machine was 0.65 to 0.75 ha /h at the operational speed of 3.0 to 4.0 km /h. Similarly, the field efficiency of the machine varied between 62 to 67 per cent.

Conclusion:

To overcome the problem of intercropping a tractor drawn seed –cum fertilizer drill was designed and developed for sowing seeds and fertilizer of different sizes at their desire rates in variable row spacing.

There were 8.9 and 11.3 per cent higher grain yield of pearl millet and cluster bean, respectively over local method of intercropping. The actual average field capacity of developed machine for inter cropping was 0.65 ha/h.

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