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Research Paper :

Modification and performance evaluation of rice cum green manure crops seeder

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ABSTRACT

To sow dry paddy in dry tilled soil, animal drawn rice cum green manure crops seeder was modified at CIAE, Bhopal. The machine served the three purpose at a time such as seeding of rice with basal application of fertilizer, seeding of green manuring crop and subsequent interculture biasi operation . The seeder was evaluated its performance in the laboratory as well as in the field and comparing with other seed drill. The comparative studies were conducted to evaluate the performance of rice cum green manure crops seeder. The study showed that the average tillering and plant population (No/m^2) at maturity were 5-6 and 268, respectively of RCGM. The field test result showed draft of 37 kgf with effective field capacity of 0.06ha/h at field efficiency of 80%. The mechanical damage of seed was found to be negligible. The seed distribution efficiency was 91.38% as compared to other seed cum fertilizer drills. But from studied data of other seed drills, it was found that the overall performance index was highest (0.880) in case of Naveen seed cum fertilizer drill. But this modified rice green manure crop seeder is specific technology suits well in the Biasi cultivated areas.

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Key words : Seeder, Biasi

Broadcasted rice generally gives high plant mortality due to uneven distribution and non uniform placement of seeds combined with moisture stress and high atmospheric temperature during the premonsoon period. In case of broadcasting, weeding is a main problem . The weeding problem is less in row seeded crops because it allows the use of mechanical weeders. The broadcasting method required more seed rate and less germination due to uncovered seeds spread on the surface of soil and birds infestation on seeds. In direct seeding and transplanting are two general method for planting rice. Direct seeding method the seeds are directly sown in the field with seeddrill or broadcasted. While transplanting of rice, requires raising of seeds on bed and then the raised plants are transplanted in field. Hence, direct seeding method is labour and seed saving as well as less time consuming method and so it requires less cost of operation compared to transplanting.

One of the most important factors that influences the germination of seeds is the uniformity of seed distribution at proper depth where adequate moisture would be available for germination of the seeds. This results in a better crop stand thereby increasing the crop yield. By putting the seeds in line, intercultural operation like weeding , hoeing and top dressing of fertilizer become easy besides being time saving and economical.

Several researchers (Abdul *et al.*, 1989; Singh *et al.,* 1983) have reported that seeding in rows along with basal application of fertilizer has facilitated higher initial establishment of crop. Further it has been reported (Singh, 2000) that green manuring improves soil fertility and requires less use of chemical fertilizer. Matiwade and Shilavantar (1992) stated that the grain yield obtained with green manuring of *Sesbania rostrata* alone was equal and even more when compared with the recommended dose of nitrogen alone. Due to small and scattered land holding pattern, the farmers mainly depend upon animal as a source of power, a suitable animal drawn seed cum fertilizer drills are essential for the farmers to complete the seeding operation in time. Keeping these in view, a animal drawn inter row crop seeder was developed for sowing of two rows of rice with seeding of one row of green manure crop in between the rice rows. The green manure crop in row spaces may be incorporated into soil by biasi tool.

The machine, therefore, would serve the threee

purpose of seeding of rice with basal application of fertilizer, seeding of green manuring crop and interculture biasi operation. This machine is light weight and cost effective suiting to the requirements of small and medium farmers.

METHODOLOGY

Based on the feed back of field test, the machine design was refined and following modification were brougth out in the machine.

– The length of handle was reduced by 20 cm.

– The metering mechanism fitting was modified to give variable seed rate and proper alignment.

– The change was made in the fitting of sprocket by key way.

– The size of ground wheel was minimized to get proper seed distribution and reduce gross weight.

The metering mechanism (fluted roller) for dropping seeds was fitted to maintain the seed rate of green manure and rice. The exposed length of fluted roller for rice and green manure was exposed in the ratio of 3:1.

The exposed length for flutted roller for rice was calculated as exposed length (L_f):

$L_f = (8 \times s \times r \times d_g) / (10 \times r \times d_f^2 \times N_f \times i)$

$L_f = (8x100x0.25x0.35)/(10x0.6x0.9^2x12x1.84)$

$= 0.658$ cm

$= 6.58$ mm

where,

i = Transmission ratio

n_g = number of rev. of ground wheel

s = seed rate, kg/ ha

r = bulk density of seed in g/cm^3

r = row spacing, m

Similarly, the exposed length of fluted roller for green manure crop (*dhaincha*)

Lf = (8x20x0.5x0.35)/(10x0.625x0.92x12x1.84)

= 2.8 mm

Table 1 : Details specification of animal drawn rice cum green manure crops seeder

Sr. No.	Particulars	Dimesions
1.	Overall dimension, (L x W x H) mm	1080 x 887 x 916
2.	Frame	
	Box section size, mm (Material)	50x30x25 (MS sheet @ 20 gauge)
	Material for box section frame	MS angle 35x35x5 mm
3.	Transport wheel	
	Diameter , mm	220
	Wheel rim, mm	Made of MS flat of 25x5
	Wheel bush/ hub	Made of ms rod of 25 mm
4.	Ground wheel drive	
	Drive	Spoke type lugs wheel, front mounted
	rim diameter, mm	350
	Lug height, mm	50
	Material of hub/bush	MS bar 25 mm dia.
	Material of rim and lugs	MS Flat 25x5 mm
5	Seed metering mechanism	
	Type	Flutted roller
	Material	Die cast aluminium
	Number of fluttes	12
6	Fertilizer metering mechanism	
	Type	Flutted roller
	Material	Die cast iron
	Number of fluttes	8
7	Ground wheel sprocket	
	Number of teeth – Big	19
	Small	14
8	No. of teeth on feed shaft sprocket	19
9	Chain	1.8 m long, 12.5 mm pitch
10	Overall weigth, kg	35

Construction of machine:

The machine was made sturdy and light weight matching to pulling capacity of bullock pair. Design dimensions (Table 1) of the rice cum green manure seeder were worked out through CAD process and drawings were prepared. The machine was fabricated in the research workshop at CIAE, Bhopal by following the standard manufacturing processes. The machine consisted of frame, power transmission unit, seed metering device, seed and fertilizer box, furrow opener, hitch attachments and beam. Power from ground drive wheel was transmitted through sprocket-chain drive to the main shaft/ feed shaft.

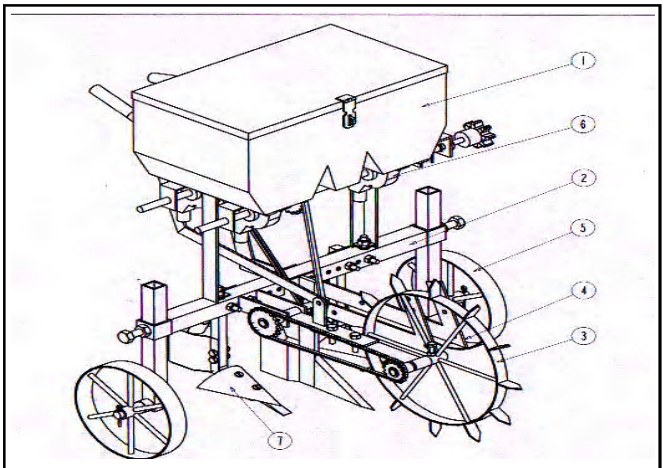
The working width of seeder was 500 mm, weight 35 kg and unit price Rs. 2500/-.

Laboratory test :

In the laboratory, the developed machine was calibrated for rice seed, green manure and fertilizer metering to measure free flow, damage of seeds and interrow variation. The seeder was calibrated for 90 kg/ ha for rice, 20 kg/ha for green manure crop seeds by adjusting the exposed length of flutes.

Field test:

The field testing of machine was conducted on CIAE



1.Seed and fertilizer box, 2. Frame, 3. Ground/Drive wheel, 4. Hitch, 5. Supporting wheel, 6. Fluted roller, 7. Furrow opener

Fig. 1 : Rice cum green manure crop seeder

research plot size of 400 m^2 in a Randomized Block Design with three replications. The following parameters were considered during the field test a) Moisture content and bulk density, b) Draft, c) Time lost in turning at head land and refilling of machine, d) Depth of placement , e) Effective width, f) field capacity and field efficiency, g) Energy utilization for seeding operation etc.

The machine was compared with the other seeddrill such as Naveen SCFD, CAET and improved factory SCFD.

RESULTS AND DISCUSSION

The laboratory test were conducted for calibration of rice seed, green manure and fertilizer metering to measure free flow, damage of seeds and interrow variation. The seeder was calibrated for 90 kg/ha for rice, 20 kg/ha for green manure crop seeds by adjusting the exposed length of flutes. The exposed length required for rice, green manure and fertilizer was 7 mm, 3 mm and 6 mm, respectively as graphically represented (Fig. 2) . The mechanical damage of seeds due to metering was found to be 0.5% in rice and 0.080% in green manure which was negligible (Table 2). The variation in seed dropping between two rows was 2.04 and 3.02 % for fertilizer and rice. These result show that the per cent variation were within the allowable limit of $\pm$5% (Tomar,1983).

The row to row spacing of rice was adjusted at 25 cm. One row between two rice rows *i.e.* at 50 cm row spacing of green manure was adjusted. The row spacing facilitate easy mechanical intercultural operation like Biasi cultivation weeding and hoeing.

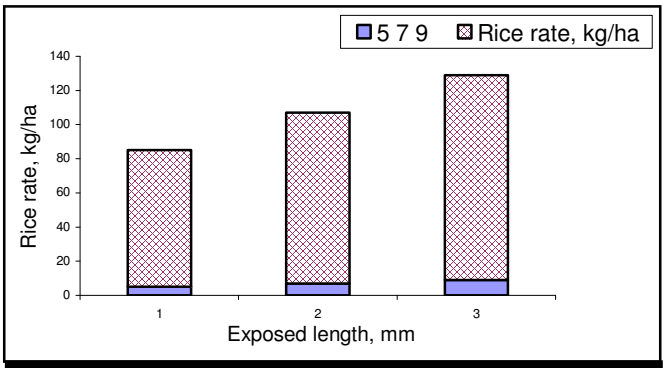


Fig. 2 : Effect of exposed length on rice

Table 2 : Mechanical damage of seed for rice and green manure

Crop (seed rate)	Weight of broken seeds (g)	Total weight of sample (g)	Broken seeds (%)	Average mechanical damage of seeds (%)
Rice (100	0.59	136.7	0.43	0.47
$kgha^{-1}$)	0.64	137.0	0.47	
	0.69	138.25	0.50	
Green	0.02	26.5	0.075	0.079
manure (20	0.022	27.5	0.080	
$kgha^{-1}$)	0.022	26.8	0.082	

Field test:

The field trials (Fig. 3) were conducted on plot size of 400 m^2 (40x10 m) laid out in a randomized block design with three replications.

The total energy utilization was calculated by multiplying the bullock pair hour and human hour utilized for seeding operation with their equivalent energy per hour (10.14 MJ/h for a pair of bullock and 1.96 MJ/h for one person).

The machine after modification was tested in laboratory as well as in the field. The result of the field study is presented in Table 3.

Fig. 3 : Field trial of modified rice cum green manure seeder

Table 3 : Performance parameters related with SCFDS

Parameter	RCGM	Naveen SCFD	IF-SCFD	CAET
Variation, %	2.04 (Rice) and 3.02 (Green Manure)	6.05	7.80	7.65
Depth of seed placement, cm	4.0	3.7	3.5	3.2
Actual seedrate,kg/ha	93.25	81.96	78.23	75
Draft,kgf	37.00	53.50	57.70	26.95
Field capacity, ha/h	0.06	0.073	0.080	0.170
Field efficiency,%	80. 00	80.21	76.92	83.59
Time loss(Tr and Tf), h/ha	2.39	-	-	-
Total energy ttilization, MJ/ha	224	204.36	188.40	188.84

Tr and Tf -Turning loss and filling loss, respectively

Table 4 : Comparison of crop parameter

Sr. No.	Crop parameter	RCGM	Naveen SCFD	IF-SCFD	CAET
1.	Seed distribution efficiency,%	93.21	91.38	90.84	87.84
2.	Number of panicles /m^2	232	200	207	190
3.	Plant population/m^2	268	247	243	233

The field tested parameter of rice cum green manure seeder are shown in Table 1. The average moisture content at 1-4 cm and 5-8 cm was 15% and bulk density was 1.27 g/cc. The other three seed cum fertilizer drill (Naveen SCFD, CAET and improved factory SCFD) were studied and compared it with RCGM for their performance evaluation. The actual seed rate in the field condition was 93.25 kg/ha in RCGM and 81.96 kg/ha in Naveen SCFD. An increase of seed rate from calibrated was recorded in both seed drill. The reason may be the falling of excess seeds into the seed tubes due to vibration during seeding operation. The actual seed rate in case of the implement factory SCFD and CAET was 78.25 and 75 kg/ha, respectively. The average depth of placement of seeds has been recorded to vary from 3.5 cm to 4 cm. It was not significant. The average draft requirement for RCGM was 37 kgf. The draft required for other two seed drill was 57.70 kgf and 53.50 kgf for IF-SCFD and Naveen, respectively. All four SCFDs were suitable for a pair of bullock without any modification in reducing draft requirement. The field capacity and field efficiency was 0.06 ha/h and 80%, respectively in case of RCGM. The field capacity and field efficiency were maximum for the other SCFD because of wider coverage. The CAET seed drill covered one meter in one run. The field efficiency for all seed drill was more than 75%. The total energy utilization for seeding operation was 200.58 MJ/ha in case of RCGM (but it was 224.70 MJ/ha total energy with operational and machinery energy). The total energy utilization for seeding operation was 188.40, 188.84 and 204.36 MJ/ha for CAET, IF and Naveen seed drill, respectively. The energy required for RCGM was lower than Naveen seed cum fertilizer drill.

Crop parameter:

The crop parameters which included average plant population, number of panicles/sq. m and seed distribution efficiency are presented in Table 4. From study of other three seed drill it was found that the plant population/ sq m varied between 233 to 247. The number of panicles per sq m varied between 190 to 207. But in case of RCGM, the plant population per sq.m was 268 and the number panicles per sq.m was 232, it may be due to different conditions of sowing and variety of rice seed. The seed distribution efficiency was found upto 93.21%.

Conclusion:

The highest seed distribution efficiency was observed for RCGM. Among all seed cum fertilizer drill, the highest field capacity and field efficiency was found in case of CAET seed drill. The cost of operation was more in case of RCGM but due to benefit of green manure it saves cost of fertilizer for third split. The plant population/ $m^2$and panicles/ m^2 was more in RCGM compared to other seed cum fertilizer drill. The draft required for RCGM was minimum compared to other seed cum fertilizer drill. The RCGM was more useful as compare to other SCFD for Biasi cultivated area where green manure may be incorporated into soil at the time of Biasi operation hence it saves fertilizer cost and improved soil fertility.

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REFERENCES

Abdul, Majid., Ahmad , S.I. and Saeed, M.A. (1989). Effect of different direct sowing techniques and date of sowing on rice production. *AMA*, **20** (3) : 19-22 .

Matiwade and Shilavantar, M.N. (1992). Influence of green manuring of *S. rostrata* on rice (*Oryza sativa*). *Indian J. Agron.,* **39** (3&4) : 19-22.

Singh, D.N., Singh, R.C., Vyas , D.L. and D.K., Mishra (1983). Studies on tillage fertility in sandy soil. *Ann. Arid Zone,* **13** (2-3) PP.148.

Singh, J.K. (2000). Effect of green manure and nitrogen levels on the physico-chemical properties of soil under Rice-Wheat cropping system. *Indian J. Agron.,* **6** (1&2) : 21-25.

Tomar , Sadachari Singh (1983). Performance index of sowing machinery. *J. Agric. Engg.,* **20** (3&4) : 9-15.

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