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Short Note

Performance evaluation of paddy sowing techniques in Himachal Pradesh

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Paddy is an important cereal crop of the state next to maize which accounts for 10.1 per cent of area and 11.6 per cent of production on total food grain basis with average productivity of 1710 kg/ha (Anon 2003-04). Kangra and Mandi districts are the major paddy growing area in the state but traditional method viz. broadcasting of sprouted/dry seed in wet/dry soil are being used by the farmers of the state (Singh, 2005). These practices result in increased cost of operation, loss of time, higher drudgery due to more manual and animal power involvement and thus reduced margin of profit for the farmers. By sowing with broadcasting methods, the farmers need to apply higher seed rate and has to perform additional haloding operation. In hand transplanting method, due to non-availability of laborers in time, transplanting gets delayed. Therefore, introduction of adequate transplanting technique for paddy is the need of hour to reduce the drudgery, time and cost of operation. The present investigation was conducted to evaluate the performance of different sowing/transplanting techniques of paddy in Himachal Pradesh and to see the feasibility of manual paddy transplanter.

The field study was conducted in 2004-05 and 2005-06 at farmers' field in village Burli Kothi of district Kangra using four sowing techniques including traditional and improved i.e.

T_1 = Bullock ploughing + puddling & leveling + transplanting by manual paddy transplanter

T_2 = Bullock ploughing + puddling & leveling + hand transplanting,

T_3 = Bullock ploughing + puddling & leveling + broadcasting of sprouted seed in puddle soil, mixing, leveling + haloding by plough + resettling of plants and

T_4 = Bullock ploughing + broadcasting of dry seed in the soil & mixing, leveling + haloding by plough + resettling of plants.

The method T_3 and T_4, both requires *haloding* (haloding is disturbing of plants in submerged conditions by bullock operated light plough and then re-settling & weeding) after 20-25 days of sowing. The puddling and *haloding* operations were carried out with bullocks. The variety used for this study was RP-2421. The mat type nursery for paddy transplanter and root wash type for hand transplanting were used. Only those operations are included in the calculations which are linked with sowing/transplanting of paddy by different methods. The performance data were recorded when actual operations were performed in the field. The crop and grain yield data were also recorded.

The comparative performance results of the different sowing techniques have been reported in Table 1. The seed rate was observed 25, 150 and 175% high in case of T_2, T_3 and T_4, respectively as compared to T_1. In traditional methods, the higher seed rate was applied to ensure optimum plant population (Gupta *et al.* 1999). The field capacity was observed 0.03, 0.004, 0.16 and 0.20 ha/h with the labour requirement of 116, 360, 196 and 186 man-hours per hectare, respectively in T_1, T_2, T_3 and T_4. This labour requirement includes nursery growing and transplanting in case of T_1 & T_2 and broadcasting, mixing of seed & leveling, haloding then re-settling of plants in T_3 & T_4. Table indicates higher plant population in case of T_3 and T_4 which was due to uneven distribution of seed with higher seed rate. The plant height was observed maximum in case of T_1 due to uniform distribution of seed at proper depth. The mat seedlings when mechanically transplanted at uniform depth and spacing established faster and more uniform growth of tillers (17.2 tillers/hill) ultimately provide higher yield as compared to other methods. It may be due to the fact that with mat seedlings the roots were inserted together with some soil within the root net and therefore the seedlings being mechanically detached in clusters from the mat had more uniform placement in the puddle soil from the day of transplanting. It was observed that there was 25-28% increase in yield in case of T_1 as compared to traditional methods T_3 and T_4. The higher yield in case of transplanter was also due to proper row-to-row placement of seedlings with proper depth which resulted in proper germination and healthy plants with more numbers of effective tillers. The data in Table 2 indicates the total comparative time and cost requirement in different

Table 1. Comparative performance of paddy sowing techniques

Particulars	T_1	T_2	T_3	T_4
Type of nursery	Mat type	Root wash	-	-
Seed rate (kg/ha)	40	50	100	110
Row spacing, cm	20	8-10	Uneven	Uneven
Plant to plant spacing, cm	10-15	8-14	Uneven	Uneven
No. of plant or seed/hill	3	2-3	-	-
Planting depth, cm	2.5-4	2-3	2.5-3.0	-
No. of plant or hill/m^2	41-46	46-54	90-94	92-98
Field capacity, ha/h	0.03	0.004	0.16* & 0.025**	0.20* & 0.03**
Field capacity for haloding, ha/h	-	-	0.020	0.021
Capacity of resettling of plants, ha/h	-	-	0.010	0.010
Labour requirement, man-h/ha				
For nursery raising	50	110	--	--
For transplanting/sowing	66	250	196	186
Ave. height of the plants, cm	101.0	98.5	97.0	98.0
No. of hills/m^2	45	53	91	95
No. of effective tillers/hill	17.2	10.6	3.6	3.2
Grain yield, q/ha	47.14	44.35	37.50	36.80

*Capacity for broadcasting of seed **capacity for mixing of seed with bullock plough & leveling

Table 2.Total comparative time and cost requirements in different methods of paddy sowing/ transplanting

Particulars	Methods of sowing/transplanting							
	Manual paddy transplanter (T_1)		Hand transplanting (T_2)		Broadcasting of sprouted seeds in puddle soil (T_3)		Broadcasting of dry seed in dry soil (T_4)	
	Quantity/No.	Cost (Rs.)	Quantity/No.	Cost (Rs.)	Quantity/No.	Cost (Rs.)	Quantity/No.	Cost (Rs.)
Seed requirement (kg/ha)	40	640	50	800	100	1600	110	1760
Polythene sheet (kg/ha)	10	400	-	-	-	-	-	-
Time required (h/ha)								
Nursery raising	50	600	110	1320	-	-	-	-
Bullock Ploughing	67	2345	67	2345	67	2345	67	2345
Puddling and leveling	80	2800	80	2800	80	2800	-	-
Sowing/transplanting	67	804	250	3000	46	552	38	456
Haloding	-	-	-	-	50	1750	48	1680
Resettling of plants	-	-	-	-	100	1200	100	1200
Total-time required (h/ha)								
Man-hrs	264	3168	507	6084	343	4116	253	3036
Bullock-hrs	147	5145	147	5145	237	8295	148	5180
Total cost of sowing (Rs/ha)	-	9353	-	12029	-	14011	-	9976

methods of paddy sowing/transplanting. The average values of five reading were taken. The cost and time requirements for only those operations have been compared which differ in these aspects. The highest cost of operation was observed in case of T_3 (Rs 14011/ha) followed by T_2 (Rs12029/ha), T_4 (Rs 9976/ha) and T_1 (Rs 9353/ha) which was due to more number of bullock and labour hours required for performing the paddy sowing in traditional methods. In hand transplanting also, cost was high due to involvement of more labour for nursery raising and transplanting. The cost of operation was observed lowest in T_1 and which was 22%, 33% and 6% less as compared to T_2, T_3 and T_4, respectively with lot of labour saving. The overall response of the farmers towards the adoption of manual paddy transplanter was highly positive and farmers are demanding the machine for purchase.

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