Studies on Integrated Nutrient Supply and Seed Rate for Direct Seeded Rainfed Upland Rice in Mid Hills of Himachal Pradesh

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Abstract

Response of rainfed rice to integrated nutrient supply and seed rate was studied during *kharif* 2002 and 2003 at the research farm of CSKHPKV, Rice and Wheat Research Centre, Malan. Results revealed that fertilizer dose of 80 kg N,40 kg P_2O_5 & 40 kg K_2O ha^{-1} can be reduced by 50% with the application of 5t FYM /ha. The paddy yield, however, reduced significantly when 50% fertilizer dose was substituted with furrow applied vermi-compost @ 1.25 t/ha or when green manure crop was raised along with paddy (in 1: 2 ratio) and turned down at 25 days after sowing. Broadcast application of vermi-compost @2.5 t /ha alone, and farmers' practice recoded significantly less panicles/m^2 and grain yield. Crop sown in lines 20 cm apart resulted in a net saving of 20 kg seed/ha without any reduction in the grain yield compared to broadcast sowing of 100kg seed/ ha, the latter though had more panicles per unit area.

In Himachal Pradesh, rice is grown in an area of 0.78 lakh hectares at varying elevations in upland to lowlands. The average rice productivity in the state is 1960 kg/ha. The yield levels realized by the farmers under upland situations are still lower. Among many factors, method of sowing (Budhar and Tamilselvan, 2002; Singh *et al.*, 2002), seed rate (kathiresan and Manoharan, 2002) and integrated nutrient management (Apurba and Gangwar, 2001; Vlek, 1990) influence the crop yield level gratly under upland situations. Integrated use of chemical fertilizers with manures, compost and green manure crops is very important for sustainable rice production special under rainfed uplands (Meelu, 1996). Like fertilizers seed is also a costly input. The quantity of fertilizers and seed is therefore required to be used judiciously particularly in view of the fact that the farmers in rainfed areas are generally poor. Therefore, present investigation was carried out with a view to develop a package involving optimization of seed requirement and efficient nutrient management for the overall improvement of productivity of rainfed upland rice.

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Materials and Methods

A field experiment was conducted at CSKHPKV Rice and Wheat research Centre, Malan (76^0 2'E, 32^0 1' n and 950 m above mean sea level) during kharif 2002 and 2003. The soil at the experimental site is silty caly loam, acidic (pH 5.7), and medium in available nitrogen (452 kg/ha), phosphorus (34.3 kg/ha) and organic carbon status and lowing potassium. The available (9) treatments arranged in randomized block design with three replications.

Table 1: Details of treatments

T1 Farmer's method of sowing (broadcasting 100 kg seed/ha) + RFD*
T2 Line sowing (80 kg seed/ha) + RFD
T3 Line sowing (80 kg seed/ha) + 50% RFD + 5 T FYM/ha
T4 Line sowing (80 kg seed/ha) + broadcasting vermicompost alone @2.5 t/ha
T5 Line sowing (80 kg seed/ha) + 50% RFD +VERMICOMPOST @ 1.25 t/ha in furrows
T6 Line sowing (80 kg seed/ha) GM (2:1) and turning GM at 25 DAS + 50% RFD
T7 Line sowing (80 kg seed/ha) + RFD + 5 T FYM/ ha
T8 Line sowing (100 kg seed/ha) +RFD
T9 Farmers' practice (Broadcasting 100 kg seed/ha) , topdress 35 kg N/ha at 35 DAS)

* RFD- Recommended fertilizer dose (80 kg N, 40 kg P_2O_5 & 40 kg K_2O/ha); DAS- Days after sowing; GM- Green Manure

Half the dose of nitrogen along with full dose of phosphorus and potassium were applied in furrows at the time of sowing except in T1 (broadcast application). Remaining N was top dressed in two equal splits at tillering and panicle initiation stages. Soybean (HPR 1156_ Sukara Dhan9) was raised as green manure crop. The main crop sown on 4th June and 9th June in the respective years. Crop received 1057.8 mm (65 rainy days) and 1137.7 mm (48 rainy days) rainfall during 2002 and 2003, respectively.

Results and Discussion

Application of recommended dose of Fertilizers (T1, T2 & T8) produced taller plants whereas additional application of 5 t/ha FYM (T7) did not increase the plant height any further. Rice in farmers' practice (T9) and the one manured with broadcast vermicompost @ 2.5 t/ha (T4) recorded minimum plant height (Table 2).

Significantly higher number of panicles were produced with recommended fertilizers and rate (100 kg/ha) either broadcast (T1) or sown in lines (T8) as compared to recommended seed rate (80 kg/ha: T2). However, during 2003 growing of in-situ green manure (T6) or supplementary use of FYM @ 5 T/ha along with recommended fertilizers (T7), recorded significantly more panicles per unit area over T2. The crop receiving only vermicopost @ 2.5 t/ha (T4) or raised with farmers' practice (T9) recorded minimum number of panicles. Total spikelets per panicles, filled grains per panicle and panicle weight were higher with 100% recommended fertilizers + lower seed rate (T2) and with complementary and supplementary application of FYM (T3 & T7). Lower values of these parameters were recorded in farmers' practice (T9). Test weight and blast incidence (%) were however, not influenced significantly due to treatments. Pooled data revealed that vermin compost alone @ 2.5 t/ha (T4) and farmers' practice (T9) delayed the crop maturity significantly.

Recommended fertilizers (T2) recorded grain yield statistically at par with 50% RFD + 5 t FYM/ha (T3) , AND 100% RFD+ 5 t FYM/ha (T7). The grain yield, however, reduced significantly when 50% dose of chemical fertilizers was substituted with furrow applied vermicompost @ 1.25 t/ha (T5), or with in situ green manure (T6). Average over the two years of grain yield improved with line sowing with lesser seed rate and substitution of 50% of chemical fertilizer dose with 5 t FYM / ha (T3) or applying 5 t FYM/ha in addition to RFD (T7). The yield increased by 1.25, 1.27 and 1.33 t/ha thus, helped reduce of chemical fertilizers by half as also reported by Apurba Sarkar and Gangwar (2001) and DRR (2002). Singh *et al.* (2004) found 40-30-20 kg/ha N-P_2O_5 as optimum fertilizer level for upland paddy.

Broadcast application of 100 kg seed/ha (T1) recorded grain yield at par with sowing of 100 kg seed in lines (T8) during 2002 and on pooled basis, while it was at par with sowing of 80 kg seed/ha in lines (T2) during 2003 (Table 2). However, T2 was significantly superior during first year and on pooled basis compared to T1 & T8. Line sowing, therefore, resulted in a net saving of 20 kg seed/ ha. Singh *et al* . (2004) advocated that upland rice crop should be sown in lines at 20 cm apart @ 80 kg seed/ha, while a seed rate of 60 kg/ha has been recommended for direct seeded rainfed upland rice in different parts of the India (DRR, 2002).

References

Apurba Sarkar and Gangwar, B. 2001. Integrated nutrient management in rice based cropping systems under different agro-ecosystems. *Oryza* 38:35-37.

Budhar, M.N. and Tamilselvan, N. 2002. Effect of stand establishment techniques on yield and economics of lowland irrigated rice (*Oryza sativa*). *Indian journal of Agronomy* 47 : 57-60.

DRR, 2002. Progress report of Directorate of Rice Research, Hyderabad, on Agronomy, Soil Science and Physiology Vol 3 pp 4.68-4.89.

Kathireson, G. and Manoharan, M.L. 2002. Effect of seed rate and method of weed control on

Table 2: Effect of treatments on growth and development, neck blast incidence and yield attributes & yield of rice

Treat-ments*	Plant height (cm)		Panicle/m^{-2}		Total spikelets per panicle		Filled grains per panicle		Test wt. (g)		Panicle wt (g)		Neck blast incidence (%)		Dura-tion (days)	Straw yield (kg ha^{-1})	Grain yield (kg ha^{-1})			
	I	II	I	II	I	II	I	II	I	II	I	II	I	II	Pool	Pool	I	II	Pool	In-crease Over T9
T1	98.5	95.8	433	407	62.7	79.0	50.3	59.0	22	20	1.25	1.36	3.4	3.7	118	4969	2188	1938	2063	975
T2	102.3	95.8	362	322	75.8	87.1	66.5	70.1	21	21	1.54	1.53	3.0	2.1	119	4162	2633	1958	2296	1208
T3	97.8	96.4	370	300	71.9	91.6	61.6	72.8	22	22	1.51	1.80	3.5	4.4	118	4330	2662	2062	2362	1274
T4	81.4	86.4	278	240	55.7	76.2	46.7	57.6	21	21	1.11	1.52	2.9	3.7	121	2464	1300	1300	1088	000
T5	94.4	91.5	365	333	66.8	86.7	56.3	72.4	21	21	1.33	1.51	3.1	3.4	118	3425	2333	2233	1794	706
T6	88.1	90.1	355	382	58.8	88.7	48.3	68.9	21	21	1.17	1.54	3.3	3.4	119	2838	1825	1825	1625	537
T7	103.0	96.3	372	374	79.9	85.9	66.8	71.0	21	22	1.51	1.81	3.8	4.3	118	5615	2938	2938	2427	1339
T8	98.9	95.2	400	395	69.2	81.9	56.1	60.5	21	21	1.31	1.53	4.0	4.2	119	4762	2142	2142	1884	796
T9	72.5	85.7	260	218	48.5	71.2	38.9	50.5	2.8	20	1.02	1.38	3.1	2.7	121	2723	1279	1279	1088	-
CD5%	7.5	7.9	32	46	7.4	10.4	5.7	10.9	NS	NS	0.23	0.20	NS	NS	2.0	48	339	339	215	-

* See materials and methods for treatment details

weed growth and yield of direct-sown rice (*Oryza sativa*). *Indian Journal of Agronomy* 47:212-215.

Meelu, O.P. 1996. Integrated nutrient management for ecologically sustainable agriculture. 23rd Tamhane Memorial Lecture. National Seminar on developments in Soil Science, 28th October-1st November, 1996, held at Gujarat Agriculture University, Anand.

Singh, V.K., Gupta, D.K. and Sinha, AK. 2004. Integrated crop management for upland rainfed rice under northern hill region of Chattisgarh. In: Proc. International symposium on Rainfed Rice Ecosystems: Perspective and Potential, 11-13 October, 2004 held at Indira Gandhi Agricultural University, Raipur, Chattisgarh, India pp. 78-79.

Vlek, P.L.G. 1990. The role of fertilizers in sustaining agriculture in sub-saharan Africa. *Fertilizer Research* 26:327-339.