

Response of hybrid rice to nutrient application in vertisols of Andhra Pradesh

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ABSTRACT

The response of hybrid rice to nutrient application was studied in field experiments during wet season. Both the test hybrids KRH-2 and PHB-71 recorded significantly higher grain yield than the check variety Jaya. Application of 120:60:80 kg of N, P₂O₅ and K₂O ha⁻¹ recorded significantly higher grain yield (6.11 t ha⁻¹) followed by 120:60:40 kg of N, P₂O₅ & K₂O ha⁻¹ (6.05 t ha⁻¹). Among the hybrids, mean maximum nutrient response of 15.57 kg grain per kg nutrients was recorded by PHB-71. Among the nutrients levels, mean maximum nutrients response (17.28 kg grain per kg nutrients) was recorded by the fertilizer schedule of 120:60:40 kg of N, P₂O₅ & K₂O ha⁻¹. Hybrid KRH-2 recorded maximum net return of Rs. 21,111 ha⁻¹ while among nutrients combinations, mean maximum net returns (Rs.23,070 ha⁻¹) was recorded with 120:60:40 kg of N, P₂O₅ and K₂O ha⁻¹.

Key words: Nitrogen, potash, nutrient response, grain yield, hybrid rice

The future gain in rice yield could be achieved, not only from effective use of resources but also with introduction of new technology, such as hybrid rice with suitable and location specific nutrient management. Hybrid rice is practically feasible and adoptable technology for enhancement of yield by 15 – 20 per cent (Paroda 1996). To overcome the problem of current decline in grain yield and input use efficiency in rice and improvement of soil health in general and nutrient use efficiency in particular, balanced nutrient use is the possible solution. Considering the importance of nutrition in hybrid rice, this study was carried out to evaluate the grain yield potential and nutrient response of promising hybrids under vertisols conditions.

Field experiment were conducted during the wet seasons at Hyderabad. The soil of the site is silty clay loam with a pH of 8.1; and 255, 35, 520 kg ha⁻¹ of available nitrogen, phosphorus and potash, respectively. Two hybrids (PHB-71 and KRH-2) of medium duration along with local check (Jaya) were tested with ten treatment combinations of nitrogen and potash (T1-Control; T2-90:60:0 kg of N, P₂O₅ and K₂O ha⁻¹; T3-90:60:40 kg of N, P₂O₅ and K₂O ha⁻¹; T4-90:60:80 kg of N, P₂O₅ and K₂O ha⁻¹; T5-120:60:0 kg of N, P₂O₅ and K₂O ha⁻¹; T6-120:60:40 kg of N, P₂O₅ and K₂O

ha⁻¹; T7-120:60:80 kg of N, P₂O₅ and K₂O ha⁻¹; T8-150:60:0 kg of N, P₂O₅ and K₂O ha⁻¹; T9-150:60:40 kg of N, P₂O₅ and K₂O ha⁻¹ and T10-150:60:80 kg of N, P₂O₅ and K₂O ha⁻¹) in a split plot design with three replications. The nitrogen (N) dose was applied in three splits i.e. 50% N at basal, 25% N at tillering and 25% N at booting stage. Phosphorus dosage (P) as per the recommendation was applied as single super phosphate at basal while Potash (K) was applied in two splits (75% at basal and 25% at panicle initiation stage). Hybrids were taken up in main plots while nutrient combinations were arranged in sub-plots. Different doses of N and K were applied through urea and muriate of potash, respectively. Twenty five days old seedlings were transplanted at 20 x 15 cm spacing with 2 seedlings per hill. Observations on grain yield and yield attributes were recorded at the time of harvest. The nutrient response (kg grain yield kg⁻¹ nutrient applied) over control was computed after adjusting grain yield at 14% moisture.

Grain yield differences were significant during both the years (Table 1). KRH-2 recorded the maximum grain yield of 5.69 t ha⁻¹ followed by PHB-71 (5.68 t ha⁻¹) and both the hybrids were significantly superior to Jaya (4.99 t ha⁻¹). The percent increase in grain yield was 14.02 and 13.83 for KRH-2 and PHB-71,

Table 1. Mean grain yield, yield attributes and nutrient response of hybrid rice.

Treatments	Grain yield (t ha ⁻¹)			Panicles (no. m ⁻²)			Panicle weight (g)			Nutrient response (kg grain kg ⁻¹ nutrients)		
	2000	2001	Mean	2000	2001	Mean	2000	2001	Mean	2000	2001	Mean
Hybrids												
KRH-2	5.61	5.76	5.69	330	337	334	3.27	3.05	3.16	15.16	14.91	15.04
PHB-71	5.62	5.74	5.68	347	343	345	3.23	3.10	3.17	15.19	15.95	15.57
Jaya	4.96	5.02	4.99	309	313	311	3.18	2.84	3.01	13.29	13.88	13.59
CD (P=0.05)	0.09	0.06	0.09	3	5	10	0.06	0.05	0.05	0.36	0.69	0.34
Nutrient combinations (kg of N, P ₂ O ₅ & K ₂ O ha ⁻¹)												
Control	2.73	2.51	2.62	232	236	234	1.81	1.72	1.77	-	-	-
90:60:0	5.18	5.12	5.15	308	309	308	2.73	2.80	2.86	16.33	17.40	16.87
90:60:40	5.52	5.32	5.42	318	323	321	2.84	2.88	2.86	14.68	14.79	14.74
90:60:80	5.67	5.43	5.55	332	330	331	2.93	2.93	2.93	12.13	12.70	12.42
120:60:0	5.92	5.79	5.86	340	337	339	3.09	3.08	3.08	16.33	18.22	17.29
120:60:40	6.20	6.05	6.13	365	358	362	3.34	3.35	3.34	15.70	16.09	15.93
120:60:80	6.21	6.10	6.16	352	355	354	3.31	3.33	3.32	13.38	13.59	13.49
150:60:0	5.84	5.90	5.87	350	350	350	3.23	3.24	3.23	16.37	16.14	16.26
150:60:40	5.87	5.95	5.90	350	353	351	3.30	3.31	3.31	12.56	13.68	13.12
150:60:80	5.92	5.91	5.92	354	350	350	3.30	3.20	3.25	11.00	11.72	11.36
CD (P=0.05)	0.20	0.11	0.16	5	8	9	0.13	0.09	0.10	1.15	NS	NS

respectively. Panicle no. m⁻² (334-345) and panicle weight (3.16-3.17 g) were significantly higher under hybrids. The mean maximum nutrient response (15.57 kg grain kg⁻¹ nutrients) was recorded by PHB-71 followed by KRH2 (15.04), which was significantly superior to Jaya (13.59). Similar results were also reported by others (Anonymous, 2000). The grain yield of rice hybrids increased significantly up to 120:60:40 kg of N, P₂O₅ and K₂O ha⁻¹ (6.13 t ha⁻¹) and further increase in fertilizer dose, did not increase the grain yield significantly. The percent increase in grain yield with the treatment 120:60:40 kg of N, P₂O₅ and K₂O ha⁻¹ was of 3.55 to 133.97 over that of remaining treatments except 150:60:80 kg of N, P₂O₅ and K₂O ha⁻¹ (6.16 t ha⁻¹). Similar results were also reported by Surekha *et al.*, (2001). The mean maximum panicle number (355 m⁻²) and panicle weight (3.32 g) were recorded by the treatment with 120:60:40 kg of N, P₂O₅ and K₂O ha⁻¹. Averaged over potash levels, mean maximum nutrient response of 15.57 was recorded by PHB-71 at N 120 kg ha⁻¹, while averaged over nitrogen levels, K40 recorded mean maximum nutrient response of 14.60. The interaction of hybrids and nutrient combinations (Table 2) indicated that KRH-2 recorded maximum grain yield (6.50 t ha⁻¹) with 150:60:80 kg of

Table 2. Interaction of hybrid rice and nutrient combinations on grain yield during wet season.

Nutrient combinations (kg of N, P ₂ O ₅ and K ₂ O ha ⁻¹)	Grain yield (t ha ⁻¹)			
	KRH-2	PHB-71	JAYA	Mean
Control	2.85	2.85	2.50	2.73
90:60:0	5.28	5.31	4.94	5.18
90:60:40	5.72	5.96	5.15	5.52
90:60:80	5.89	5.87	5.26	5.67
120:60:0	6.27	6.16	5.33	5.92
120:60:40	6.47	6.33	5.81	6.20
120:60:80	6.45	6.41	5.76	6.21
150:60:0	6.04	6.12	5.35	5.84
150:60:40	6.16	6.20	5.26	5.87
150:60:80	6.50	6.41	4.83	5.92
Mean	5.76	5.74	5.02	

CD (P=0.05)

H at same t = 0.30

T at same H =0.30

N, P₂O₅ and K₂O ha⁻¹, which could be the optimum nutrient combination for higher grain yield. Mean maximum nutrient response of 15.93 kg grain kg⁻¹ nutrients was recorded by the same combination (120:60:40 kg of N, P₂O₅ and K₂O ha⁻¹). Among hybrids,

Table 3. Economic returns of hybrids under different nutrient combinations

Treatments	Grain yield (t ha ⁻¹)	Cost of cultivation (Rs. ha ⁻¹)	Gross returns (Rs. ha ⁻¹)	Net returns (Rs. ha ⁻¹)	B:C Ratio
Hybrids					
KRH-2	5.69	13029	34140	21111	1.62
PHB-71	5.68	13029	34080	21051	1.61
Jaya	4.94	13029	29940	16901	1.30
Nutrient combinations (kg of N, P ₂ O ₅ and K ₂ O ha ⁻¹)					
Control	2.62	10500	15720	5220	0.50
90:60:0	5.15	12555	30900	18345	1.46
90:60:40	5.42	12915	32520	12605	1.52
90:60:80	5.55	13275	33300	20025	1.51
120:60:0	5.86	12870	35160	22290	1.73
120:60:40	6.05	13230	36300	23070	1.74
120:60:80	6.11	13950	36660	22710	1.63
150:60:0	5.87	13185	35220	22035	1.67
150:60:40	5.91	13545	35460	21915	1.62
150:60:80	5.97	14265	35820	21555	1.51

Paddy price = Rs. 600 q⁻¹,

N (Urea) = Rs.7.50 kg⁻¹,

P₂O₅ (Single super phosphate) = Rs.18.50 kg⁻¹,

K₂O (Muriate of potash) = Rs.9.00 kg⁻¹

mean maximum net returns and B:C ratio of Rs. 21,111 ha⁻¹ and 1.62 was recorded by KRH-2 followed by PHB-71, respectively. Under different nutrient combinations, mean maximum net returns and B:C ratio of Rs. 23,070 ha⁻¹ and 1.74 were recorded under 120:60:40 kg of N, P₂O₅ and K₂O ha⁻¹ followed by 120:60:0 kg of N, P₂O₅ and K₂O ha⁻¹ (Rs. 22,290 ha⁻¹ and 1.73) (Table 3). To obtain higher grain yield, nutrient use efficiency and economic returns hybrids KRH-2 and PHB-71 can be cultivated with optimum fertilizer dose of 120:60:0 kg of N, P₂O₅ and K₂O ha⁻¹ in clay loam soils of Andhra Pradesh during wet seasons.

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