

Effect of integrated nutrient management on grain yield and economic returns of hybrid rice

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ABSTRACT

Studies on integrated nutrient management of hybrid rice revealed that both hybrids (PHB-71 and KRH-2) recorded significantly higher grain yield than high yielding check variety Jaya. Among organic sources of nutrients, green manure recorded maximum grain yield followed by farm yard manure and both sources were significantly superior over control (without organic sources). Application of graded levels of NPK increased grain yield significantly up to 120:60:30 kg ha⁻¹ NPK. Mean maximum net returns of Rs. 25,981 ha⁻¹ was recorded under 120:60:30 kg NPK level with green manure application, while 120:60:30 kg ha⁻¹ NPK + green manure recorded net returns of Rs. 19,769 ha⁻¹, which was almost comparable with 120:60:30 kg ha⁻¹ NPK application without organic manure (Rs. 18,596 ha⁻¹).

Key words: Hybrid rice, FYM, green manure, economic returns

Demand for plant nutrients has increased considerably due to intensive cropping and increasing cost of nitrogenous fertilizers. It is necessary to find out other alternate sources of nitrogen. Thus, it is important to use inorganic fertilizer efficiently through suitable application method and follow integrated nutrient management practices. Besides supplying plant nutrients, organic manures improve soil physical condition and help sustaining crop productivity. Even with application of recommended doses of NPK 120:60:30 kg ha⁻¹, it was not possible to sustain the productivity of rice-rice system on a long term basis (Nambiar *et al.*, 1992). Use of green manure/green leaves have been found most suitable for rice crop. Hegde (1996) reported that 25-50% nitrogen need of rice could be substituted by organic and biological sources like farmyard manure and green manure. Attempts have been made in the present study to evaluate the efficiency of FYM and green manure with inorganic fertilizers for enhancing the grain production of rice hybrids in Vertisols of Andhra Pradesh.

Field experiments were conducted during wet season 2001 and dry season 2001–02 at experimental farm of Directorate of Rice Research, Hyderabad (A.P.). The soil of experimental site was clayey

(Vertisols) with pH of 8.2 and available N, P and K were of 215, 16 and 345 kg ha⁻¹, respectively. Experiment was laid out in split-split plot design with three replications. Two organic sources (Green manure, and FYM) were tested with two rice hybrids (PHB-71 and KRH-2) and one local check variety (Jaya) under four levels of NPK. In green manure plot Dhaincha (*Sesbania aculeata*) was incorporated @ 10 t ha⁻¹ in field while in FYM plot well decomposed FYM @ 10 t ha⁻¹ was applied 3 days before final puddling. On dry weight basis the N, P and K content was 0.5, 0.2 and 0.5 per cent in FYM while 2.0, 0.25 and 1.2 per cent was in green manure crop, respectively. The recommended dose of fertilizer was 120:60:40 kg NPK ha⁻¹.

Twenty-five days old seedlings were transplanted on 15th July and 15th January during wet and dry seasons respectively. Two seedlings hill⁻¹ were transplanted at 20 x 10 cm spacing. Observations on yield and yield attributes were recorded at harvest. Harvested grains were sun dried and final grain yield was adjusted at 14% moisture. The economic returns were worked out by considering selling price of Rs. 650 q⁻¹ and fertilizer price of Rs. 10.50, 18.75 and 8.09 kg⁻¹ of N, P₂O₅ and K₂O, respectively. The cost of

cultivation was of Rs. 12,000 ha⁻¹, Rs. 16,000 ha⁻¹ and Rs. 11,000 ha⁻¹ under green manure, FYM and without organic sources, respectively.

Grain yield differences among different treatments were significant during both the season (Table 1). Both sources of organic manures (GM and FYM) recorded significantly higher grain yield over the mean grain yield of without organic manure plot (3.93 t ha⁻¹). The percentage increase in grain yield of 29.5 and 23.9 under green manure and farmyard manure, respectively over the mean grain yield of inorganic

increase in grain yield over the check variety was of 19.2 and 15.8 with the hybrids PHB-71 and KRH-2, respectively. The grain yield differences between PHB-71 and KRH-2 were non-significant during wet season 2001, while PHB-71 recorded significantly higher grain yield (5.04 t ha⁻¹) KRH-2 than (4.90 t ha⁻¹) during dry season 2000–2001.

Application of different doses of NPK fertilizers influenced the grain yield significantly during both the seasons (Table 1). Grain yield increased significantly upto 100% recommended NPK

Table 1. Effect of integrated nutrient management on grain yield and yield attributes of rice hybrids.

Treatments	Grain yield (t ha ⁻¹)			Panicles m ⁻²			Panicle weight (g)		
	Wet 2001	Dry 2001-02	Mean	Wet 2001	Dry 2001-02	Mean	Wet 2001	Dry 2001-02	Mean
Organic sources									
Without organic	3.84	4.01	3.93	301	300	300	2.45	2.50	2.48
Green manure	5.00	5.18	5.09	323	329	326	3.00	2.95	2.98
FYM	4.92	5.08	5.02	322	325	324	2.95	2.87	2.91
CD(P=0.05)	0.20	0.17	0.20	5	6	7	0.07	0.06	0.07
Varieties									
PHB-71	4.90	5.04	4.97	328	330	329	3.15	2.92	3.04
KRH-2	4.75	4.90	4.83	328	325	327	3.05	2.87	2.96
Jaya	4.12	4.22	4.17	290	300	295	2.60	2.53	2.57
CD(P=0.05)	0.20	0.23	0.19	3	7	8	0.08	0.06	0.09
NPK levels (kg ha ⁻¹)									
0	2.68	3.38	3.03	256	250	253	2.10	2.04	2.07
50%	4.31	4.99	4.65	315	300	308	2.85	2.74	2.80
100%	5.82	5.83	5.83	351	340	346	3.35	3.22	3.29
150%	5.54	5.74	5.64	339	335	337	3.10	3.09	3.10
CD (P=0.05)	0.14	0.74	0.15	4	6	5	0.05	0.06	0.7

fertilizer plot. The grain yield differences between green manure and farmyard manure were non-significant during wet season 2001 while during dry season 2001–2002, green manure recorded significantly higher grain yield (5.18 t ha⁻¹) over the mean grain yield of farmyard manure (4.81 t ha⁻¹). Similar results were also reported by Paroda (1998). Panicle production and panicle weight also showed similar pattern of grain yield production.

Both hybrids (PHB-71 and KRH-2) recorded significantly higher grain yield (4.83 to 4.97 t ha⁻¹) over Jaya (4.17 t ha⁻¹) during both the seasons. The per cent

Table 2. Effect of interactions between hybrids, organic sources and schedules of fertilizer application on grain yield during wet 2001

Treatments/ Hybrids	Grain yield t ha ⁻¹				
	Recommended NPK (kg ha ⁻¹)				
	Control	50%	100%	150%	Mean
PHB-71	2.84	4.81	6.21	5.77	4.91
KRH-2	2.74	4.66	6.05	5.53	4.75
Jaya	2.47	3.46	5.21	5.34	4.12
Mean	2.68	4.30	5.82	5.54	4.59

CD(P=0.05) for Hybrid at same level of NPK= 0.24
Recommended NPK level at same hybrid = 0.24

(5.83 t ha⁻¹) and thereafter decreased (5.14 t ha⁻¹) with 100% of recommended NPK. These findings are in conformity with those of AICRIP (2002). Yield attributes were also in the similar trend as that of grain yield production.

The interaction effect of hybrids and increasing levels of NPK on grain yield was significant during wet season 2001 (Table 2). The hybrid PHB-71 receiving 100% recommended NPK recorded the highest grain yield (6.21 t ha⁻¹) which was comparable with the grain yield (6.05 t ha⁻¹) recorded with KRH-2 at the same

On the basis of these findings it can be concluded that green manure + 50% recommended NPK applied to the rice hybrid PHB-71 or KRH-2, can optimize rice production in the Deccan plateau region of Andhra Pradesh.

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Table 3. Economic returns (Rs. ha⁻¹) under organic-inorganic sources of fertilizer

Treatments	Mean grain yield (t ha ⁻¹)	Cost of cultivation (Rs. ha ⁻¹)	Gross returns (Rs. ha ⁻¹)	Net returns (Rs. ha ⁻¹)	B:C Ratio
Without organic					
Control	2.43	11,000	15,795	4,795	1.44
50%	3.78	12,354	24,570	12,216	1.99
100%	4.97	13,709	32,305	18,596	2.36
150%	4.60	14,748	29,900	15,152	2.03
Green manure					
Control	3.40	12,000	22,100	10,100	1.84
50%	5.10	13,354	33,150	19,796	2.48
100%	6.26	14,709	40,690	25,981	2.77
150%	5.89	15,748	38,325	22,537	2.43
FYM					
Control	3.28	16,000	21,320	5,320	1.33
50%	5.06	17,354	32,890	15,536	1.89
100%	6.23	18,709	40,495	21,786	2.16
150%	5.76	19,748	37,375	17,627	1.89

level of recommended NPK and both these treatment combination were significantly superior to the rest of the treatments.

Among different treatment combinations of organic and without organic sources (Table 3), green manure + 100% recommended NPK recorded maximum net returns and B: C ratio (Rs. 25,981 ha⁻¹ and 2.77) followed by green manure + 150% NPK and B:C ratio (Rs. 22,537 ha⁻¹ and 2.46) and FYM + 100% NPK and B:C ratio (Rs. 21,786 ha⁻¹ and 2.16). Green manure + 50% recommended NPK recorded higher net returns and B:C ratio of Rs. 19,796 ha⁻¹ and 2.48 than 100% NPK application (Rs. 18,596 ha⁻¹ and 2.03). This shows that green manure + 50% recommended NPK application can save about 50% recommended NPK.

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