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Maximizing hybrid rice productivity through nitrogen and potassium

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Abstract : Field experiments were conducted at Agricultural College and Research Institute, Madurai during *kharif* and *rabi* seasons of 1999-2000 and 2000-2001, to study the effect nitrogen and potassium management in maximizing the productivity of hybrid rice (ADTRH 1 and CORH 2). The experiments were laid out in randomized block design with three replications. The treatments included sources and levels of nitrogen and split application of N and K. The results revealed that application of 10 t ha^{-1} green manure along with 200 kg ha^{-1} inorganic nitrogen improved the yield and yield attributes of rice hybrids (ADTRH 1 and CORH2) and also recorded higher yield (8210; 7775 kg ha^{-1} in *kharif* and *rabi* seasons respectively). Similarly, application of N and K, in four equal splits at active tillering, panicle initiation, booting and flowering recorded higher yield of 7598 kg ha^{-1} in *kharif* and 7272 kg ha^{-1} in *rabi* seasons.

Keywords: ***Hybrid rice, Green manure, Inorganic nitrogen, Split application, Yield.***

Introduction

Rice occupies a pivotal place in Indian agriculture and it is the staple food for more than 70 per cent of population and a source of livelihood for about 120-150 million rural households. It accounts for about 43 per cent of the total food grains and 55 per cent of cereal production in the country (Pandey *et al.*, 2000). At the accelerating current growth rate of 1.8 per cent of population, rice requirement by 2020 is estimated to be around 140 million tones. There is no scope for horizontal expansion of cultivable area. Therefore, rice productivity and production have to be increased to meet the future demand. Among the various strategies proposed to improve rice productivity, exploitation of heterosis through the development of hybrid rice is one among them. Rice hybrids yield about 20 per cent increased grain yield over inbred cultivars (Virmani *et al.*, 1991). In India about fifteen rice hybrids have been developed and released so far by public and private sector including three from Tamil Nadu namely CORH1, CORH2 and ADTRH1.

Materials and Methods

Field experiments were carried out during *kharif* and *rabi* seasons of 1999-2000 and 2000-2001 at Agricultural College and Research Institute, Madurai (9° 54' N and 78° 54' E).The experimental fields were sandy clay loam with well-drained condition. The soil fertility status contained 224-232 kg available N, 13.2-17.2 kg available P and 235-290 kg available K per ha. The organic carbon content was from 0.38-0.42 per cent. The rice hybrids ADTRH 1 and CORH 2 were raised during *kharif* and *rabi* seasons respectively. The experiments were laid out in randomized block design with three replications. The following treatments were included in the study.

Table 1. Effect of green manure along with levels and split application of N and K on yield attributes and yield of rice hybrids during *kharif* and *rabi* seasons (pooled data of 2 years)

Treat-ments	*kharif*				*rabi*			
	No.of panicles m^{-2}	Filled grains $panicle^{-1}$	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	No.of panicles m^{-2}	Filled grains $panicle^{-1}$	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})
GM and N levels								
L_1	436	113	7266	8782	431	108	7191	8375
L_2	479	124	7795	9428	467	110	7518	8752
L_3	455	120	7588	9176	445	114	7354	8563
L_4	503	127	8210	9822	493	118	7775	9020
L_5	373	94	6726	8205	381	98	6241	7339
L_6	410	102	7038	8506	410	102	6763	7869
SEd	4.56	0.812	76.23	83.21	4.28	0.56	81.04	87.52
CD (p=0.05)	9.26	1.648	154.78	168.92	8.68	1.137	164.51	177.66
Split application of N and K								
T_1	435	110	7289	8838	428	106	7036	8190
T_2	446	113	7429	8976	439	108	7113	8325
T_3	453	117	7598	9161	447	110	7272	8558
SEd	3.21	0.912	49.5	55.26	3.01	0.42	57.91	61.52
CD (p=0.05)	6.52	1.851	100.49	112.18	6.11	0.853	117.58	124.89

Interaction not significant

Factor I : Sources and levels of N

L_1- 150 kg N* ha^{-1} + 6.25 t green manure ha^{-1}
L_2- 200 kg N* ha^{-1} + 6.25 t green manure ha^{-1}
L_3 - 150 kg N* ha^{-1} + 10 t green manure ha^{-1}
L_4- 200 kg N* ha^{-1} + 10 t green manure ha^{-1}
L_5- 150 kg N* ha^{-1} alone
L_6 - 200 kg N* ha^{-1} alone

* inorganic source

Factor II : Split application of nitrogen and potassium

T_1 = Three equal splits at AT, PI, B
T_2 = Three equal splits at AT, PI, F
T_3 = Four equal splits at AT, PI, B, F

AT- Active Tillering, PI - Panicle Initiation; B - Booting, F - Flowering
(Phosphorus and Potassium each at 50 kg ha^{-1} were common for all treatments)

Sesbania aculeata was sown in separate field by broadcast method using a seed rate of 25 kg ha^{-1} during May for *kharif* and August for *rabi* in both the years. When the crop was 45 days old, it was cut at ground level, transported and incorporated in the treatment plots seven days before the transplanting of rice crop. Observations on yield parameters and yield were taken. The data were subjected to statistical analysis as described by Gomez and Gomez (1984).

Results and Discussion

Application of green manure increased the grain yield significantly at both the levels of nitrogen tested (150 and 200 kg N ha^{-1}) during *kharif* and *rabi* seasons of both the years. Among the green manure levels, application of green manure at 10 t ha^{-1} was significantly superior to application of green manure @ 6.25 t ha^{-1} at both the levels of N tested. As a whole, application of 200 kg ha^{-1} in combination with 10 t ha^{-1} green manure was superior to rest of the treatments evaluated.

Consequence of the improvement on the growth, yield attributes, nutrient uptake and the grain and straw yield showed a significant increase (Srivastava and Tripathi, 2000). The marked increase in grain yield (8210 ; 7775 kg ha^{-1} in *kharif* and *rabi* seasons respectively) (Table l) due to green manure over other sources could be attributed to the enrichment of soil fertility through green manure addition in to the soil (Gopalswamy and Vidhyasekaran, 1987) and this improved the soil physical properties as well as fertility. This in turn might have promoted the growth parameters and yield attributes contributing to the increased grain yield. The slower and steady rate of release of nutrients from organic sources have helped the rice plant to meet the nutrient requirement at all stages and thereby favourably influenced the various growth and yield parameters which ultimately resulted in higher yield (Budhar, 1994).

Application of N and K in four equal splits at AI, PI, B & F stages produced higher yield attributes and grain yield with 7598 kg ha^{-1} in *kharif* and 7272 kg ha^{-1} in *rabi* seasons. (Table l). This might be due to the increased efficiency of nitrogenous fertilizers applied along with potassium and thus led to more uptake of nutrients and accumulation of more assimilates (Ramamoorthy *et al.,* 1997).

In the present study, the grain yield was higher in *kharif* than *rabi* during both the years because of favourable agro climatic conditions like higher rainfall and temperature.

From the above results, it could be concluded that application of green manure @ 10 t ha^{-1} along with 200 kg N ha^{-1} and split application of N and K at AT, PI, B and F recorded higher yield attributes and yield.

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