Madras Agric. J. 90 (10-12) : 611-614 October-December 2003

https://doi.org/10.29321/MAJ.10.A00145

Organics in the improvement of nutrient use efficiencies in white ponni

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Abstract: **A field experiment was carried out during the rabi seasons on 1996-97 and 1997-98 to study the sustainability of rice cv. White ponni to green manuring and N and K levels. The grain and straw yields obtained from green manuring along with the application of 50 per cent of the recommended N and K and application of 100 per cent N and K applied alone were on par with each other. Agronomic efficiency of the applied N and K were higher in green manuring with 50 per cent of the recommended N and K. However, non-green manured treatments recorded higher physiological efficiency than green manured treatments. The treatments with green manuring registered positive nutrient balance compared to non-green manuring.**

***Key words** : Green manuring, Agronomic efficiency, Physiological efficiency, Nutrient balance.*

troduction

White ponni is a ruling variety for rabi ason with its fine grain quality but because its long stature and poor responsiveness to organic fertilizers, it is prone to lodging. Periyar - Vaigai command area in which e study area situates, single crop wetlands e kept fallow during the months of July August when there is a possibility of receiving pproximately 150 mm of rainfall from South est Monsoon. Using the initial rains, a green anure like dhaincha can be grown. Daincha an effectively substitute part of inorganic N nd thus can save some amount of nonrenewable source of energy needed for the manufacture f urea. Potassium has an indirect influence n rice grain yield as it increases the utilization fficiency of nitrogenous fertilizers. It also imparts dging and diseases resistance to crop plants y encouraging strong shoot and root system t times of excess N application. Keeping the bove objectives in view, the present study as undertaken.

laterials and Methods

A field experiment was conducted during e rabi seasons of 1996-97 and 1997-98 at gricultural College and Research Institute, adurai. The soil of the experimental field as low in available N (232 kg h^{-1}), medium available P (13.5 kg ha^{-1}) and high in available (290 kg ha^{-1}). The experiment was conducted Randomised Block Design with four replications. The treatment details are as follows :

F_1 - recommended N and K fertilizer alone
F_2 - 75% of recommended N and K alone
F_3 - 50% of recommended N and K alone
F_4 - Green manure + recommended N and K
F_5 - Green manure + 75% of recommended N and K
F_6 - Green manrue + 50% of recommended N and K.

Recommended fertilizer dose for white ponni of 75:37.5:37.5 kg ha^{-1} of N, P_2O_5 and K_2O was followed. N and K fertilizers were applied according to the treatment schedule while entire P was applied as basal uniformly to all the treatments. The green manure crop *viz.* dhaincha (*Sesbania aculeata*) was grown with a seed rate of 60 kg ha^{-1} and ploughed *in situ* at 45 days after sowing.

Grain and straw yields of rice were recorded N and K use efficiencies were calculated as follows :

Agronomic Efficiency (AE)

The AE is the response in yield per unit of fertilizer nutrient applied and as calculated by the following formula suggested by Yoshida (1981).

Table 1. Yield in rice (kg ha^{-1})

Treatments	1996-97		1997-98	
	Grain yield	Straw yield	Grain yield	Straw yield
F_1	4904	8827	5218	9451
F_2	4646	8362	4964	8897
F_3	4466	8022	4749	8513
F_4	5318	9571	5631	10044
F_5	5114	9204	5427	9702
F_6	4847	8729	5165	9258
SEd	72	155	77	135
CD (P=0.05)	159	313	171	302

Table 2*. Agronomic efficiency (AE) and physiological efficiency (PE) of N and K

Treatments	1996-97				1997-98			
	AE		PE		AE		PE	
	N	K	N	K	N	K	N	K
F_1	25.9	51.9	34.4	37.9	26.3	52.5	35.2	39.2
F_2	30.0	60.0	54.2	47.6	29.8	59.5	51.8	41.6
F_3	39.9	79.9	40.9	45.7	39.2	78.4	53.1	37.1
F_4	22.3	44.6	25.8	28.6	22.5	45.0	25.2	28.7
F_5	26.1	52.7	26.1	28.8	52.2	52.2	25.2	26.1
F_6	32.2	64.3	25.6	27.5	31.9	63.7	25.4	23.5

* - Data not analysed

$$AE = \frac{\text{Grain yield in fertilized plot (kg ha}^{-1}) - \text{Grain yield in unfertilized plot (kg ha}^{-1})}{\text{Quantity of fertilizer nutrient applied (kg ha}^{-1})}$$

Physiological Efficiency (PE)

The PE also known as efficiency of utilization as indicated by kg of grain per kg of absorbed nutrient and was computed as given below (Yoshida, 1981).

$$AE = \frac{\text{Grain yield in fertilized plot (kg ha}^{-1}) - \text{Grain yield in unfertilized plot (kg ha}^{-1})}{\text{Nutrient uptake in fertilizer plot (kg ha}^{-1}) - \text{Nutrient uptake in unfertilized plot (kg ha}^{-1}).}$$

Nutrient Balance

The nutrient balance was worked o as per the procedure suggested by Yadav (198

Nutrient Balance = Total nutrients added total nutrients remov

(Increase or decrease in the available nutrie status before the cropping system)

Results and Discussion

Grain and Straw Yields (Table 1)

Green manure plus half of the recommen N and K (F_6) was able to produce comparat economic yield with 100 per cent recommend N and K (F_1) alone (Table 1). This is becau green manure on decomposition increased t availability of N in the soil (Fleming *et* 1981) which enhanced the uptake of N the crop and thereby increased the grain yi of rice (Kundu *et al.* 1991).

Table 3*. N balance sheets (kg ha^{-1}) during 1996-97 and 1997-98

Treatments	Initial soil available N	Total N added through		Final soil available N	Total N removed	Net gain or Net loss of N
		Fertilizer	GM			
1996-97						
F_1	232	75	-	221	81	-5
F_2	232	56	-	203	78	-7
F_3	232	38	-	184	71	-15
F_4	232	75	39	240	121	+15
F_5	232	56	39	228	111	+12
F_6	232	38	39	215	104	+31
1997-98						
F_1	232	75	-	223	81	-3
F_2	232	56	-	204	79	-5
F_3	232	38	-	187	73	-10
F_4	232	75	45	241	130	+19
F_5	232	56	45	231	111	+15
F_6	232	38	45	221	106	+12

- Data not analysed

Table 3*. K balance sheets (kg ha^{-1}) during 1996-97 and 1997-98

Treatments	Initial soil available K	Total K added through		Final soil available K	Total K removed	Net gain or Net loss of K
		Fertilizer	GM			
1996-97						
1	290	38	-	272	96	+40
2	290	28	-	266	82	+30
3	290	18	-	257	72	+21
4	290	38	12	284	115	+59
5	290	28	12	276	106	+52
6	290	18	12	267	84	+31
1997-98						
1	290	38	-	277	97	+46
2	290	28	-	271	87	+39
3	290	18	-	263	75	+30
4	290	38	15	292	120	+69
5	290	28	15	284	112	+63
6	290	18	15	275	92	+44

- Data not analysed

Nutrient use efficiencies (Table 2)

In the present study, Agronomic Efficiency (AE) of N was improved when green manure was combined even with low level of N (50% of N). This shows that green manure, apart from contributing organic nitrogen, improved the efficiency of fertilizer N (Table 2). Such positive effect of green manuring was seen with 100 per cent N also, though the efficiency gets decreased at higher levels of N. Budhar

et al. (1994) reported such integration of organic and inorganic sources of N leading to higher AE. The AE of K also followed the same trend when applied in combination with green manure as that of N.

In physiological efficiency (PE), uptake of N and K is related with the grain yield. The uptake was maximised when fertilizer N was combined with green manuring, while green manuring alone could not increase the uptake substantially. This means the difference in uptake between green manure plus 50 per cent N and K or green manure plus 100 per cent N and K is wider.

Nutrient balance studies (Table 3 & 4)

It was obviously seen that cultivation of green manure preceding to rice and incorporation of the same resulted in a positive N and K balance position. The increased N and K balance in green manure applied plots might due to large amount of N and K addition through green manuring over and above the amount required by the crop. Every incremental increase in N and K level resulted in successive increase in the N and K balances. The results corroborate with the findings of Wankhade was Pandrangi (1993) and Velu and Ramanathan (1996).

Conclusions

Green manuring with 50 per cent of the recommended N and K produces comparable results with 100 per cent recomended N and K alone. From this it is inferred that 50 per cent of the N and K can be substituted through green manuring. Lodging of white ponni was considerably reduced when 50 per cent of the recommended N and K were applied along with green manure. In green manuring with 50 per cent of the recommended N and K, the nutrient use efficiencies were better. Tl positive nutrient balance was also obtained wi green manuring. From this two years of stud it is inferred that green manuring can be us as a tool to get sustained yield through nutrie use efficiencies and to maintain soil nutrie balance.

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(Received: July 2002; Revised: June 2003)