Journal of Tropical Agriculture 36 (1998) : 58-61

UPTAKE OF NUTRIENTS BY RICE AND WEEDS IN THE EARLY STAGES OF SEMI-DRY RICE CULTURE

Proper nutritional management is recognised as the key for realising the most efficient production in crop plants. Weeds absorb at least part of the available nutrients and affect crop growth by restricting the absorption by rice. Weeds are the highest menace in the semi-dry system of rice culture where early growth of rice is inhibited by weed growth. Bridgit *et al.* (1991) have reported that weeds limit productivity of semi-dry rice to the tune of 75 per cent and that weed infestation is confined to the early stages. As the weeds removed in manual weeding are thrown out and not recycled, the nutrient loss by weed removal is a steady and continuous means of nutrient drain (Anon, 1993). Information on nutrient drain due to weeds, especially in the semi-dry system is meagre under our condition. The results on this aspect generated from an experiment conducted to study the nutrient removal pattern of rice and weeds in the early periods of rice growth in the semi-dry system are presented here.

A field experiment was conducted at the Agricultural Research Station, Mannuthy, of the Kerala Agricultural University, using rice variety Jyothi and green manure cowpea (var. Kanakamony) during the kharif season of 1993 under the semi-dry system. The soil was sandy clay loam in texture and acidic in reaction with medium fertility. The experiment was laid out in randomised block design with three replications in plots of 20 m^2. The treatments consisted of factorial combinations of four levels of nitrogen (0, 35, 70 and 105 kg N ha^{-1}), two levels of phosphorus (0 and 35 kg P_2O_5 ha^{-1}), two seed rates for cowpea for simultaneous *in situ* green manuring (15 and 30 kg seeds ha^{-1}) and a control with normal package of practices (KAU, 1993). Cowpea was dibbled as per the seed rate levels in the interspaces of rice which was planted at a spacing of 15 cm x 15 cm. On water stagnation by about 45-50 days after sowing, growth of cowpea is ceased and it gets decomposed. Application of nitrogen was done in three equal split doses viz., basal, at active tillering and panicle initiation stages. Phosphorus was applied fully as basal. A uniform dose of 35 kg K_2O ha^{-1} was applied to all the plots irrespective of the treatments. All other cultural operations were done uniformly. Samples of rice and weeds were collected at 20 days after sowing and analysed for the nutrients (Jackson, 1958). The data obtained were statistically analysed by using the analysis of variance technique (Panse and Sukhatme, 1985).

Application of increasing levels of nitrogen increased the removal of N by rice significantly at all stages of observation, and at 20 days after sowing (DAS) the maximum uptake value was observed at 105 kg N ha^{-1} (Table 1), whereas in the case of P, K, Ca, Mg, S and Fe the response to higher levels of nitrogen was observed with progressive stages of rice growth. As against this, in weeds the uptake values of all the elements studied were maximum at zero level of nitrogen application and minimum at the highest level tried in the experiment. Similarly, the dry matter production of weeds was also less at higher levels of nitrogen (Table 2) due to the suppression of weed growth through the salt index (Nair, 1968). The decreased dry matter production might be the reason for a lower nutrient uptake by weeds at the higher levels of nitrogen.

Application of phosphorus had shown an increase in the uptake of all the nutrients by rice as well as weeds.

Simultaneous *in situ* green manuring though significantly increased the uptake of certain

Table 1. Effect of treatment levels on nutrient uptake by rice and weeds at 20 days of growth, kg ha $^{-1}$

Treatment	Rice						
	N	P	K	Ca	Mg	S	Fe
N (kg ha $^{-1}$)							
0	14.87	1.86	18.19	1.96	1.28	2.32	0.70
35	18.48	2.01	22.80	2.83	1.30	2.51	1.04
70	18.72	1.94	18.17	2.19	1.18	2.46	0.67
105	22.99	1.58	18.31	2.07	1.21	2.18	0.67
SEm±	0.67	0.06	0.64	0.08	0.05	0.09	0.04
CD (0.05)	1.37	0.13	1.33	0.17	NS	0.19	0.07
P_2O_5 (kg ha $^{-1}$)							
0	18.23	1.56	18.43	2.06	1.10	2.09	0.70
35	19.30	2.14	20.31	2.47	1.38	2.65	0.84
SEm±	0.48	0.04	0.45	0.06	0.04	0.07	0.03
CD (0.05)	0.97	0.09	0.92	0.12	0.07	0.14	0.05
Seed rate (kg ha $^{-1}$)							
15	20.49	1.87	20.72	2.51	1.39	2.60	0.70
30	17.04	1.83	18.02	2.02	1.10	2.13	0.84
SEm±	0.48	0.04	0.45	0.06	0.04	0.07	0.03
CD (0.05)	0.97	NS	0.92	0.12	0.07	0.14	0.05
Mean for seed rates	18.77	1.85	19.37	2.26	1.25	2.37	0.77
Control	18.32	1.53	20.37	2.04	1.21	2.07	0.70
SEm±	1.35	0.12	1.28	0.17	0.10	0.19	0.07
CD (0.05)	NS	0.25	NS	NS	NS	0.39	NS

Table 1 (contd.)

Treatment	Weeds						
	N	P	K	Ca	Mg	S	Fe
N (kg ha $^{-1}$)							
0	16.03	0.92	20.17	1.64	1.50	1.74	1.13
35	9.91	0.67	11.74	1.24	0.86	0.95	0.58
70	11.15	0.73	13.43	1.38	1.11	1.31	0.73
105	9.20	0.66	10.78	1.04	0.83	1.02	0.41
SEm±	0.72	0.04	0.56	0.07	0.05	0.08	0.03
CD (0.05)	1.47	0.08	1.15	0.14	0.09	0.16	0.05

Table 1 (contd.)

P_2O_5 (kg ha^{-1})							
0	9.68	0.57	11.16	1.04	0.89	1.49	0.53
35	13.46	0.92	16.90	1.61	1.25	1.49	0.89
SEm±	0.51	0.03	0,39	0.05	.0.03	0.06	0.02
CD (0.05)	1.04	0.06	0.81	0.10	0.06	0.12	0.04
Seed rate (kg ha^{-1})							
15	11.43	.0.71	14.14	1.22	1.11	1.27	0.73
30	11.71	0.78	13.92	1.43	1.04	1.25	0.69
SEm±	0.51	0.03	0.39	0.05	0.03	0.06	0.02
CD (0.05)	NS	0.06	NS	0.10	0.06	NS	0.04
Mean for seed rates	11.57	0.74	14.03	1.33	1.08	1.26	0.71
Control	24.57	1.35	29.01	2.05	1.70	2.26	1.47
SEm±	1.45	0.08	1.13	0.14	0.09	0.16	0.05
CD (0.05)	2.95	0.16	2.23	0.28	0.18	0.32	0.11

Table 2. Drymatter production of rice, weeds and cowpea at 20 days of growth, kg ha^{-1}

Treatments	Rice	Weeds	Cowpea
Nitrogen (kg ha^{-1})			
0	592	526	105
35	770	294	106
70	574	359	120
105	644	263	140
SEm±	101	20	2.2
CD (0.05)	NS	41	4.6
PA (kg ha^{-1})			
0	602	292	110
35	689	423	126
SEm	71	14	1.6
CD (0.05)	NS	29	2.3
Cowpea seed (kg ha^{-1})			
15	659	361	84
30	631	355	152
SEm±	71	14	1.6
CD (0.05)	NS	NS	3.2

elements by rice, its positive influence was nullified in the case of weeds where the inter-cropping reduced the uptake drastically. When the percentage increase in nutrient removal by rice was 2.5 (N), 21 (P), 10.8 (Ca), 3.3 (Mg), 14.5 (S) and 10 (Fe), there was a decline of 53 (N), 45 (P), 52 (K), 35 (Ca), 37(Mg), 44 (S) and 52 (Fe) per cent by weeds under inter-cropping. This shows that simultaneous *in situ* green manuring could reduce the nutrient removal by weeds rather than increasing the uptake by rice. This also suggests that by reducing the nutrient removal by weeds, the system make the nutrients more available and absorbed by the rice which would otherwise have been absorbed by the weeds. The interesting fact is that the weeds have produced comparable amount of dry matter to the rice crop by 20 DAS though fields have been completely free of weeds at the time of sowing (Table 2). This high rate of emergence and growth of weeds evidently is the result of their better adaptability to the iron rich lateritic alluvium than the high yielding varieties of rice. Bridgit *et al.* (1992) have reported that high yielding varieties of rice fail to grow well in lateritic soils.

Compared to rice, weeds have removed larger quantities of N, K and Mg. Mg is not a recommended element and far more K is absorbed than what is usually applied. Thus, even assuming that the deficiency of N is made up through application of chemical fertilizer, weeds inevitably go on depleting the soil of K and Mg and steadily erode the fertility and productivity of soil. Sreedevi and Iyer (1974) have reported that lateritic soils are deficient in K and Marykutty *et al.* (1992) have found an unfavourable ratio of N/K and Ca + Mg/K as one of the limiting factors in rice culture in laterites. Cowpea intercropping in the early stages of semi-dry rice appears to have contributed at least in part by limiting weed growth and thereby conserving more of K and Mg. Nutrient balance analysis in the present study confirms this observation.

This forms a part of the M.Sc.(Ag) thesis of the first author submitted to the Kerala Agricultural University, Trichur, 1995.

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