Madras Agric. J., 95 (7-12) : 333-338 July-December 2008
https://doi.org/10.29321/MAJ.10.100590

Studies on uptake of N, P and K as influenced by different rates (doses) of pretilachlor in transplanted rice

S. DEEPA AND R. JAYAKUMAR
Department of Soil Science and Agricultural Chemistry, Tamil Nadu Agricultural University, Coimbatore - 641 003, Tamil Nadu.

Abstract : Field experiments were conducted in wetlands of Tamil Nadu Agricultural University, Coimbatore during *rabi,* 2001-02 and summer, 2002 to study the effect of weed control treatments on nutrient uptake by crop and removal by weeds and their impact on yield. Pretilachlor at five levels (0.5, 0.75,1.0,1.5 and 3.0 kg ha^{-1}) were compared with anilofos (0.4 kg ha^{-1}), butachlor (1.25 kg ha^{-1}) and pretilachlor (Rifit) (0.75 kg ha^{-1}) as well as the farmers' practice of two manual weeding and un weeded control. Nutrient uptake by crop and removal by weeds were recorded at active tillering, panicle initiation and at harvest stage. The results revealed that pretilachlor at 3.0 kg ha^{-1} resulted in reduced nutrient depletion by weeds and was comparable with pretilachlor at 1.0 kg ha^{-1}. Pretilachlor at 1.0 kg ha^{-1} recorded maximum nutrient uptake by crop and remained comparable with pretilachlor at 0.75 kg ha^{-1} and hand weeding twice and thereby grain yield of rice.

Key words: Rice, nutrient uptake, removal by weeds, yield.

Introduction

Weed infestation is one of the major constraints responsible for low yields of rice in India. Weeds form a serious negative factor in crop production and are accounted for a marked yield loss of 11-20 per cent in transplanted rice (Ghosh and Moorthy, 1998). Besides reduction in yield, weeds remove a large amount of plant nutrients from the soil. An estimate shows that weeds can deprive the crops 47 per cent N, 42 per cent P, 50 per cent K, 39 per cent Ca and 24 per cent Mg of their nutrient uptake (Balasubramaniyam and Palaniappan, 2001). The extent of weed competition on rice was assessed through nutrient removal by weeds since these two parameters are highly correlated. More quantum of nutrients was taken up by weeds resulting in the reduction of availability of nutrients to the crop, which adversely affected the growth by creating a greater competition and finally the reduction in the yield of rice. Significant negative relationship was observed between N uptake by crop and weed (Chinnamuthu, 1990). In this context, the present study was conducted to find out the uptake of nitrogen (N), phosphorus (P) and potash (K) by the crop in comparison with weeds in transplanted rice.

Materials and Methods

Field experiments were conducted in a cropping system of rice-rice during *rabi,* 2001 and summer, 2002, at wetlands of Tamil Nadu Agricultural University, Coimbatore. The soil of the experimental site was clay loam in texture, tending towards alkaline in reaction with pH of 8.5 and EC 0.14 dSm^{-1} and possess relatively low N status and high P and K

Table 1. Effect of treatments on nutrient removal (kg ha^{-1}) by weeds

Trt. No.	Treatments	*Rabi* (2001-02)			Summer (2002)		
		Active tillering	Panicle initiation	Harvest	Active tillering	Panicle initiation	Harvest
				Nitrogen			
T_1	Pretilachlor 0.5 kg + HW	12.6	14.8	16.8	10.2	12.8	15.9
T_2	Pretilachlor 0.75 kg + HW	12.3	12.7	14.3	8.41	8.51	9.20
T_3	Pretilachlor 1.0 kg+ HW	8.43	8.70	13.2	6.48	6.93	8.51
T_4	Pretilachlor 1.5 kg + HW	6.62	7.30	10.8	5.91	6.72	7.08
T_5	Pretilachlor 3.0 kg+ HW	6.00	6.08	8.70	4.11	4.13	6.74
T_6	Pretilachlor 0.75 kg + HW	10.6	11.8	13.2	7.22	7.78	11.7
T_7	Anilofos0.4kg + HW	11.8	12.8	14.8	6.85	7.25	9.51
T_8	Butachlorl.25kg + HW	11.0	13.2	15.1	5.61	6.18	8.93
T_9	Hand weeding twice	6.30	9.00	11.0	5.30	5.57	7.09
T_{10}	Un weeded control	18.2	18.5	18.9	18.6	19.4	25.9
	SEd	1.68	1.43	1.52	1.05	1.69	0.471
	CD (P = 0.05)	3.54	3.01	3.20	2.30	3.56	0.990
				Phosphorus			
T_1	Pretilachlor 0.5 kg+ HW	0.380	0.780	0.810	0.290	0.525	1.040
T_2	Pretilachlor 0.75 kg + HW	0.310	0.550	0.660	0.220	0.428	0.600
T_3	Pretilachlor 1.0 kg+ HW	0.240	0.330	0.520	0.160	0.254	0.560
T_4	Pretilachlor 1.5 kg+ HW	0.220	0.320	0.460	0.130	0.218	0.380
T_5	Pretilachlor 3.0 kg+ HW	0.150	0.220	0.450	0.120	0.187	0.330
T_6	Pretilachlor 0.75 kg + HW	0.270	0.460	0.640	0.J70	0.374	0.770
T_7	AnilofosQ.4kg + HW	0.270	0.370	0.660	0.200	0.426	0.620
T_8	Butachlorl.25kg + HW	0.230	0.310	0.680	0.190	0.467	0.580
T_9	Hand weeding twice	0.300	0.530	0.550	0.241	0.320	0.440
T_{10}	Un weeded control	0.700	0.900	1.000	0.590	0.668	1.070
	SEd	0.024	0.076	0.040	0.035	0.025	0.060
	CD (P = 0.05)	0.052	0.161	0.094	0.075	0.052	0.130
				Potassium			
T_1	Pretilachlor 0.5 kg+ HW	9.13	13.3	16.6	7.16	12.1	13.9
T_2	Pretilachlor 0.75 kg + HW	7.54	8.35	14.2	4.78	7.85	8.70
T_3	Pretilachlor 1.0 kg+ HW	5.81	6.00	10.7	4.50	6.95	7.43
T_4	Pretilachlor 1.5 kg+ HW	5.03	5.83	9.87	3.86	5.96	6.88
T_5	Pretilachlor 3.0 kg + HW	3.68	4.13	9.59	3.71	5.19	6.13
T_6	Pretilachlor 0.75 kg + HW	6.47	7.00	13.1	4.78	7.15	10.3
T_7	Anilofos 0.4 kg + HW	6.33	6.49	13.5	5.13	6.50	8.30
T_8	Butachlorl.25kg + HW	5.49	5.61	13.7	5.02	6.25	7.80
T_9	Hand weeding twice	7.02	7.72	11.3	5.7TJ	6.60	7.80
T_{10}	Un weeded control	16.8	18.7	20.2	13.9	17.3	22.7
	SEd	0.708	0.573	0.813	0.431	0.668	0.650
	CD (P = 0.05)	1.48	1.20	1.70	1.00	1.41	1.36

Table 2. Effect of treatments on nutrient uptake (kg ha^{1}) by rice

Trt. No.	Treatments	*Rabi* (2001-02)			Summer (2002)		
		Active tillering	Panicle initiation	Harvest	Active tillering	Panicle initiation	Harvest
			Nitrogen				
T_1	Pretilachlor 0.5 kg + HW	26.3	64.6	108	21.3	58.0	88.1
T_2	Pretilachlor 0.75 kg + HW	31.3	68.5	112	23.2	64.6	118
T_3	Pretilachlor 1.0 kg+ HW	36.4	72.3	122	24.3	69.2	124
T_4	Pretilachlor 1.5 kg+ HW	30.6	65.7	114	22.3	60.7	118
T_5	Pretilachlor 3.0 kg + HW	30.0	65.3	113	21.7	60.6	116
T_6	Pretilachlor 0.75 kg + HW	34.5	69.5	117	22.8	69.1	119
T_7	Anilofos 0.4 kg + HW	32.0	66.7	118	23.5	64.2	120
T_8	Butachlorl.25kg + HW	32.1	72.0	119	23.8	68.5	123
T_9	Hand weeding twice	36.1	72.7	119	24.1	73.1	125
T_{10}	Un weeded control	26.3	53.8	97.7	21.1	49.2	87.1
	SEd	0.814	1.66	3.84	1.03	1.66	4.32
	CD (P = 0.05)	1.71	3.49	8.07	2.17	3.49	9.07
			Phosphorus				
T_1	Pretilachlor 0.5 kg+ HW	4.11	9.43	15.7	3.23	8.73	16.1
T_2	Pretilachlor 0.75 kg + HW	4.62	9.79	17.7	3.68	9.56	20.7
T_3	Pretilachlor 1.0 kg+ HW	4.86	10.6	18.4	3.90	10.5	24.8
T_4	Pretilachlor 1.5 kg+ HW	4.51	9.47	17.1	3.48	9.29	20.8
T_5	Pretilachlor 3.0 kg + HW	4.43	9.56	16.9	3.39	9.27	19.4
T_6	Pretilachlor 0.75 kg + HW	4.59	10.5	17.6	3.54	9.75	22.0
T_7	Anilofos 0.4 kg + HW	4.62	9.99	17.5	3.66	9.94	20.5
T_8	Butachlorl.25kg + HW	4.76	10.2	17.8	3.76	10.2	22.6
T_9	Hand weeding twice	4.90	10.4	17.9	3.67	10.8	24.8
T_{10}	Un weeded control	3.59	8.35	14.4	3.08	7.17	15.1
	SEd	0.650	0.657	0.811	0.319	0.645	0.926
	CD (P = 0.05)	NS	1.15	1.74	NS	1.35	1.94
			Potassium				
T_1	Pretilachlor 0.5 kg+ HW	32.4	63.4	115	23.1	61.3	97.4
T_2	Pretilachlor 0.75 kg + HW	35.3	68.1	121	24.6	67.1	123
T_3	Pretilachlor 1.0 kg+ HW	40.6	71.5	127	26.4	75.4	135
T_4	Pretilachlor 1.5 kg + HW	34.6	66.5	117	24.4	66.2	121
T_5	Pretilachlor 3.0 kg+ HW	34.5	64.4	117	23.9	66.2	121
T_6	Pretilachlor 0.75 kg + HW	36.7	67.6	123	24.9	67.6	127
T_7	Anilofos 0.4 kg + HW	38.6	69.2	124	24.9	67.5	130
T_8	Butachlor 1.25 kg + HW	39.8	69.6	125	25.0	71.5	132
T_9	Hand weeding twice	39.9	71.5	123	25.5	72.6	131
T_{10}	Un weeded control	30.9	57.1	111	22.0	49.3	91.8
	SEd	1.63	0.806	2.70	0.798	0.861	3.58
	CD (P = 0.05)	3.44	1.69	5.67	1.67	1.80	7.53

Table 3. Effect of treatments on yield attributes and yield (kg ha^{-1}) of rice

Trt. No.	Treatments	*Rabi* (2001-02)				Summer (2002)			
		Panicle (No.m^{-2})	Panicle length (cm)	Grains Panicle^{-1}	Thousand grain wt. (g)	Panicle (No.m^{-2})	Panicle length (cm)	Grains Panicle^{-1}	Thousand grain wt. (g)
Yield attributes									
T_1	Pretilachlor 0.5 kg + HW	240	21.2	109	19.8	304	19.4	93.0	18.2
T_2	Pretilachlor 0.75 kg+ HW	315	24.1	154	20.9	320	20.2	108	18.3
T_3	Pretilachlor 1.0 kg + HW	315	24.2	155	21.4	345	21.6	113	18.5
T_4	Pretilachlor 1.5 kg+ HW	249	21.1	110	19.5	314	14.9	107	18.3
T_5	Pretilachlor 3.0 kg + HW	256	21.0	109	19.6	309	19.8	105	18.2
T_6	Pretilachlor 0.75 kg+ HW	274	22.8	148	19.8	326	20.9	105	18.3
T_7	Anilofos 0.4 kg + HW	280	22.8	141	20.6	334	21.3	108	18.4
T_8	Butachlorl.25kg + HW	286	22.5	151	19.4	336	21.5	104	18.5
T_9	Hand weeding twice	315	24.0	153	21.5	341	21.5	108	18.6
T_{10}	Un weeded control	235	20.1	79	19.2	289	19.1	84	17.8
	SEd	27.3	0.81	20.3	0.470	3.80	0.080	2.20	0.130
	CD (P = 0.05)	57.4	1.70	42.7	0.990	7.90	0.180	4.60	0.270

Yield

Trt. No.	Treatments	Grain yield	Straw yield	Grain yield	Straw yield
T_1	Pretilachlor 0.5 kg + HW	5249	7874	4977	7113
T_2	Pretilachlor 0.75 kg + HW	5580	8370	5588	8141
T_3	Pretilachlor 1.0 kg+ HW	5737	8606	5822	8255
T_4	Pretilachlor 1.5 kg+ HW	5395	7793	5417	7952
T_5	Pretilachlor 3.0 kg + HW	5292	7745	52%	7922
T_6	Pretilachlor 0.75 kg + HW	5522	8433	5515	8160
T_7	Anilofos 0.4 kg + HW	5524	8286	5491	8136
T_8	Butachlorl.25kg + HW	5466	8199	5566	8154
T_9	Hand weeding twice	5680	8520	5800	8214
T_{10}	Un weeded control	3047	4570	2773	4370
	SEd	187	302	142	119
	CD (P = 0.05)	393	635	298	250

status. The treatments included five doses of pretilachlor at 0.5 to 3.0 kg ha^{-1} were compared with standard treatments *viz.*, pretilachlor (Rifit) at 0.75 kg ha^{-1}, anilofos (Aniloquard) at 0.4 kg ha^{-1} and butachlor (Machate) at 1.25 kg ha^{-1} along with hand weeding twice and un weeded control. The experiment was conducted in a randomized block design with three replications.

The herbicides were applied on 3rd day after transplanting and one hand weeding was given for all the herbicide treated plots at 45 DAT (Days after transplanting). The hand

weeding treatment received two hand weedings at 20 and 45 DAT. The dry weights of weeds (kg ha^{-1}) were recorded at active tillering, panicle initiation and at harvest by removing weeds falling within the quadrate, shade dried and oven dried at 70°C for 72 hours. Weed samples were also collected at these stages to determine the N, P and K removal by weeds. Plant DMP (Dry matter production) and nutrient uptake of rice were recorded at active tillering, panicle initiation and at harvest to evaluate the effect of weed control practices on crop growth. Nitrogen content was estimated by Micro Kjeldhal digestion method as suggested by Humphries (1956).The Phosphorus and Potassium contents were estimated by Triple acid digestion method as suggested by Jackson (1973). The uptake of nutrients (N, P and K) was worked out by multiplying the per cent nutrient content with dry matter production and expressed in kg ha^{-1}. The yield and yield parameters were recorded at harvest.

Results and Discussion

The results of the field experiments conducted to study the nutrient removal by weeds and nutrient uptake by plants using pretilachlor as pre emergence herbicide in transplanted rice are presented below.

Nutrient removal by weeds (Table 1)

Higher doses of pretilachlor (T_5, T_4 and T_3) resulted in lower removal of N, P and K followed by butachlor (T_8) and anilofos (T_7). This was attributed to the lesser weed DMP aiding in the reduced quantum of weed N, P and K removal. This is in accordance with findings of Prakash *et al.* (1995). The N removal by weeds varied from 8.7 to 18.9 and from 6.74 to 25.9 kg ha^{-1} during *rabi* and summer, respectively at harvest stage. Pre-emergence application of pretilachlor at 3.0 kg ha^{-1} significantly reduced the N removal by weeds and was on par with pretilachlor at 1.5 kg ha^{-1} and 1.0 kg ha^{-1}, at all the stages during both the seasons. The similar trend was followed in P and K.

In unweeded control, weeds depleted as high as 18.9, 1.0 and 20.2 kg of N, P and K in *rabi* season and 25.9, 1.07 and 22.7 kg of N, P and K in summer season respectively, at harvest stage. The pattern of nutrient removal by weeds showed that wherever effective weed control was possible the nutrient loss due to weeds was minimum. The loss of nutrients to weeds between seasons varied with intensity of weeds and weed dry matter accumulation.

Nutrient uptake by the crop (Table 2)

Pretilachlor at 1.0 kg ha^{-1} recorded the highest uptake of nutrients as high as 122, 18.4 and 127 kg ha^{-1} of N, P and K in *rabi* and 124, 24.8 and 135 kg ha^{-1} of N, P and K in summer at harvest stage, followed by hand weeding twice. This clearly indicated that the above promising weed management practices had registered lower weed population, which in turn reduced the nutrient (N, P and K) depletion by weeds to a greater extent and there by greater availability of the nutrients to the crop.

Increased weed dry matter significantly reduced the DMP and N uptake by crop in plots treated with lower dose of pretilachlor (0.5 kg ha^{-1}).

Yield and yield attributes (Table 3)

The grain yield of rice was significantly influenced by the weed control treatments over unweeded control. The grain yield ranged from 3047 to 5737 and from 2773 to 5822 kg ha^{-1} during *rabi* and summer.

The highest grain yield of 5737 and 5822 kg ha^{-1} were obtained with pretilachlor at 1.0 kg ha^{-1} during *Rabi* and summer respectively. This was due to reduced nutrient removal by weeds and enhanced uptake of nutrients by crop coupled with yield favouring attributes as evidenced from tables 1 and 2. The most important factors deciding the grain yield *viz.*, panicles m^{-2} (no.), panicle length, grains $panicle^{-1}$ and 1000 grain weight were the highest in pretilachlor at 1.0 kg ha^{-1}. The hand weeding twice followed the treatment T_3 and this might be due to increased competition free environment with no crop toxicity and consequent growth and increase in yield parameters and yield.

The straw yield was significantly influenced by the weed management practices. The highest straw yield was obtained in the pretilachlor at 1.0 kg ha^{-1} (8606 and 8255 kg ha^{-1} during *rabi* and summer respectively) followed by hand weeding twice. This was due to lesser crop-weed competition which reflected in the higher uptake of nutrients and consequent higher straw yield.

Thus, application of pretilachlor at 1.0 kg ha^{-1} followed by one hand weeding at 45 DAT, recorded reduced weed dry weight and was more effective in bringing down the removal of N, P and K by weeds thereby enhancing their uptake by the crop. This could be ascribed to better weed control in this treatment, which reduced competition between crop and weeds and increased the grain yield of rice.

References

Balasubramaniyam, P. and Palaniappan, SP. (2001). Principles and practices of Agronomy. Agrobios Publishing Co. Pvt. Ltd., New Delhi, p.306-364.

Chinnamuthu, C.R. (1990). Selectivity and efficiency of anilofos and its degradation pattern under different methods of seed bed preparation and organic manuring in direct seeded flooded rice. Ph.D. Thesis. Tamil Nadu Agrl. Univ., Coimbatore.

Ghosh, A and Moorthy, B.T.S. (1998). Weed management deserves more attention in rainfed lowland cultivation. *Indian Fmg.*, **48(6):** 15-18.

Prakash, P., Nanjappa, H.V. and Ramachandrappa, B.K. (1995). Chemical weed control in direct seeded puddled rice *(Oryza sativa* L.). *Crop Res.,* **9(2):** 197-202.

Humphries, E.C. (1956). Mineral components and ash analysis. Modern methods of plant analysis. Springer Verlag, Berten-1. p.468-502.

Jackson, M.L. (1973). Soil chemical analysis. Prentice Hall of India Pvt. Ltd., New Delhi.