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UPTAKE OF N, P AND K BY FOUR HIGH YIELDING RICE VARIETIES UNDER DIFFERENT FERTILIZER LEVELS*

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A field experiment was conducted during the Kharif 1972 at Agricultural College Farm, Bapatla, to study the NPK uptake by the four high yielding rice varieties at different stages of crop growth, at different fertilizer levels. The results indicated that the uptake of N and P gradually increased upto panicle initiation with a further steep increase up to flowering and remained more or less constant at harvest. But in case of K followed the same trend up to flowering stage, dropped to a lower level by harvest time. P uptake at flowering had a significant contribution to grain yield

Information has been filing up regarding the role of major nutrients on the grain yield in rice, Mahapatra and Panda (1972) studied the uptake and utilisation of N, P and K by dwarf *Indica* rices and concluded that increasing levels of fertility, the nitrogen content in the plant increased. Muthuswamy *et al*. (1973) observed that the grain yield of rice was related to nitrogen uptake at panicle initiation stage and also grain and straw yields were correlated with the uptake of N and K at flowering stage. The uptake of nutrients differs from variety to variety and also with variation in agro-climatic and soil conditions. This investigation was undertaken with a view to study the pattern of uptake at different stages of crop growth by the high yielding rice varieties at different fertilizer levels.

MATERIAL AND METHODS

A field trial was conducted at the Agricultural College Farm, Bapatla, Andhra Pradesh during Kharif 1972 in a randomised block design with a factorial concept. Soil type is sandy clay loam, medium in available N and P and high in available K. Four high yielding rice varieties Cul. 1612, Cul. 1447-1-1, IET 1039 and IET 1991 were grown with five fertilizer levels.

	N	P_2O_5	K_2O
F_1	0	0	0
F_2	50	25	25
F_3	100	50	50
F_4	150	75	75
F_5	200	100	100

Phosphorus and potassium were applied basally in the form of superphosphate and muriate of potash

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espectively. Half of the nitrogen was applied basally, remaining was applied in two equal splits at maximum tillering and panicle initiation stages in the form of ammonium sulphate.

The plant samples were collected at four different stages of plant growth (1) at the time of maximum tillering stage (2) at the time of pancile initiation, (3) at the time of flowering and (4) at the time of harvest. Nitrogen was estimated by microkjeldhal method (A.O.A.C. 1960). phosphorus was estimated by the phospho-vanodomolybdate method of Koening Johnson (1942). Flame photometer (type No. 121 Systranix) was used for the estimation of potassium (A.O.A. C. 1960). The uptake of nutrients were calculated and given in Table 1. The results were subjected to statisifical scrutiny.

RESULTS AND DISCUSSION

The uptake of N and P gradually increased up to panicle initiation with a further steep increase up to flowering and remaining more or less at the same level at harvest in all the four varieties, indicating the need of these nutrients at tillering and preflowering stages. Thus it was apparent that rice crop needs nitrogen fertilization at tillering and panicle initaition stages. Similar trend was observed by Upadhyay and Datta (1973). The uptake of K while recording a gradual increase up to flowering, dropped to a lower level by harvest time, possibly due to a return of a part of its uptake at flowering back to the soil during the ripening period in all the four rice varieties. Such behaviour in crop plants, especially cereals, has been reported by Mahapatra and Panda (1972). Increased fertilizer application resulted in increased uptake of these three nutrients in all the four varieties. Cul. 1612 was superior to other varieties as regards N and P uptake up to flowering, with IET 1039 being the poorest especially in the later stages. As regards K uptake, Cul. 1447—1—1 was superior to others with IET 1039 being again the poorest. Multible regression equations were worked out for nutrient uptake as flowering stage on grain yield (Table 2) since no further uptake of NPK was observed by the rice plants after flowering.

The regression equations indicated that in varieties Cul. 1612, Cul. 1447-1-1 and IET 1991, more than 90 per cent of variation in yield was accounted for by the uptake of N, P and K at flowering stage, whereas in the case of IET 1039, N,P and K uptake accounted for only 66 per cent of yield variation and remaining 1/3rd of such variation being due to other factors.

The regression equations further indicated that in the case of Cul. 1612, IET 1991 and IET 1039 the phosphorus uptake at flowering contributed most towards grain yield, followed by to some extent by potassium uptake. The contribution of nitrogen uptake at flowering stage to grain yield was negative in the case of Cul. 1612, IET 1039 and negligible in the case of IET 1991. The foregoing trend broadly points to the fact that phosphorus accumulation at flowering stage is initial for grain yield, to a little extent

potassium seemed to have similar role, but nitrogen which is more in demand in the early stages of tillering and vegetative growth, does not seem to be so much involved in post flowering physiology ending up with grain yield.

Upadhyay and Datta (1973) as well as Muthuswamy *et al.* (1973) also opined that utilisation of nitrogen was higher prior to and at floral initiation stage. Patnaik and Gaikwad (1969) reported that P stored in Plant during active growth period was efficiently utilized for grain production. The above regression equations also revealed a significant contribution of P uptake at flowering time to grain yield of three out of the four varieties tried.

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Table 2 The regression equations were as follows :

Varieties	Y								R^2
Cul. 1612	Y = 1278	—	80.35 N	+	838 32 P	—	21.50 K		0.95
Cul 1447-1-1	Y = 74.62	+	91.21 N	—	841.20 P	+	53.12 K		0.91
IET. 1991	Y = 4408	—	18.12 N	+	186.11 P	+	11 23 K		0.66
IET. 103	Y = 1917	—	1.50 N	+	229.92 P	+	1.93 K		0.97

Table 1. NPK uptake at different stages of crop growth (kg/ha).

	Nitrogen				Phosphorus				Potassium			
Mean for varieties												
Cul. 1612	33.9	68.7	157.3	155.5	4.8	13.4	27.8	27.8	28.9	96.4	153.6	124 7
Cul. 1447-1-1	34.6	70.0	154 9	153.1	3.7	13.3	26.0	26.8	29.3	104.3	158 2	129.9
IET 1039	32.2	61.6	144 8	143.4	3.7	11.7	24.4	24.3	28 0	85.4	141 8	109 2
IET 1891	34.3	68.5	150.5	148.4	4.0	12.3	25.3	25.3	31.0	97.2	150.5	111·0
Mean for fertilizer treatments												
F_1	20.2	42.6	165 5	104.9	2.6	8.7	18.6	18.8	17.1	56.8	94.5	80.1
F_2	26.6	52.6	127.8	126.9	3.2	10.3	22 4	22.5	23.4	74.0	123.7	100.9
F_3	33.4	65.3	150.8	14.91	3.8	12.3	25.9	25 7	29.1	91.5	149.4	118.1
F_4	40.3	80.2	188 6	168 0	4 5	14.5	29.1	29.0	35 0	116.4	176.5	136.2
F_5	48.4	96.8	205.7	201.7	5 1	17.3	33.5	33.5	42.1	140.5	211.6	158.1
Varieties												
C. D. (P=0. 05)	1.37*	5.31*	7.45*	...	0.131*	0.937*	1.76*	...	N.S	10.13*	N.S	...
Treatments	1.54*	5.92*	8.32*	...	0.153*	1.04*	1.96*	...	2 33*	11.28*	13.88*	...
Var. X Treatments	NS	NS	NS		NS	NS	NS		NS	NS	NS	