Indian Journal of Agronomy 45 (3) : 575–579 (September 2000)

Split application of potassium on rice (*Oryza sativa*) in coastal zone of West Bengal

S. PAL, S.K. GHOSH[1] AND A.K. MUKHOPADHYAY[2]

Regional Research Station, Coastal Saline Zone, Bidhan Chandra Krishi Viswavidyalaya, Kakdwip, 24 Parganas (South) West Bengal 743 347

Received: December 1999

ABSTRACT

A field experiment was conducted to study the response of 2 high-yielding rice (*Oryza sativa* L.) varieties, 'IET 1444' ('Rasi') and 'IET 4094' ('Khitish') of different duration, to split application of potassium vis-a-vis customary full dose of 60 kg K_2O/ha as basal during the rainy season of 1997 and 1998 on silty clay soils. Split application of potassium was significantly superior, giving up to 14.47% higher yield to its application only as basal dose. An additional return up to Rs 501.00/ha was obtained from the different treatments consisting of different time of potassium application, the most economic treatment being the one, where half of the potassium was applied at transplanting and remaining half either at panicle-initiation stage (var. 'IET 1444') or in 2 equal splits at tillering and panicle-initiation stage (var. 'IET 4094') synchronizing with 1 split dose of nitrogen.

Key words : Rice, Split application, K, Economics

High-yielding varieties of rice need considerable quantity of potassium. The time of application of potassium fertilizer governs to a great extent its efficiency, because of differences in uptake pattern by different varieties depend on their duration in field. In order to maintain utmost economy of potassium fertilization and adequate supply of potassium during peak period of its demand by the crop, it is imperative that efforts be made to increase the efficiency of the applied potassium by reducing its loss through leaching and fixation (Shiroshita, 1963). Sekhon *et al.* (1973) observed 2 peaks of potassium absorption rate, one at maximum tillering and the other at flowering stage. Split application of potash is superior to its basal application (Singh *et al.*, 1976; Agarwal *et al.*, 1980; Ghosh *et al.*, 1995). Hence a field investigation was initiated to study the response of 2 rice varieties to split application of potassium over its conventional application as a single basal dose.

Present address : [1,2]Department of Agricultural Chemistry and Soil Science, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal 741 252

MATERIALS AND METHODS

The field experiment was conducted at the Regional Research Station (Coastal Saline Zone) at Kakdwip (22 °40' N 89°E), in 24-Parganas (South) of West Bengal. The effect of split application of the recommended dose of K (60 kg K_2O/ha) as compared with the conventional basal application as a single dose at transplanting on 2 high-yielding rice varieties, 'IET 1444' of early duration (105 days) and 'IET 4094' of medium duration (120 days), grown as rainy-season *(kharif)* rice during 1997 and 1998 were studied. The experiment was conducted in randomized block design with net plot size of 5 m × 3 m for each of the 5 treatment combinations of potassium (Table 1) and 4 replications. Recommended dose of nitrogen @ 120 kg/h a and phosphorus @ 60 kg P_2O_5/ha in the form of urea and single superphosphate respectively were applied uniformly to each plots in both the years. Half the dose of N and full dose of P_2O_5 were applied as basal at the time of transplanting (Table 1). Seedlings of 25 days age were transplanted in row-to-row spacing of 20 cm and hill-to hill spacing of 10 cm. The remaining N was top-dressed in 2 equal split doses, at the time of tillering and panicle-initiation stage. Potassium was applied in the form of muriate of potash. The soil was silty clay, having pH 7.2, organic carbon 0.56%, cation-exchange capacity 22.0 meq/100 g and electrical conductivity 3.0 mmhos/cm at 25°C. The crop was adequately protected from insects, pests, diseases and weed infestations. The grain yield, test weight and 2 biological parameters were recorded for each treatment and separately for each replications and the data were statistically analysed. The physical and chemical properties of soil of the experimental site were analysed following Jackson (1967).

RESULTS AND DISCUSSION

The split application of potassium (K_2, K_3 and K_4 treatments) resulted higher grain yield over the basal application (K_1 treatment) at the same dose of 60 kg K_2O/ha (Table 2). However, there was a distinct variations among the 3 split treatments of K as well as between the 2 varieties tested. While application of 50% potassium as basal and 50% as top dressing at panicle-initiation stage (K_3 treatment) recorded the highest grain yield with 'LET 1444' and for 'IET 4094 it was observed in the K_4 treatment, i.e. 50% as basal and the remaining 50% in 2 equal splits, i.e. 25% at

Table 1. Time and dose of potassium fertilization

Treatment	Potassium (K_2O kg/ha)	Time of application		
		Basal	Tillering stage	Panicle-initiation stage
K_0	0	0	0	0
K_1	60	60	0	0
K_2	60	30	30	0
K_3	60	30	30	0
K_4	60	30	15	15

tillering and 25% at panicle-initiation stage.

The results indicate that in rice, under transplanted condition, high requirement of potassium at early stage is met by basal application. Requirement of potassium at tillering and panicle-initiation stage was best satisfied by the application of 50% of potassium was top-dressed at panicle-initiation stage. Substantially higher economic returns were obtained owing to split application of potassium as compared to the basal one (Table 2). Vijay Kumar *et al.* (1973) also noted higher net returns in K split over K basal treatment. Despite a marginal increase in the pooled average values, number of effective tillers/hill with differences in the number of splits of K fertilization in both the varieties, no statistical significance could be detected (Table 4). So also the results of pooled average length of panicle did not show statistically significant variation due to variation in split doses in both the rice varieties. However, significant variation in

Table 3. Effect of K fertilization on pooled average grain yield (kg/ha) of 2 rice varieties

Variety	Without K	With K
'IET 1444'	3,585	3,830
'IET 4094'	3,702	3,947

Table 2. Effect of split application of potassium on grain yield response of K fertilization and additional economic return on rice varieties

Treatment	Grain yield (q/ha)			Increase in yield (%)	Response of K fertilization	Additional economic return (Rs/ha)
	1997	1998	Pooled			
'IET 1444'						
K_0	33.91	34.58	34.25			
K_0^1	35.46	36.24	35.85	4.67	2.66	154.00
K_2^1	37.25	38.24	37.74	10.18	5.81	336.00
				(5.27)	(3.15)	(182.00)
K_3	39.58	42.50	41.04	19.82	11.31	655.00
				(14.47)	(8.65)	(501.00)
K_4	39.16	41.23	40.19	17.34	9.90	573.00
				(12.10)	(7.24)	(419.00)
CD (P = 0.05)	1.50	1.60	1.58			
'IET 4094'						
K_0	37.24	36.80	37.02			
K_0^1	38.00	38.25	38.12	2.97	1.83	147.00
K_2^1	38.57	38.95	38.76	4.70	2.90	234.00
				(1.68)	(1.07)	(84.00)
K_3	39.74	39.60	39.67	7.15	4.41	356.00
				(4.06)	(2.58)	(209.00)
K_4	40.09	42.56	41.33	11.64	7.18	580.00
				(8.42)	(5.35)	(433.00)
CD (P = 0.05)	0.52	0.70	0.62			

Details of treatments are given in Table 1

Values in parentheses represent corresponding increase over full K application as basal (K_1)

Table 4. Effect of split application of potassium on 2 yield-contributing characters of rice plant

Treatment	Average number of effective tillers/hill			Average length of panicle (cm)		
	1997	1998	Pooled	1997	1998	Pooled
'IET 1444'						
K_0	8.60	10.20	9.40	22.26	22.60	22.43
K_1	8.70	10.40	9.55	23.56	23.80	23.68
K_2	8.70	10.40	9.55	24.10	24.25	24.17
K_3	9.00	10.70	9.85	24.33	24.55	24.44
K_4	8.80	10.40	9.60	23.86	24.00	23.93
CD (P=0.05)	NS	NS	NS	NS	NS	NS
'IET 4049'						
K_0	7.86	7.50	7.68	23.23	23.48	23.35
K_1	8.20	7.80	8.00	23.63	23.78	23.70
K_2	8.40	8.10	8.25	24.10	24.25	24.17
K_3	8.86	8.50	8.68	24.70	24.75	24.72
K_4	9.20	8.80	9.00	25.20	25.80	25.50
CD (P = 0.05)	NS	NS	NS	NS	NS	NS

Details of treatments are given in Table 1.
NS, Not significant

Table 5. Effect of split application of potassium on test weight [1,000-grain weight (g)] of 2 rice varieties

Treatment	'IET 1444'				IET 4094'			
	1997	1998	Pooled	Increase (%)	1997	1998	Pooled	Increase (%)
K_0	18.86	19.48	19.17		20.04	20.21	20.12	
K_1	19.44	20.10	19.77	3.13	20.33	20.61	20.47	1.24
K_2	20.51	20.68	20.59	7.40 (4.14)	20.78	20.95	20.86	3.67 (2.40)
K_3	21.29	21.16	21.22	10.69 (5.33)	20.82	21.20	21.01	4.42 (3.14)
K_4	20.54	19.92	20.23	5.53 (2.32)	21.01	22.00	21.50	6.85 (5.54)
CD (P = 0.05)	0.46	0.58	0.54		0.26	0.38	0.33	

Details of treatments are given in Table 1.

Table 6. Effect of split application of potassium on the uptake of potassium (kg/ha) by 2 rice varieties

Treatment	'IET 1444'				'IET 4094'			
	1997	1998	Pooled	Increase (%)	1997	1998	Pooled	Increase (%)
K_0	17.8	18.4	18.1		19.7	14.5	19.6	
K_1	20.5	20.7	20.6	13.81	23.7	23.9	23.8	21.42
K_2	21.1	21.7	21.4	18.23 (3.88)	25.0	25.4	25.2	28.57 (5.88)
K_3	22.7	24.3	23.5	29.83 (14.07)	25.9	25.7	25.8	31.63 (8.40)
K_4	22.1	23.5	22.8	25.96 (10.67)	26.1	27.8	26.9	37.24 (13.02)
CD (P=0.05)	0.75	0.85	0.8		1.0	1.4	1.2	

Details of treatments are given in Table 1

Values in parentheses represent corresponding increase over full K application as basal (K_1)

test weight, was noted in both varieties due to variation in split application (Table 5). Significant increase due to K fertilization over no-K treatment reflect K responsiveness of the soil. Superiority of split applications in both the varieties was clearly demonstrated. Similar observation was also recorded by Das *et al.* (1970). Among the 3 splits of K application, K_4 treatment was found more effective for 'IET 4094'. However, in the early variety ('IET 1444') the K_3 treatment proved to be more effective a indicating some intervarietal variations (Table 5). Signi- ficant differences were also recorded in K uptake by rice grain due to splitting of K levels over basal and these follow the same trend as in the case of rice yield (Table 6).

Thus split application of K may be recommended for the coastal soils of West Bengal.

REFERENCES

Agarwal, H.S., Gupta, N.K. and Pal, B.R. 1980. Suitable time and method of potash application in paddy. *Indian Potash Journal* **3** : 4–8.

Das, K. C., Misra, A. and Pandey, J. 1970. Effect of split application of potash on rice. *Fertiliser News* **15** (8) : 49–51.

Ghosh, S.K., Pal, S. and Mukhopadhyay, A.K. 1995. Split application of potassium to maximise its efficiency on yield of high yielding rice. *Indian Agriculturist* **39** (4) : 259–264.

Jackson, M.L. 1967. *Soil Chemical Analysis.* Prentice-hall of India Private Limited, New Delhi.

Sekhon, G.S. and Kansal, B.D. 1973. Influence of potassium on dry matter yield and cationic balance in wheat. *Agrochimica* **18** (½) : 94–101.1.

Shiroshita, T. 1963. *Theory and Practice of Growing Rice,* pp. 183–227. Fiji Publication Company, Tokyo.

Singh, U.S., Shukla, D.N. and Singh, R.P. 1976. Effect of technique and levels of potassiun application on the yield of high yielding rice (var. CR 44–34). *Indian Potash Journal* **1** (2) : 30–32.

Vijaya Kumar, G., Sankara Reddi, G.H. and Yogeswara Rao, Y. 1973. Response of Jaya rice to potassium. *Potash Newsletter* **8** (3).