

Potassium fertilization in rice (*Oryza sativa*) on vertisols of Godavari flood plains

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Received: December 1996

ABSTRACT

A 2-year field investigation was carried out at wetland farm of Maruteru during the winter (*rabi*) 1993–95 on the great Godavari plains. Rice (*Oryza sativa* L.) 'IR 64' responded to 60 kg K₂O/ha. Application of K₂O at 40 kg/ha did not influence the yield and yield attributes when applied either as basal or at active tillering or in 2 equal splits (basal and panicle-initiation stages). However, 40 kg K₂O/ha applied at panicle-initiation stage remarkably enhanced the yield over no K. This treatment was on a par with 60 kg K₂O/ha, irrespective of method of application. In general, K fertilization showed beneficial effect on grain filling and harvest index and reduced the duration of crop.

Key words: Potassium, Rice, Vertisols, Flood plains

Since no systematic attempt has been made so far with regard to potassium fertilization of rice on Godavari plains, the present investigation was planned to gather information in response of winter (*rabi*) rice to potassium in relation to its time of application.

MATERIALS AND METHODS

The field experiment was conducted at Research Farm, Maruteru (16.38°N, 81.44°E and above mean sea-level) during winter (*rabi*) season 1993–95 on a clay-loam soil of Godavari delta. Soil was ill-drained, argillous nature with pH 6.9, CEC 45 meq/100 g soil,

organic carbon 0.62% and 340, 13.8, 315.4 kg/ha of available N, P and K, respectively. The trial was laid out in randomized block design with 4 replications. The treatments comprised 3 K levels (0, 40 and 60 kg K₂O/ha) and 4 methods of application [entire P as basal and N was applied in 3 equal splits, i.e., basal tillering and panicle initiation (PI) and potassium was applied as per treatments. A recommended dose of 120 kg N and 60 kg P₂O₅/ha was applied as urea and single superphosphate. Potassium was supplied through muriate of potash. Rice seedlings ('IR 64') of 25 days were transplanted in 5 m x 3

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m plots at 15 cm x 15 cm spacing during second week of December. Water was ponded at 5 cm depth continuously till the grain ripening.

RESULTS AND DISCUSSION

Potassium dressing showed a greater influence on some physiological parameters of rice (Table 1). Application of K at higher rates advanced the crop maturity by 3 days. It is a known fact that excess N delays the crop ma-

turity. Similarly, deletion of K caused delay in flowering. Early ripening under adequate K fertilization may be ascribed that K exerts a balancing effect on N metabolism and alleviates the adverse affects of excess N such as delay in maturity (De Datta, 1981).

The phenomena of grain-filling was distinctly influenced by K fertilization. The crop without applied K recorded increased sterile and partially filled spikelets/panicle. The available information indicates that K-defi-

Table 1. Physiological parameters of rice as influenced by levels and method of K application (mean data of 2 years)

Treatment	Grain filling/panicle			Harvest index	Phytomass at flowering (kg/m ²)	K-use efficiency (kg grain/kg K)	Field days to crop maturity
	Fully filled	Partially filled	Sterile				
Control (No K)	76	14	16	43	4.80		96
<i>40 kg K₂O/ha</i>							
Basal	81	8	12	44	5.12	6.0	96
Active tillering (15 DT)	83	6	9	45	5.43	13.2	96
Panicle initiation (PI)	86	5	8	45	5.94	17.0	95
½ as basal + ½ at PI stage	82	9	11	44	5.23	3.8	96
<i>60 kg K₂O/ha</i>							
Basal	88	6	9	46	5.81	12.3	94
Active tillering	87	7	7	45	5.97	13.3	93
Panicle initiation	89	4	6	46	5.51	13.6	93
½ as basal + ½ at PI stage	86	3	8	45	5.62	14.0	93
CD (P = 0.05)	8.3	4.0	5.1	1.5	0.71		

Table 2. Grain yield and its attributes as influenced by K levels and method of application (mean data of 2 years)

Treatments	Grain yield (kg/ha)		Mean yield (q/ha)	Relative yield	Effective tillers/hill	Panicle weight (g)	Value: cdst ratio
	1993-94	1994-95					
Control (No K)	50.2	45.5	47.6	100	8.6	1.3	
<i>40 kg K₂O/ha</i>							
Basal	53.0	47.1	50.0	105	8.4	1.5	3.0
Active tillering (15 DT)	56.8	49.2	52.9	111	9.2	1.6	6.62
Panicle initiation (PI)	58.7	50.0	54.4	114	10.5	1.6	8.50
½ as basal + ½ at PI stage	51.1	47.0	49.1	103	9.4	1.4	1.87
<i>60 kg K₂O/ha</i>							
Basal	58.9	51.0	55.0	115	9.0	1.7	9.25
Active tillering	59.0	52.1	55.6	117	9.1	1.8	10.00
Panicle initiation	59.4	52.3	55.8	117	10.3	1.6	10.25
½ as basal + ½ at PI stage	59.5	52.5	56.0	118	9.5	1.5	10.50
CD (P = 0.05)	8.4	4.9	6.7		0.71	0.3	

cient plants show poor germination of pollen in the floret which leads to high spikelets sterility (Von Uexhull, 1978). Addition of 60 kg K_2O /ha enhanced the filled spikelets by decreasing the sterility (Table 1). The improved grain filling under K application was ascribed to increasing photosynthetic activity, as K stimulates some vital bio-chemical process like oxidative phosphorylation and photophosphorylation (Mengal, 1976).

Higher K dressing greatly improved the phytomass production but influenced the harvest index to a little extent which could be ascribed to more carbon assimilation and effective translocation of assimilates to reproductive parts (Mengal, 1971).

Rice yield and its attributing characters responded favourably to higher dose (60 kg K_2O /ha) of K but not at lower dose (40 kg/ha) except when the entire dose was applied at panicle-initiation stage (Table 2). Similarly, Raju *et al.* (1986) also did not find any response to 40 kg K_2O /ha applied as basal. No response of rice to lower dose of K might be due to the fact that small quantities of fertilizer is sufficient to satisfy the sorption sites of clay surface but not able to enrich the soil solution which really contribute to the crop needs (Grimme, 1976). Interestingly, the same dose when applied at panicle initiation, the

yield was significantly enhanced by 12.4% over no K. Extensive ramification of roots throughout soil volume at panicle initiation might have helped in the interception of K ions before fixation by soil micelles.

Irrespective of mode of application, potassium at 60 kg/ha greatly improved the filled grains/panicle and effective tillers to a little extent and resulted in improvement of grain yield significantly.

Thus in heavy soils higher doses are needed when applied as basal or as split to maintain available K within the reach of plants. When small quantities are to be applied it is better to apply at panicle-initiation stage for efficient utilization.

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