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Yield and Quality of Rice as Affected by Cultivars and Time of Potassium Application

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ABSTRACT

An experiment involving different times of potassium application was carried out using different rice cultivars. The significantly higher grain yield and harvest index were recorded with Swarna. Grain quality parameters such as, head rice recovery and protein content were significantly superior to Samba Mahsuri compared to that of other cultivars. Application of potassium in three splits (50% as basal + 25% at active tillering + 25% at panicle initiation) significantly increased grain yield, straw yield and also significant improvement in head rice recovery and protein content was noticed in the treatment receiving potassium in three splits over entire as basal application.

Key words : Cultivars, Potassium, Protein content, Rice, Time, Quality, Yield.

Potassium use in crop production is necessary because, its application may improve water use efficacy, crop quality, tolerance to salinity, drought, pest and diseases and helps to maintain crop yields. Potassium is involved in the formation of proteins through the polymerization of amino acids and other primary units in plants and coupling of certain amino acids in the formation of peptide (Balram Singh *et al.,* 1977). Agronomists should also tailor the management practices to realize the genetic potential for quality of the cultivars in the field. Normally farmers apply entire potassium as basal but recent reports have supported rice response to split application of potassium. Information, however, on whether this response to potassium vary across the rice cultivars or not is lacking. Keeping this in view, the present trial was carried out to study the influence of rice cultivars and time of potassium application on yield and quality of rice.

MATERIAL AND METHODS

A field experiment was conducted during *kharif* 2005 at the Agricultural College Farm, Bapatla (A.P). The soil was sandy clay loam (sand 66%, silt 5% and clay 29%) with pH 8.47, organic carbon 0.57% and 234, 28 and 426 kg ha^{-1} available N, P_2O_5 and K_2O, respectively. Thirty three days old seedlings were transplanted with a spacing of 20 cm x 15 cm. The experiment was laid out in randomized block design with factorial concept with three replications. The experiment consisted of five rice cultivars (Swarnamukhi (NLR-145), Swarna (MTU-7029), Deepti (MTU-4870), Samba Mahsuri (BPT-5204) and Bapatla Sannalu (BPT-1768)) and three times of potassium application (100% as basal, 75% as basal +25% at panicle initiation and 50% as basal + 25% at active tillering + 25% at panicle initiation). The recommended doses of 120 kg N, 60 kg P_2O_5 and 40 kg K_2O ha^{-1} was applied. Nitrogen was applied in three split doses of 50% as basal and 25% each at active tillering and panicle initiation stages and entire P_2O_5 was applied basally to all the treatments. However, potassium was applied as per the treatments.

The grain samples, which were properly dried and processed, were taken for the assessment of quality of the rice. The quality parameters like head rice recovery (Bandyopadhyay and Roy, 1992), volume expansion ratio (Murthy, 1965) were analysed and protein content was determined by the method suggested by AOAC (1980).

RESULTS AND DISCUSSION

Grain yield and straw yield of rice were significantly influenced by both cultivars and time of potassium application. However, the interaction between cultivars and time of potassium application was non significant (Table-1). Among the cultivars, Swarna exhibited over all superiority to other cultivars. The highest grain yield (4676 kg ha^{-1}) and harvest index (44.0%) were observed with Swarna followed by Deepti and Swarnamukhi respectively (Table 1). The highest grain yield in case of Swarna might be due to its desirable traits like wider adoptability, high yielding ability coupled with yield stability at nitrogen input and high photosynthetic efficiency (Rao *et al.,* 1982). The lowest grain yield

Table 1. Grain yield (kg ha^{-1}), Straw yield (kg ha^{-1}) and harvest index of rice as influenced by cultivars and time of potassium application.

Treatments	Grain yield (kg ha $^{-1}$)	Straw yield (kg ha $^{-1}$)	Harvest index (%)
Cultivars			
C_1 - Swarnamukhi	4342	5672	43.4
C_2 - Swarna	4676	5970	44.0
C_3 - Deepti	4513	5991	43.0
C_4 - Samba Mahsuri	3548	4885	42.2
C_5 - Bapatla Sannalu	4077	5999	40.5
SEm±	81	79	0.4
CD(p=0.05)	234	229	1.2
Time of potassium application			
T_1-100% as B	3912	5429	41.9
T_2 - 75% as.B + 25% at PI	4160	5747	42.0
T_3 - 50% as B + 25% at AT + 25% at PI	4622	5910	43.9
SEm±	62	62	0.3
CD (p=0.05)	181	178	0.9
Interaction			
Cultivars x Time of potassium application	NS	NS	NS

B= Basal AT= Active Tillering PI= Panicle Initiation NS= Non Significant

(3545 kg ha^{-1}) with Samba Mahsuri might be due to its lower number of yield attributes. Similar results with different cultivars were also reported by Priyadarsini and Prasad (2003).

The highest straw yield (5999 kg ha^{-1}) with Bapatla Sannalu might be due to longer vegetative stage than other cultivars. The highest harvest index was recorded with Swarna followed by Swarnamukhi, Deepti and Samba Mahsuri. The lowest harvest index (40.5%) noticed with Bapatla Sannalu is attributed to the fact that harvest index is always inversely correlated with plant height and growth duration (Yoshida, 1981)

Head rice recovery and protein content were significantly influenced by rice cultivars and time of potassium application. However, the interaction between the two factors were non significant (Table-2). Head rice recovery and protein content were significantly superior with the cultivar Samba Mahsuri. These results are in close agreement with Priyadarsini and Prasad (2003).

Application of potassium at different times resulted in significantly higher yields. The highest grain yield (4622 kg ha^{-1}), straw yield (5910 kg ha^{-1}) and harvest index (43.9%) was recorded with application of potassium in three splits (50% as basal + 25% at AT + 25% at PI). The increase in grain yield was a reflection of increase in yield attributing characters. The beneficial effect of K^+ is to promote phloem loading and transport and thus provides the physiological sink with assimilate (Mengel and Kirkby, 1980). Increase in grain yield with split application was also reported by Meena *et al.* (2003).

Head rice recovery and protein content significantly increased with the split application of potassium over entire application as basal. Maximum head rice recovery (63.5%) was obtained with application of potassium in three splits, where as the lowest value was obtained with K applied entirely as basal. Application of K helps in its continuous

Table 2: Physical and Chemical quality characters of rice as influenced by cultivars and time of potassium application

Treatments	Head rice recovery	Volume expansion ratio	Protein content
Cultivars			
C_1 - Swarnamulkhi	58.8	3.33	6.73
C_2 - Swarna	60.9	3.45	6.56
C_3 - Deepti	60.0	3.63	6.10
C_4 - Samba Mahsuri	65.5	3.67	7.16
C_5 - Bapatla Sannalu	62.6	3.50	6.31
SEm±	0.9	0.05	0.04
CD(p=0.05)	2.6	0.15	0.12
Time of potassium application			
T_1-100% as B	59.8	3.42	6.41
T_2 - 75% as.B + 25% at PI	61.0	3.50	6.49
T_3 - 50% as B + 25% at AT + 25% at PI	63.5	3.62	6.82
SEm±	0.7	0.04	0.03
CD (p=0.05)	2.0	NS	0.09
Interaction			
Cultivars x Time of potassium application	NS		NS

B= Basal AT= Active Tillering PI= Panicle Initiation NS= Non Significant

availability, which results in increased filled grains and reduction of immature and chaffy grains in the panicle. Immature and chaffy grains break easily during milling ultimately leading to lower head rice recovery (Pillaiyar, 1988). The treatment receiving potassium in three splits recorded the maximum protein content (6.82%). These results are in agreement with Swarna Jagadeesh Reddy and Ravi Kumar (2004). However, split application did not show any significant increase in volume expansion ratio over basal application.

From the present study, it is concluded that the highest yield was recorded with the cultivar, Swarna while that quality parameters of Samba Mahsuri manifested supremacy over other cultivars. Application of potassium in three splits (50% as basal + 25% at AT + 25% at PI) resulted in increased yield and quality of rice.

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