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Response of potassium in fodder sorghum (*Sorghum bicolor*)

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Sorghum (Sorghum bicolor L. Munch) is the king of millets and third important crop in the country after rice and wheat. Sorghum is not only staple food but it is also required to fulfil fodder requirement in order to make animal husbandry sector more viable. There is a great need to maintain regular and balanced supply of more nutritious feed and fodder in the state. However, the productivity of this crop is very low mainly because of imbalanced use of fertilizers. Potassium is important for growth and yield of crops as the quantity of K absorbed by roots is second to that of nitrogen Potassium is required for improving the yield because of its role in photosynthesis water use efficiency and plant tolerance to diseases, drought and cold as well for making the balance between protein and carbohydrate. Inadequate information is available on the effect of K on sorghum in Agra condition. This study was therefore, conducted to evaluat the effect of K on yield nutrients uptake and quality of sorghum.

A field experiment was conducted during kharif season of 2013 at Panwari village of Agra (U.P.). The experimental site falls under South-west semi-arid zone and characterized by semi-arid climate with extreme temperature during summer (45 to 48° C) and very low temperature during winter (as low as 2°C). The experimental soil was sandy loam in texture having pH 7.9, organic carbon 3.1 g kg^{-1}, available N 156 kg ha^{-1}, available P 9.0 kg ha^{-1} and available K 106 kg ha^{-1}. The experiment was laid out in randomized block design with four replications. The treatments consisted of six rates of K (0, 20, 40, 60, 80 and 100 kg K_2O ha^{-1}). The sorghum crop was sown in first week of July 2013. A basal dose of 120 kg N and 60 kg P_2O_5 ha^{-1} was applied through urea and single super phoshate, respectively. Appropriate management practices were adopted to raise the crop. Crop was harvested after 90 days of sowing. Plant samples were digested in di-acid mixture of HNO_3: $HClO_4$ (10:4) and sulphur content was determined turbiditimetrically (Chesnin and Yien, 1951). Phosphorus and K in di-acid digest were determined by vanadomolybdate yellow colour method (Jackson, 1973) and flame photometer, respectively. Nitrogen content was estimated by modified Kjeldahl method and protein content was calculated by multiplying with a factor of 6.25. The uptake of nutrients was obtained as product of their concentrations and yield..

Table 1: Effect of potassium levels on yield, K uptake of efficiency indices in sorghum

Potassium (kg ha^{-1})	Yield (q ha^{-1})		Protein content (%)	N uptake (kg ha^{-1})	P uptake (kg ha^{-1})	K uptake (kg ha^{-1})	Available K (kg ha^{-1})
	Green foliage	Dry matter					
0	290.0	72.5	8.6	108.0	16.7	129.8	100
20	319.5	80.3	8.7	122.0	18.0	148.1	107
40	346.4	88.8	8.8	136.7	18.8	170.4	110
60	368.8	94.7	9.0	145.0	20.0	186.5	116
80	372.0	95.4	9.2	149.0	20.6	191.6	122
100	347.6	89.2	9.2	138.2	18.2	181.0	130
SEm $\pm$	2.14	0.87	0.06	1.85	0.33	2.9	1.05
CD (P=0.05)	4.70	1.96	0.14	4.00	0.71	6.2	2.22

Green foliage and dry matter yields of sorghum increased significantly with potassium application over control. The mean yield of green foliage and dry matter increased by 27.1 and 30.6 % over control owing to addition of 60 kg K_2O ha^{-1}, respectively. As K is essential for plant development, the favourable effect of high dose of K on growth was mainly responsible for higher yields. Singh *et al.* (2015) and Singh *et al.* (2016) also reported similar results.

Increasing levels of K significantly increased the protein content in sorghum plants from 8.6 % at control to 9.2 % at 80 kg K_2O ha^{-1}. The increase in protein content with K levels may be attributed to role of K in nitrogen metabolism. Similar results were reported by Kumar *et al.* (20145). The nitrogen uptake by sorghum crop increased significantly over control due to potassium application and maximum value was recorded at 80 kg K_2O ha^{-1} (Table 1). However, both levels of K (60 and 80 kg K_2O ha^{-1}) were statistically at par with respect to N uptake by sorghum crop. This increase in N uptake by sorghum crop may be ascribed to higher dry matter production due to K application. Singh (2017) observed the same trend of results in wheat. The uptake of P by sorghum crop increased significantly with K addition over control. The maximum value of P uptake was recorded with 80 kg K_2O ha^{-1} followed by a reduction at 100 kg K^2O ha^{-1}. Similar results were reported by Singh *et al.* (20150. The K uptake by sorghum crop increased from 129.8 to 191.6 kg ha^{-1} as the dose of K was increased from 0 to 80 kg K_2O ha^{-1}. This increase in K uptake may be ascribed to higher dry matter yield and K content in plants Singh *et al.* (2016) also reported similar results.The data (Table 1) revealed that decline in available K status in post harvest soil was noted in control or lower dose of K. Available K status increased significantly with increasing levels of K and maximum value was recorded with 100 kg K_2O ha^{-1}. Similar results were reported by Yadav *et al.* (2012)

From the results, it can be concluded that 60 kg K_2O ha^{-1} is optimum dose of potassium to maintain soil K fertility and harvest optimum yield of sorghum crop.

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