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Genotype and Potassium fertilizer interaction in Rabi Sorghum

Key words : Potassium fertilizer, *Rabi* sorghum

Sorghum crop is an important component of rainfed production system in the states of Maharashtra, Karnataka and Andhra Pradesh. In India Sorghum occupies about 10 mha of cultivable land every year during the *Kharif* and *Rabi* seasons. Sorghum's relatively better root activity, vis-à-vis Maize even at the end of the season, helps in supply of high value crop residues in addition to the grain, fulfilling the dual needs of a dry land farmer thus and infusing stability parameter into a farming system.

Rainfed production system in India is driven by the distribution of monsoon rainfall by the low-pressure areas on the land and the sea between June and October months during *Kharif* and the residual soil moisture retained by the soils (Vertisols) between October and February months during the *Rabi* season every year. Kumar *et al.* (2003), discussing the strengths of sorghum hybrid technology developed through the All India Coordinated Sorghum Improvement project (AICSIP), indicated that the interaction of ideal genotype and a conducive environment resulted in a quantum jump in productivity levels. With intermittent rains during *Kharif,* the improved genotype helped to harness the natural and applied resources more efficiently, while during *Rabi,* soil environmental management assumed greater importance so as to exploit the full potential of a high yielding genotype.

The seasonal weather induced variability in available soil moisture limits the potential of a given high yielding sorghum genotype, while nutrient management including nitrogen (N), phosphorus (P_2o_5) and Potasium (K) assumes primary role which in turn improve the soil moisture use efficiency. Baskaran *et al.* (1995) found that sorghum cultivar CO 25 required 2.9 kg N, 0.9 kg P_2o_5 and 4.2 kg K to produce 0.1 ton of grain, thus high- lighting the high quantum role of K among the three major essential nutrients. Umar *et al. (*1993) in their green house experiments with sorghum cultivar CSH 5 identified that the adverse soil moisture stress effects on dry matter accumulation and yield could be overcome by application of potassium. Balsubramanian *et al.* (1986) justified the additional advantage of potash treatment in reducing the incidence of shootfly (*Atherigona soccata*) dead hearts and the stem borer (*Chilo partellus*) stem tunneling, while Mukherjee (1976) indicated that applied Potash decreases fungal disease infection in sorghum by developing leaves with thickened cuticle and strong epidermal walls that prevent entry of germinating spores from the leaf surface. Thus potassium as an essential nutrient has multiple roles to play in the growth and development of sorghum plant.

Genotype and nutrient interactions greatly influence the outputs from a unit area. Shinde *et al.* (1992) while comparing the nutrient uptake pattern by the hybrids and their parents on one hand and improved versus local varieties on the other, found that the rate of change in K content at growth stage GS 2 and GS 3 was faster in hybrids and their parents as well as the improved varieties. Solankey *et al.* (1988) found that sorghum variety Vidisha 60-1 had the best capacity for partitioning the three major nutrients from the foliage to seed, while the hybrid (CSH 6) was the most efficient in utilizing these nutrients under rainfed field conditions. Ogunlela and Yusuf (1988) found significant sorghum genotype by potassium nutrient interactions, where in the variety L 187 produced highest grain yield with 25 kg Kha^{-1}, while FFBL variety responded up to 75 kg Kha^{-1}, thus indicating a differential response to potassium application.

The present study conducted during *Rabi* 2001-02 and 2002-03 seasons aimed to quantify the genotype by potassium nutrient interaction in terms of their productivity.

The trial was conducted during *Rabi* season at Agricultural Research Station, Tandur in Andhra Pradesh for two years during 2001-02 and 2002-03 *Rabi*. The design of the experiment was split plot design with potassium fertilizer treatments as main plots and genotypes as sub-plot treatment. The treatments were replicated thrice.

Main plot treatments: (A): Potassium fertilizer rates

i. 0 kg ha^{-1}
ii. 20 kg ha^{-1}
iii. 40 kg ha^{-1}
iv. 60 kg ha^{-1}

Sub plot treatments: (B) Sorghum Rabi genotypes

i. CSH 15R
ii. CSV 216R
iii. M35-1

Average Rainfall pattern during the crop growth period during the years 2001-02 and 2002-2003.

Average Rainfall pattern during the crop growth period during the years 2000-01 &2001-2002

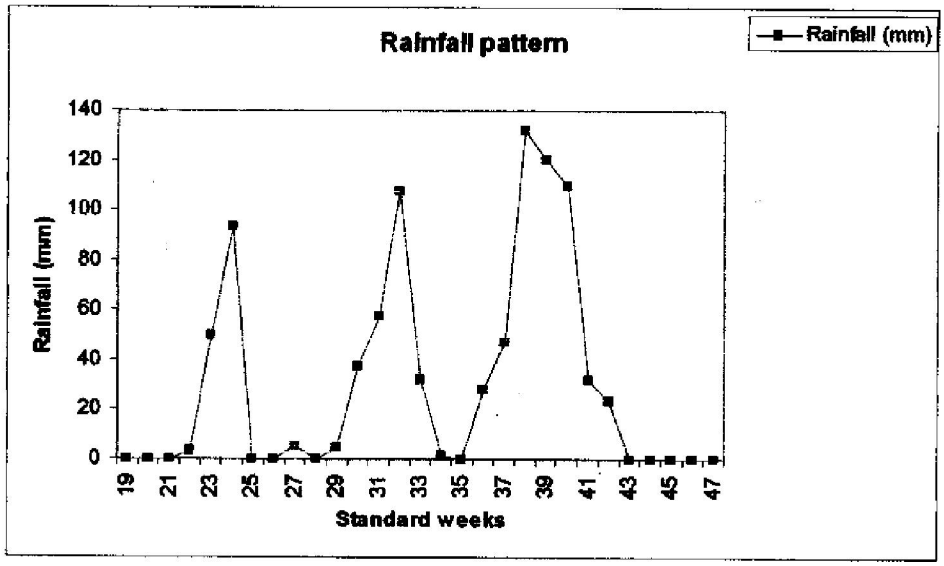

Table 1. Pooled Sorghum yield and response to application of potassium fertilizer

Rate of potassium fertilizer application	Grain yield (kg ha^{-1})	Response kg kg^{-1}	Fodder yield (kg ha^{-1})	Response kg kg^{-1}
0 kg ha^{-1}	2740	-	4530	-
20 kg ha^{-1}	2950	10.5	4660	6.5
40 kg ha^{-1}	3250	15.0	4990	16.5
60 kg ha^{-1}	3990	12.0	5090	5.0
SEm+/-	99.79	-	98.76	-
C D +/- 0.05	289	-	286	-

Observations during both the years on sorghum in terms of grain and fodder yields were recorded at harvest from a net plot area of 10.8 sq.m. Pooled analysis was presented for the study conducted.

There was significant effect of potassium application in terms of both grain and fodder yields (Table 1). Sorghum grain yield increased with increased application of potassium fertilizer up to 60 kg ha^{-1}. Response to potassium application in grain yield was to an extent of 15 kg kg-1 of K fertilizer, while the fodder yield was the highest with 16.5 kg kg^{-1} was obtained with 60 kg ha^{-1} of K fertilizer rate (Table 1). This indicates that potassium plays an important nutrient re-distribution role in *Rabi* sorghum, induced by the end of the season limited moisture conditions (Fig 1) After 43rd standard week i.e., 28th of October, the crop thrives entirely on the stored soil moisture which in turn is a function of the soil depth. Genotypes with high re-distribution efficiency can help to produce higher grain proportion.

Table 2. Potassium Vs genotype interaction effect on Sorghum grain yield (kg ha^{-1})

Factor	Potassium level of application			
	0 kg ha^{-1}	20 kg ha^{-1}	40 kg ha^{-1}	60 kg ha^{-1}
CSH 15R	2770	2950	3130	3670
CSV 216R	2800	3000	3440	3580
M53-1	2630	2900	3190	3210
CD (0.05)	236	-	-	-

Genotype effects:

The grain yield and fodder yield differed significantly among the three genotypes. The variety CSV 216R attained the highest grain yield (3580 kgha^{-1}) due to the production of more dry matter than the hybrid CSH 15R and variety M35-1.

Potassium x genotype interaction effect:

The hybrid CSH 15R recorded the highest grain yield at 60 kgha^{-1} level of potassium application, while the varieties CSV 216R attained the highest grain yield at 40 kgha^{-1}, and M 35-1 at 60 kgha^{-1} (Table 2). Nutrient use efficiency could be a function of partitioning trait and is clearly seen in CSH 15R, which has a high partitioning efficiency. Crop improvement programme, aiming at high yielding genotypes for a *Rabi* environment, indirectly selects for efficient root systems that respond to better management interaction in utilizing the soil moisture more efficiently.

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