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Response of pre-released *Kharif* sorghum (*Sorghum bicolor* L. Moench) genotypes to different fertility levels under rainfed environment

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Abstract

A field experiment was conducted to study the Response of pre-released *Kharif* Sorghum Genotypes to different Fertility Levels under rainfed environment. at AICRP on Sorghum, Main Agricultural Research Station, Dharwad (Karnataka) during kharif-2020. The experiment was laid out in split plot design with thirty two treatment combinations and two replications. The treatments consisted of four fertility levels in main plots and eight genotypes in sub plots. The data revealed that, application of 100% RDF recorded significantly higher plant height (211.7 cm), grain weight/panicle (57.5 g), 100-grain weight (3.06 g), grain yield (55.54 q/ha), fodder yield (10.77 t/ha), gross returns (Rs.111341 /ha), net returns (Rs.70323 /ha) and B: C ratio (2.73) compared to other fertility levels. Both the test varieties SPV-2568 and SPV-2569 produced higher grain yield compared to check varieties (CSH-25, CSH-30 and CSV-20).

Keywords: Fertility, genotypes

Introduction

Sorghum [*Sorghum bicolor* (L.) Moench] is one of the important cereal crop in India because of large size of among other grain millets is called 'Great millet' and it was introduced to India from East Africa. Though the area of *Kharif* sorghum is decreasing year by year, the production and productivity is in increasing trend due to high yielding genotypes and advanced technology. Identification of good quality sorghum genotypes and development of location specific production technology offer an excellent opportunity to enhance the productivity.

Among the production factors, fertilizer plays a vital role in deciding the yield of sorghum. The nutrient requirement further increases with the use of high yielding cultivars and also soil moisture availability. The newly released varieties and hybrids respond differently to different fertility levels depending upon the type of root system and their root density. Hence, there is need to optimize the fertilizer quantity required to obtain higher productivity. With this context, the performance of various sorghum genotypes was evaluated to different fertility levels under rainfed condition.

Materials and Methods

A field experiment was conducted to study the "Response of pre-released *Kharif* Sorghum genotypes to different fertility levels under rainfed environment at All India Coordinated Research Project on Sorghum, Main Agricultural Research Station, University of Agricultural Sciences, Dharwad, Karnataka during *kharif* 2020-21. Dharwad is situated at 15°29' North latitude and 74°59' East longitude at an altitude of 689 m above mean sea level and comes under northern transitional zone (Zone-8) of the agro-climatic zones of Karnataka. Soil of the experimental site was clay with a good water holding capacity. Recommended fertilizer was 100:75:25 kg N:P₂O₅:K₂O /ha. The experiment consisted of 32 treatment combinations comprising four fertilizer levels 0% RDF, 50% RDF (50:37.5:12.5 NPK Kg ha⁻¹), 100% RDF (100:75:25kg NPK ha⁻¹) and 150% RDF (150:112.5:37.5 NPK Kg ha⁻¹) and eight sorghum genotypes (G₁-SPH-1888, G₂-SPH-1914, G₃-SPH-1912, G₄-SPV-2568, G₅-SPV-2569, G₆-CSH-25, G₇-CSH-30, G₈-CSV-20 including checks) with two replications. The field experiment was laid out in a split plot design.

As per the treatments, half dose of nitrogen and full dose

of phosphorus and potassium was applied in through urea DAP and MOP. Remaining half of the nitrogen was applied at 30 days after

sowing. Sowing of sorghum genotypes was done manually with a row spacing of 45cm and 15cm between plants. Thinning was done by retaining one plant per hill to maintain optimum plant population. All the other agronomic practices were followed uniformly in all the treatments. The data collected from the experiment was subjected to statistical analysis as described by Gomez and Gomez (1984) [3]. The level of significance used in F test was P=0.05.

Results and Discussion

Fertility levels

The data presented in Table 1 revealed that, the linear increase in growth, yield parameters, grain and fodder yield. Application of 100% RDF (100:75:25kg NPK ha⁻¹) recorded significantly higher grain (55.54 q/ha) and fodder yield (10.77 t/ha) over 0 and 50% RDF and it was on par with 150% RDF. The per cent increase in grain yield was to an extent of 62.48 and 10.55 higher over 0% and 50% RDF respectively. Significant improvement in higher grain and fodder yield could be attributed to profound influence of N and P fertilization on growth and development of the crop due to increase in nutrient accumulation and their translocation to sink. Similar results were reported by Sumeriya *et al.*, (2005) [5]. The higher grain yield at 100% RDF might be related to higher values of yield parameters viz., grain weight (57.5 g/panicle) and 100-seed weight (3.06 g), The better performance of these yield parameters might be attributed to mineral nutrition especially nitrogen which plays an important regulative functional role in plant system through synthesis and translocation of growth hormones which help in better growth and development of plant (Bringer *at al.*, 1980) [1]. Similarly, the same treatment realized significantly higher gross returns (Rs. 111341/ha), net returns

(Rs.70323/ha) and BC ratio (2.73) compared to 0% and 50% RDF which was due to higher grain and fodder yield (Table 2). The results are in agreement with the findings of Mali *et al.*, 2000 [4].

Performance of genotypes

Among genotypes, the test variety SPV-2568 exhibited significantly higher grain yield (59.05q/ha), Stover yield (10.0 t/ha), gross returns (Rs.116401/ha), net returns (Rs.76950 /ha) and BC ratio (2.93) as compared to checks (CSH-25, CSH-30 and CSV-20) but was on par with SPV-2569. The per cent increase in grain yield was to the tune of 27.3, 33.9 and 54.09 over CSH-25, CSH-30 and CSV-20 respectively. The higher grain yield was mainly due to higher grain weight (54.5 g/panicle) and higher 100-grain weight (3.29 g). Similarly, the same variety exhibited significantly higher fodder yield (10.01 t/ha) over checks and was on par with SPV-2569 (Table 1). The better performance of the new varieties and hybrids was due to influence of nutrients on protein synthesis, involvement in several physiological and metabolic processes in the plant system (Tisdale *et al.*, 1990) [6]. Further, significantly higher gross returns (Rs. 116401), net returns (Rs. 76950) and BC ratio (3.33) was recorded with SPV-2568 over checks but was on par with SPV-2569 (Table 2). The higher returns were mainly due to higher grain and fodder yield.

Interaction effect

The data on interaction effect of fertility levels and genotypes revealed that, the new variety SPV-2568 produced significantly higher grain yield of 66.35 q/ha with 150% RDF compared to others but at par with 100% RDF (65.31q/ha) (Table.3). These results were in conformity with the findings of Dashora *et al.*, (2014) [2].

Table 1: Growth, yield parameters, grain yield and fodder yield of sorghum genotypes as affected by different fertilizer levels

Treatments	Plant height (cm)	Grain weight (g/panicle)	100-grain weight(g)	Grain yield (q/ha)	Fodder yield (t/ha)
Fertilizer levels (F)					
F ₁ : 0% RDF	179.1	41.1	2.74	34.12	6.37
F ₂ :50% RDF(50:37.5:12.5 NPK Kg ha ⁻¹)	197.6	47.7	3.0	50.15	8.82
F ₃ :100% RDF (100:75:25kg NPK ha ⁻¹)	211.7	57.5	3.06	55.44	10.77
F ₄ : 150% RDF (150:112.5:37.5 NPK Kg ha ⁻¹)	204.1	49.0	3.08	53.83	10.59
S.Em. +/-	0.81	0.99	0.03	0.73	0.14
CD (5%)	2.72	2.90	0.09	2.14	0.41
Sorghum genotypes (G)					
G ₁ -SPH-1888	162.3	45.9	3.13	51.54	9.04
G ₂ -SPH-1914	136.5	46.8	2.84	45.28	9.59
G ₃ -SPH-1912	202.7	49.0	2.94	45.96	8.78
G ₄ -SPV-2568	249.6	54.5	3.29	59.05	10.01
G ₅ -SPV-2569	264.2	53.8	3.23	56.44	9.54
G ₆ -CSH-25	167.2	44.1	2.86	46.39	8.93
G ₇ -CSH-30	152.7	47.1	2.65	44.09	8.76
G ₈ -CSV-20	249.8	49.4	2.81	38.32	8.46
S.Em. +/-	0.82	1.32	0.05	1.64	0.17
CD (5%)	2.41	4.41	0.19	5.48	0.57
Interactions (F×G)					
S.Em. +/-	2.34	2.81	0.08	2.07	0.39
CD (5%)	6.83	8.21	0.26	6.05	1.16

RDF-Recommended dose of fertilizer

F-Fertilizer, G-Genotype

Table 2: Economics as affected by different fertilizer levels.

Treatments	Gross returns (Rs./ha)	Net returns (Rs./ha)	BC ratio
Fertilizer levels (F)			
F ₁ : 0% RDF	71806	37056	2.06
F ₂ :50% RDF(50:37.5:12.5 NPK Kg ha ⁻¹)	99890	62006	2.64
F ₃ :100% RDF (100:75:25kg NPK ha ⁻¹)	111341	70323	2.73
F ₄ : 150% RDF (150:112.5:37.5 NPK Kg ha ⁻¹)	102168	63953	2.45
S.Em. +/-	3586	2493	0.07
CD (5%)	10469	7277	0.21
Sorghum genotypes (G)			
G ₁ -SPH-1888	90206	62630	2.78
G ₂ -SPH-1914	92309	52858	2.53
G ₃ -SPH-1912	92173	52722	2.54
G ₄ -SPV-2568	116401	76950	3.33
G ₅ -SPV-2569	111226	71775	3.02
G ₆ -CSH-25	93160	53709	2.38
G ₇ -CSH-30	95373	55922	2.37
G ₈ -CSV-20	79561	40110	2.15
S.Em. +/-	6646	3980	2.06
CD (5%)	22227	13311	2.64
Interactions (FxG)			
S.Em. +/-	10145	7051	0.20
CD (5%)	29612	20583	0.60

RDF-Recommended dose of fertilizer

F-Fertilizer, G-Genotype

Table 3: Interaction effects of sorghum genotypes and Fertility levels on grain yield

Genotypes	Fertility levels				Mean
	0% RDF	50% RDF	100% RDF	150% RDF	
SPH-1888	37.72	53.86	61.38	53.22	51.54
SPH-1914	33.14	47.26	51.31	49.40	45.28
SPH-1912	30.02	49.06	54.26	50.50	45.96
SPV-2568	39.34	65.23	65.31	66.35	59.05
SPV-2569	41.30	58.83	60.45	65.20	56.44
CSH-25	32.39	44.83	54.72	53.62	46.39
CSH-30	34.02	44.43	46.63	51.31	44.09
CSV-20	25.04	37.72	49.46	41.07	38.32
Mean	34.12	50.15	55.44	53.83	
S.Em. +/- 2.07					
CD (5%) 6.05					

Conclusion

Based on the experimental results, it could be inferred that, application of 100% recommended dose of fertilizer (100:75:25kg NPK ha⁻¹) found optimum for *kharif* sorghum genotypes for getting higher grain yield, fodder yield and net returns. Further, test varieties SPV-2568 and SPV-2569 produced higher grain yield compared to check varieties (CSH-25, CSH-30 and CSV-20).

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