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Bandiwaddar TT
AICRP-Sorghum, Main
Agricultural Research Station,
University of Agricultural Sciences,
Dharwad, Karnataka, India

Syeda Samina Anjum
AICRP-Sorghum, Main
Agricultural Research Station,
University of Agricultural Sciences,
Dharwad, Karnataka, India

Shaila HM
AICRP-Sorghum, Main
Agricultural Research Station,
University of Agricultural Sciences,
Dharwad, Karnataka, India

Gangaiah B
AICRP-Sorghum, Main
Agricultural Research Station,
University of Agricultural Sciences,
Dharwad, Karnataka, India

Hanamaratti NG
AICRP-Sorghum, Main
Agricultural Research Station,
University of Agricultural Sciences,
Dharwad, Karnataka, India

Corresponding Author:
Bandiwaddar TT
AICRP-Sorghum, Main
Agricultural Research Station,
University of Agricultural Sciences,
Dharwad, Karnataka, India

Effect of different fertility levels on growth and yield of *rabi* sorghum (*Sorghum bicolor* L. Moench) genotypes under receding soil moisture environment

Bandiwaddar TT, Syeda Samina Anjum, Shaila HM, Gangaiah B and Hanamaratti NG

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Abstract

A field experiment was conducted to study the “Effect of different fertility levels on growth and yield of *rabi* sorghum genotypes under receding soil moisture environment” during *rabi* 2021-22 at AICRP on Sorghum, Main Agricultural Research Station, Dharwad (Karnataka). The experiment was comprising of four fertility levels and eight genotypes laid out in split plot design with thirty two treatment combinations and two replications. The data revealed that, application of 100% RDF (50:25:0 kgNPK/ha) recorded significantly higher plant height (239 cm), Panicle weight (96.8g), grain weight/panicle (68.7 g), 1000-grain weight (30.5 g), grain yield (36.28 q/ha), fodder yield (6.57 t/ha), gross returns (Rs.99702 /ha), net returns (Rs.61119 /ha) and B: C ratio. SPV-2644 gave significantly higher grain yield (40.81q/ha) fodder yield (7.42t/ha), gross returns (Rs.111312/ha), net returns (Rs.74339/ha) and BC ratio (2.95) compared to checks (CSV-29R, CSV-26, CSV-22R and M35-1) followed by SPH-1897.

Keywords: Fertility, RDF, genotypes

Introduction

Sorghum (*Sorghum bicolor* L. Moench) is grown in tropics and subtropics climates especially in the semi-arid tropics. It is extensively grown around the world, including Africa, Asia, Australia and America. Sorghum is called as “camel crop” because of drought, water logging and saline-alkaline tolerance. It is one of the most efficient C₄ plant in terms of photosynthesis. Apart from grains, it provides valuable fodder which is one of the principal roughage feeds in India.

Sorghum is grown in India on an area of 4.6 m ha, producing 4.50 m t with a productivity of 988 kg ha⁻¹ (Anon., 2023). Maharashtra, Karnataka, Andhra Pradesh and Telangana are the leading states for *rabi* sorghum. *Rabi* sorghum is grown on residual soil moisture in post-rainy season and its productivity is dependent on the quantity of rain during the pre-sowing monsoon and the water-holding capacity of the soil. Soil moisture conservation, use of high-yielding cultivars and fertilizer management play a major role in improving the productivity of *rabi* sorghum. In this context, the performance of various sorghum genotypes were evaluated under different fertility levels in receding soil moisture environment.

Materials and Methods

A field experiment was conducted to study the “Effect of different fertility levels on growth and yield of *rabi* sorghum genotypes under receding soil moisture environment” at All India Coordinated Research Project on Sorghum, Main Agricultural Research Station, University of Agricultural Sciences, Dharwad (Karnataka) during *rabi* 2021-22. Soil of the experimental site was clay with a good water holding capacity and CEC. Recommended dose of fertilizer (50:25:0 kg N:P₂O₅:K₂O /ha) was applied at basal. The experiment consisted of 32 treatment combinations comprising four fertilizer levels (0% RDF, 50% RDF, 100% RDF (50:25:0kg NPK ha⁻¹) and 150% RDF and eight sorghum genotypes (G₁-SPH-1897, G₂-SPV-2735, G₃-SPV-2644, G₄-CSV-29R, G₅-CSV-26, G₆-CSV-22R, G₇-M35-1 and G₈-CSH-15R) with two replications. The field experiment was laid out in a split plot design.

Sowing of sorghum seeds 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) [2]. The level of significance used in F test was $P=0.05$.

Results and Discussion

Fertility levels (Table1 and 2)

The data revealed that, application of 100% RDF (50:25:0 kg NPK ha⁻¹) recorded significantly higher grain (36.28 q/ha) and fodder yield (6.57t/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 24.7 and 6.02 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) [4]. The higher grain yield at 100% RDF might be due to higher values of yield parameters viz., grain weight (68.7 g/panicle) and 1000-seed weight (30.5 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 *et al.*, 1980). Similarly, the same treatment gave significantly higher gross returns (Rs. 99702/ha), net returns (Rs.61119/ha) and BC

ratio(2.58) compared to 0% and 50% RDF which was due to higher grain and fodder yield (Table 1). The results are in agreement with the findings of Mali *et al.*, 2000 [3].

Performance of genotypes (Table1 and 2)

Among the tested genotypes, the variety SPV-2644 exhibited significantly higher grain yield (40.81q/ha), Stover yield (7.42 t/ha), gross returns (Rs.111312/ha), net returns (Rs.74.9 /ha) and BC ratio (2.95) as compared to checks (CSV-29R, CSV-26, CSV-22R and M35-1) followed by SPH-1897. The per cent increase in grain yield was to the tune of 26.4,14.28,27.05 and 36.44 over CSV-29R, CSV-26,CSV-22R and M35-1 respectively. The higher grain yield was mainly due to higher grain weight (70.8 g/panicle) and higher 1000-grain weight (32.56 g). Similarly, the same variety exhibited significantly higher fodder yield (7.42 t/ha) over checks. 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) [5]. Further, significantly higher gross returns (Rs.111312/ha), net returns (Rs. 74339/ha) and BC ratio (2.95) was recorded with SPV-2644 over checks. The higher returns was 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-2644 produced significantly higher grain yield of 43.74q/ha with 150% RDF compared to others but at par with 100% RDF (43.62q/ha). These results were in conformity with the findings of Dashora *et al.*, (2014)

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)	1000-grain weight(g)	Grain yield (q/ha)	Fodder yield (t/ha)
Fertilizer levels (F)					
F ₁ : 0% RDF	199.7	44.8	25.77	29.10	5.27
F ₂ :50% RDF(25:12.5:0 kgNPK ha ⁻¹)	199.7	44.8	25.77	29.10	5.27
F ₃ :100% RDF (50:25:0 kg NPK ha ⁻¹)	199.7	44.8	25.77	29.10	5.27
F ₄ : 150% RDF (75: 37.5:0 kg NPK ha ⁻¹)	199.7	44.8	25.77	29.10	5.27
S.Em. +/-	0.759	0.464	0.139	0.185	0.025
CD (5%)	2.219	1.354	0.406	0.455	0.072
Sorghum genotypes (G)					
G ₁ -SPH-1897	248.0	67.3	30.15	38.03	6.90
G ₂ -SPV-2735	201.3	55.7	27.38	32.85	5.95
G ₃ -SPV2644	239.3	70.8	32.56	40.81	7.42
G ₄ -CSV-29R	218.8	53.9	28.28	32.22	5.80
G ₅ -CSV-26	257.3	64.2	29.48	35.71	6.46
G ₆ -CSV-22R	246.5	56.5	27.87	32.12	5.85
G ₇ -M35-1	199.0	52.8	27.34	29.91	5.42
G ₈ -CSH-15R	207.5	51.9	27.06	29.32	5.32
S.Em. +/-	0.886	0.612	0.160	0.278	0.047
CD (5%)	2.960	2.047	0.536	0.930	0.159
Interactions (FxG)					
S.Em. +/-	2.148	1.312	0.393	0.439	0.07
CD (5%)	6.270	3.830	1.148	1.287	0.203

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	76044	43380	2.19
F ₂ : 50% RDF (25:12.5:0 kg NPK ha ⁻¹)	76044	43380	2.19
F ₃ : 100% RDF (50:25:0 kg NPK ha ⁻¹)	76044	43380	2.19
F ₄ : 150% RDF (75: 37.5:0 kg NPK ha ⁻¹)	76044	43380	2.19
S.E.m. +/-	385	384	0.010
CD (5%)	1125	1124	0.029
Sorghum genotypes (G)			
G ₁ -SPH-1897	93554	66267	2.74
G ₂ -SPV-2735	90091	52024	2.36
G ₃ -SPV-2644	111312	74339	2.95
G ₄ -CSV-29R	88155	50088	2.31
G ₅ -CSV-26	97963	59896	2.57
G ₆ -CSV-22R	88556	50489	2.32
G ₇ -M35-1	81966	43899	2.15
G ₈ -CSH-15R	72953	42598	2.12
S.E.m. +/-	637	637	0.017
CD (5%)	2132	2132	0.056
Interactions (F x G)			
S.E.m. +/-	1090	1089	0.028
CD (5%)	3181	3181	0.083

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	
G ₁ -SPH-1897	32.82	38.59	40.62	40.09	38.03
G ₂ -SPV-2735	27.66	33.09	35.52	35.12	32.85
G ₃ -SPV-2644	35.00	40.90	43.62	43.74	40.81
G ₄ -CSV-29R	27.77	32.46	35.23	33.44	32.22
G ₅ -CSV-26	31.07	36.74	37.37	37.66	35.71
G ₆ -CSV-22R	27.71	31.88	34.48	34.42	32.12
G ₇ -M35-1	25.52	30.37	32.17	31.59	29.91
G ₈ -CSH-15R	25.28	29.74	31.26	31.01	29.32
Mean	29.10	34.22	36.28	35.88	
S.E.m. +/- 0.439					
CD (5%) 1.287					

Conclusion

Based on the experimental results, it could be inferred that, application of 100% recommended dose of fertilizer (50:25:0kg NPK ha⁻¹) found optimum for *rabi* sorghum genotypes for getting higher grain yield, fodder yield and net returns. Further, test varieties SPV-2644 and SPH-1897 produced higher grain yield compared to check varieties (CSV-29R, CSV-26, CSV-22R and M35-1).

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