The Pharma Innovation Journal 2023; 12(12): 2444-2446

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(12): 2444-2446

www.thepharmajournal.com
Received: 04-10-2023
Accepted: 09-11-2023

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Effect of fertilizer levels on growth and yield of fodder sorghum (*Sorghum bicolor* L.) varieties

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Abstract
An agronomic investigation was carried out at the experimental farm, Department of Agronomy, College of Agriculture, Latur (Maharashtra), during *kharif*, 2022 to examine the impact of fertilizer levels on growth and yield of fodder sorghum varieties. Three levels of each factor were included in the factorial randomized block design (FRBD). Nine treatment combination, each consisting of two factors with fertilizer levels and varieties were tested. First factor consist of different fertilizer levels *viz*. F1 (75% RDF), F2 (100% RDF) and F3 (125% RDF) and second factor consist of three varieties *viz*. V1 (Dagadi), V2 (CSH 22 SS) and V3 (Phule Suchitra). The results stated that application of 125% RDF (F3) recorded significantly higher growth and yield attributes which was comparable with 100% RDF (F2) and it was significantly superior over 75% RDF (F1). Among the fodder sorghum varieties CSH 22 SS (V2) recorded significantly higher growth and yield attributes which was comparable with Phule Suchitra (V3) and significantly superior over Dagadi jowar (V1).

Keywords: Fodder sorghum, varieties, green fodder yield, fertilizer levels

Introduction
India covers 34% of total sorghum area in the world and produce 17% of world population. In India sorghum is grown on area of about 4.24 million hectares and productivity 4.78 million tonnes. Yield of sorghum in India is 1128 kg ha^{-1}. In India, Maharashtra is the largest sorghum growing state followed by Karnataka, Rajasthan, Tamil Nadu, Andhra Pradesh, Uttar Pradesh, Telangana, Madhya Pradesh. Maharashtra is the largest sorghum growing state with an area of 1.94 million ha *i.e.*, 45.63% and production of 1.76 million tones i.e., 36.85% with average productivity 911 kg ha^{-1} (Anonymous, 2021) [2].

Sorghum as a source of fodder and feed has the potential to meet the by dairy sector needs. Single cut forage sorghum varieties yield about 400-500 and 100-150 q ha^{-1} of green and dry fodder respectively rich in quality. In terms of quality, it contains 8-10% crude protein, 60-65%, NDF, 37-42% ADF, 32% cellulose and 21-23% hemi-cellulose when harvested at 50% flowering stage (Kumar *et al*., 2012) [12].

India faces net deficit of 61.1% green fodder, 21.9% dry crop residues and 64% feeds (Kumar *et al*., 2012) [12]. Presently, the country faces a net shortfall of 35.6% green fodder, 10.5% dry crop leftovers and 44% concentrate feed ingredients. Hence, it is big challenge in front of us to utilize the available land wisely with its fullest potential to produce fodder for the animals (Singh *et al*., 2021) [17]. Therefore, to increase milk production in the country, we have to increase the fodder production by increasing the area and productivity of the crop.

Green forage supply must rise at a rate of 1.69% per annum to satisfy the deficit, however the under cultivated fodder accounts for only 4% of the total cultivated land (8.4 million ha) in country and has remain unchanged over last few decades (Dagar 2017; Hali *et al*., 2018; Meena *et al*., 2018) [8, 10, 13]. Adequate fertilization and suitable genotypes are among the major factors limiting forage sorghum production in our country.

Fertilizer application is one of the important factor that markedly increase the fodder yield. An adequate supply of nutrients at each growth stage is essential for optimum growth and development of fodder sorghum. Nutrients are important for physiological, growth and yield point of view (Alloway, 2008) [1] but at the same time optimum plant stand is equally important to get maximum yield (Reddy *et al*., 2010) [16].

Keeping these facts in view the present field experiment entitled 'Effect of fertilizer levels on growth and yield of fodder sorghum (*Sorghum bicolor* L.) varieties.'

Materials and Methods

An experiment was carried out to determine the effect of fertilizer levels on growth and yield of fodder sorghum (*Sorghum bicolor* L.) varieties during *kharif* season of 2022-2023 at Experimental Farm, Agriculture College, Latur. The soil of experimental plot was clayey in texture, low in available nitrogen (231.0 kg ha^{-1}), medium in available phosphorous (16.90 kg ha^{-1}) and very high in available potassium (434 kg ha^{-1}). The soil was moderately alkaline in reaction having pH 7.05. After harvesting of crop, nitrogen (224 kg ha^{-1}), phosphorous (14.27 kg ha^{-1}) and potassium (398.23 kg ha^{-1}) was available in the soil.

The experiment was laid out in Factorial Randomized Block Design with nine treatments combinations, consisting of two factors, fertilizer levels and varieties which included three levels of fertilizer and three varieties. The first factor consist of different fertilizer levels *viz*. F1 (75% RDF), F2 (100% RDF) and F3 (125% RDF) and second factor consist of three varieties *viz*. V1 (Dagadi), V2 (CSH 22 SS) and V3 (Phule Suchitra). Each treatment was replicated three times. The experimental gross plot size was 5.4 x 4.5 m2 and net plot size was 4.4 x 3.9 m2. Sowing was done on 3rd July 2022. The recommended cultural practices and plant protection measures were undertaken.

Results and Discussion Effect of fertilizer levels

Among the fertilizer levels, application of 125% RDF ha^{-1} recorded higher plant height cm), number of leaves plant^{-1} (12.18), mean leaf area (41.49 dm^2), leaf area index (27.55), fresh weight plant^{-1} (g) (679.44), stem girth plant^{-1} (2.14 cm) of forage sorghum and it was found at comparable with the application of 100% RDF ha^{-1}. The lowest growth attributes were observed with application of 75% RDF ha^{-1}. The increase in growth characters was attributed to increased availability of nutrients leading to better nutritional environment in root zone for growth and development. Similar results were reported by Ayub *et al*., (2002) [4], Chaudhary *et al*., (2018) [6], Chauhan *et al*., (2019) [7] and Patil *et al*., (2018) [15].

Highest green fodder yield (58.90 t ha^{-1}), leaf: stem ratio (0.34), number of tillers plant^{-1} (2.78) were recorded with application of 125% RDF ha^{-1} over the application of 75% RDF ha^{-1}, however it was followed by application of 100% RDF ha^{-1}. This might be due to better growth in crop with regard to height, number of leaves, stem girth and adequate supply of nutrients at each growth stage. Similar results were reported by Joorabi *et al*., (2014) [11] and Ayub *et al*., (2002) [4].

Effect of varieties

Among the fodder sorghum varieties, CSH 22 SS recorded higher growth attributes *viz*. plant height (272.33 cm), number of leaves plant^{-1} (12.64), mean leaf area (41.10 dm^2), leaf area index (27.40), fresh weight plant^{-1} (666.00 g), Stem girth plant^{-1} (2.14 cm) than Dagadi and it was found comparable with Phule Suchitra. Increase in the growth attributes might be due to their genetic constituent. Similar results were reported by Ayub *et al*., (2002) [4], Nirmal *et al*., **(**2016) [16], Ghani *et al*., (2022) [9] and Bhoya *et al*., (2014) [5].

Highest green fodder yield (64.02 t ha^{-1}), leaf: stem ratio (0.35), number of tillers plant^{-1} (2.91) were recorded by CSH 22 SS over Dagadi, however it was followed by Phule Suchitra. Similar results were reported by Ayub *et al*., (2005) [3] and Tandel *et al*. (2020) [18].

Interaction effect

The effect of interaction between different fertilizer levels and varieties on growth and yield attributes was found to be non-significant.

Table 1: Effect of fertilizer levels on growth attributes of fodder sorghum

Treatments	Plant height (cm)	Number of leaves plant^{-1}	Leaf area plant^{-1} (dm^2)	Fresh weight of plant (g)	Stem girth plant^{-1} (cm)	No. of tillers plant^{-1}
Fertilizer levels (F)						
F1: 75% RDF	238.44	9.67	35.99	603.11	1.54	2.57
F2: 100% RDF	262.00	11.40	40.00	654.67	1.96	2.78
F3: 125% RDF	268.22	12.18	41.49	679.44	2.14	2.78
S.Em ±	6.80	0.40	1.04	15.99	0.07	0.09
CD at 5%	20.57	1.20	3.14	47.95	0.21	NS
Varieties (V)						
V1: Dagadi	236.00	9.07	35.92	569.89	1.50	2.52
V2: CSH 22 SS	272.33	12.64	41.10	701.33	2.13	2.91
V3: Phule Suchitra	260.33	11.53	40.45	666.00	2.00	2.67
S.Em ±	6.80	0.40	1.04	15.99	0.07	0.09
CD at 5%	20.57	1.20	3.14	47.95	0.21	0.28
Interaction (F × V)						
S.Em ±	11.89	0.69	1.82	27.71	0.12	0.17
CD at 5%	NS	NS	NS	NS	NS	NS
General Mean	256.22	10.84	39.16	645.74	1.88	2.70

Table 2: Effect of fertilizer levels on leaf: stem ratio and yield of fodder sorghum

Treatments	Leaf: Stem Ratio	Green Fodder yield (t ha^{-1})
Fertilizer levels (F)		
F1: 75% RDF	0.29	50.17
F2: 100% RDF	0.32	54.99
F3: 125% RDF	0.34	58.90
S.E. m ±	0.01	1437.37
CD at 5%	0.03	4308.79
Varieties (V)		
V1: Dagadi	0.27	39.07
V2: CSH 22 SS	0.35	64.02
V3: Phule Suchitra	0.32	60.96
S.E. m ±	0.01	1437.37
CD at 5%	0.03	4308.79
Interaction (F × V)		
S.E. m ±	0.02	2489.61
CD at 5%	NS	NS
General mean	0.31	74.63

Conclusion

Based on the result of present investigation entitled effect of fertilizer levels on growth and yield of fodder sorghum (*Sorghum bicolor* L.) varieties the following inference are drawn.

- The study showed that the application of 125% RDF proved to be effective for getting higher yield of fodder sorghum.
- Whereas among the varieties, CSH 22 SS was found to be more remunerative for getting higher yield of fodder sorghum.

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