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RESEARCH COMMUNICATION

Effect of different nutrient management practices on growth and fodder yield in dual-purpose and multi cut forage sorghum

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Abstract

A field experiment was laid out at College of Agriculture, Vellayani during rabi 2024 to evaluate the integrated nutrient sources on fodder yield in multi cut forage and annual dual-purpose sorghum. The experiment was laid out in randomized block design (RBD) with 3 replications. The treatment combination included 2 varieties (V_1-CSH-24 MF, V_2-Telangana Jonna) and 7 levels of treatments consisting of different sources of nutrients. Considering the performance of varieties, the variety V_1, CSH-24 MF proved to be the best performing variety with respect to growth and yield characters. A higher plant height of 199 cm and leaf length of 62.98 cm was registered by the variety CSH-24 MF. The variety V_1, CSH -24 MF recorded the highest green fodder yield of 23.45 t ha^{-1} and dry fodder yield of 4.22 t ha^{-1}. With regards to treatments, T_7 (100 % recommended dose of fertiliser (RDF) of nitrogen, phosphorus and potassium (NPK) through organic sources + AZT + PSB) recorded higher green fodder yield of 23.86 t ha^{-1} and dry fodder yield of 4.29 t ha^{-1} and was found to be on par with T_6 (100 % RDF of recommended NPK through inorganic sources + AZT + PSB). The increased plant height of 198.38 cm and leaf length of 64.16 cm was also recorded by the treatment T_7 (100 % RDF of recommended NPK through organic sources + AZT + PSB). However, comparative studies evaluating integrated nutrient sources involving organic, inorganic and biofertilisers on growth and fodder yield of multi cut forage and annual dual-purpose sorghum under Kerala conditions are limited.

Keywords: dual-purpose; multi cut forage; nutrient management; sorghum

Introduction

Sorghum is the world's fifth most important cereal crop after maize, rice, wheat and barley. Compared to other major cereals, sorghum requires less water, less external inputs, more resistant to pest and diseases and can withstand harsh climatic circumstances (1). The integrated use of inorganic fertilisers in varying proportions plays a significant role in enhancing forage and grain productivity, improving plant nutrient uptake and sustaining soil nutrient status in forage-based cropping system. The use of organic manures contributes to better physical and biochemical soil properties (2). Inorganic inputs combined with various natural sources of nutrient and biofertilisers can increase production level (3). Biofertilisers like phosphorus solubilising bacteria and *Azospirillum* can build dry fodder and green fodder yield production from 7.8 to 11.3 % (4). Considering the importance of integrated nutrient management for improving fodder yield and soil health, there is a need to evaluate suitable combinations of inorganic fertilisers, organic manures and biofertilisers for sorghum grown under Kerala conditions.

Materials and Methods

The experiment was conducted at College of Agriculture, Vellayani in rabi 2024 to study the effect of integrated nutrient sources on fodder yield of sorghum. The experiment was laid out in randomized block design (RBD) with 3 replications. The treatment combinations included 2 varieties (V_1-CSH-24 MF, V_2-Telangana Jonna) and 7 levels of nutrient sources (T_1-100 % recommended dose of fertiliser (RDF) of recommended nitrogen, phosphorus and potassium (NPK) through inorganic sources, T_2-100 % RDF of recommended NPK through organic sources, T_3-75 % of recommended dose of nutrients (RDN) through inorganic sources + 25 % through vermicompost + *Azotobacter* (AZT) + phosphate-solubilising bacteria (PSB), T_4-75 % of RDN through inorganic sources + 25 % through farmyard manure (FYM) + AZT + PSB, T_5-75 % of RDN through inorganic sources + 25 % through poultry manure + AZT + PSB, T_6- 100 % RDF of recommended NPK through inorganic sources + AZT + PSB, T_7-100 % RDF of recommended NPK through organic sources + AZT + PSB). The growth parameters recorded were plant height (cm), leaf length, leaf width, leaf-stem ratio and days to 50 % flowering green fodder yield, dry fodder yield, gross returns, net returns and benefit-cost ratio (BCR) was taken as yield characters (5) and statistically analysed by using the General R-based Analysis Platform Empowered by Statistics (GRAPES 1.0.0) software developed by previous researchers (6).

Results

Perusal of the data revealed that among the 2 varieties, the variety V_1, CSH-24 MF proved to be the best performing variety with respect to growth and yield characters. Plant height (199.21 cm) and leaf length (62.98 cm) were found to be the highest for the variety V_1. The variety V_2, Telangana Jonna recorded the lowest number of days to attain 50 % flowering (Table 1). The green fodder yield (23.45 t ha^{-1}) and dry fodder yield (4.22 t ha^{-1}) were found the highest for variety V_1 (Table 2).

With regard to treatments, T_7 (100 % RDF of recommended NPK through organic sources + AZT + PSB) recorded taller plants (198.38 cm) with higher leaf length (64.16 cm) and lower number of days to attain 50 % flowering (66.66) which was on par with T_5 (75 % of RDN through inorganic source + 25 % through poultry manure + AZT + PSB) (Table 1). The treatment T_7 recorded higher green fodder yield of 23.86 t ha^{-1} and dry fodder yield of 4.29 t ha^{-1} and was found to be on par with T_6 (Table 2). The highest gross returns were recorded by the treatment T_7 whereas the highest net returns and BCR were recorded by the treatment T_6.

Discussion

The results of the present investigation clearly indicated the beneficial effect of integrated nutrient management on growth, yield and economics of fodder sorghum. The superiority of T_7 (100 % RDF through organic sources + *Azotobacter* + PSB) in terms of plant height, leaf length and fodder yield can be attributed to the combined and sustained nutrient supply from organic sources along with enhanced nutrient availability through biofertiliser activity.

The findings are in close agreement with those of previous researchers, who reported a consistent increase in sorghum yield with increasing levels of NPK coupled with FYM application (7). The improved performance under T_7 in the present study may similarly be due to improved soil fertility and synchronised nutrient release throughout the crop growth period.

The positive influence of integrated use of fertilisers, organic manures and biofertilisers observed in the present study corroborates the findings of previous researchers, who reported higher productivity of sweet sorghum with vermicompost

Table 1. Effect of integrated nutrient management practices on growth attributes and days to 50 % flowering in multi cut and dual-purpose sorghum

Treatments	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Leaf stem ratio	Days to 50 % flowering
Variety 1 (CSH-24 MF)	199.21	62.98	6.56	0.35	75.61
Variety 2 (Telangana Jonna)	173.33	58.28	7.11	0.54	60.57
SEm (±)	0.903	1.092	1.325	0.136	0.35
C.D (p = 0.05 %)	2.626	3.175	NS	NS	1.017
T_1: 100 % RDF of recommended N through inorganic sources	190.22	59.94	5.80	0.50	68.83
T_2: 100 % RDF of recommended N through organic sources	181.56	61.61	6.06	0.34	67.00
T_3: 75 % of RDN through inorganic sources + 25 % through vermicompost + AZT + PSB as seed treatment 5 g kg^{-1} seed	182.60	58.56	5.58	0.29	70.50
T_4: 75 % RDN through inorganic sources + 25 % through FYM + AZT + PSB	172.22	59.22	5.41	1.06	69.33
T_5: 75 % of RDN through inorganic sources + 25 % through Poultry manure + AZT + PSB as seed treatment 5 g kg^{-1} seed	193.90	61.10	12.71	0.31	66.66
T_6: 100 % RDF + FYM (inorganic + organic sources) + AZT + PSB as seed treatment 5 g kg^{-1} seed	185.00	59.83	6.07	0.31	67.33
T_7: 100 % RDF of recommended N through organic sources + AZT + PSB as seed treatment 5 g kg^{-1} seed	198.38	64.16	6.26	0.31	67.00
SEm(±)	1.69	2.043	2.478	0.255	0.654
CD (p = 0.05 %)	4.914	8.255	NS	NS	1.902

Note: Organic sources: Vermicompost; FYM: Farmyard manure; AZT: *Azobacter chroococcum*; PSB: *Bacillus polymyxa*; NS: non-significant.

Table 2. Effect of the integrated nutrient management practices on fodder yield, gross return, net return and BCR in multi cut and dual-purpose sorghum

Treatments	GFY (t ha^{-1})	DFY (t ha^{-1})
Variety 1 (CSH-24 MF)	23.45	4.219
Variety 2 (Telangana Jonna)	16.67	3.029
SEm (±)	0.063	0.053
C.D (p = 0.05 %)	0.184	0.154
T_1: 100 % RDF of recommended N through inorganic sources	20.65	3.73
T_2: 100 % RDF of recommended N through organic sources	17.01	3.15
T_3: 75 % of RDN through inorganic sources + 25 % through vermicompost + AZT + PSB as seed treatment 5 g kg^{-1} seed	18.55	3.33
T_4: 75 % RDN through inorganic sources + 25 % through FYM + AZT + PSB	16.85	3.03
T_5: 75 % of RDN through inorganic sources + 25 % through Poultry manure + AZT + PSB as seed treatment 5 g kg^{-1} seed	20.75	3.73
T_6: 100 % RDF + FYM (inorganic + organic sources) + AZT + PSB as seed treatment 5 g kg^{-1} seed	22.73	4.08
T_7: 100 % RDF of recommended N through organic sources + AZT + PSB as seed treatment 5 g/kg seed	23.86	4.29
SEm(±)	0.118	0.099
C.D (p = 0.05 %)	0.344	0.288

Note: Organic sources: Vermicompost; FYM: Farmyard manure; AZT: *Azobacter chroococcum*; PSB: *Bacillus polymyxa*; GFY: Green fodder yield; DFY: Dry fodder yield.

combined with *Azospirillum*, PSB and recommended NPK under rainfed conditions (8). In the present study, the enhanced plant height and leaf length under T_7 and T_5 indicated better nitrogen availability through *Azotobacter* and improved phosphorus availability due to PSB, which together might have promoted vigorous vegetative growth.

The reduction in days to attain 50 % flowering under T_7, which was on par with T_6 and T_2, may be attributed to improved nutrient uptake and enhanced physiological efficiency, leading to early crop maturity. Similar responses under integrated nutrient management were also reported earlier (9), where superior green and dry fodder yields of sorghum with combined application of RDF and biofertilisers in clay loam soils.

Overall, the present study confirms that integrated nutrient management involving organic sources and biofertilisers not only enhances growth and yield of fodder sorghum but also improves economic returns, thereby offering a sustainable and cost-effective nutrient management strategy.

Conclusion

Based on the results, it can be concluded that superior growth and yield of fodder sorghum were observed with the application of 100 % RDF of recommended NPK through organic sources along with AZT and PSB (T_7). Among the varieties evaluated, V_1 (CSH-24 MF) proved to be the best-performing variety with respect to growth and yield attributes. Similar studies may be conducted to identify suitable nutrient sources with different biofertilisers and in other popular fodder crops of Kerala.

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Authors' contributions

SSR drafted the original manuscript and conducted the investigation and data analysis. GG and AMR carried out the investigation and reviewed and edited the manuscript. ASA performed the analysis and compiled the references. All authors read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interests to declare.

Ethical issues: None

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