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Effect of inorganic and organic nutrients on quality and yield parameters of fodder sorghum under south Gujarat condition

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Abstract

A field experiment was carried out during the summer season of the year 2019 at the Agronomy farm of N. M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat), with a view to study nutrient management in fodder Sorghum (*Sorghum bicolor* L. Moench) under South Gujarat condition. The experiment was laid out in a Factorial Randomized Block Design (FRBD) with Twelve treatments and Three replications.

Keywords: Nutrient management, South Gujarat condition, organic manures, inorganic fertilizers, banana pseudostem enriched sap

Introduction

Fodder crops are the plant species that are cultivated and harvested for feeding the animals in the form of forage, silage and hay. India has 4.9 per cent of the total cropped area under cultivated forages. At present, the country faces a net deficit of 35.6 per cent green fodder, 26.0 per cent dry crop residues and 41 per cent concentrate feed ingredients. The situation is further aggravated due to increasing growth of livestock particularly that of genetically upgraded animals. The available forages are poor in quality, being deficient in available energy, protein and minerals. To compensate the low productivity of the livestock, farmers maintain a large herd of animals, which adds to the pressure on land and fodder resources. (Anon., 2013) ^[1]. Among fodder crops, sorghum (*Sorghum bicolor* L. Moench) is one of most widely adopted fodder crop which is extensively grown during summer seasons. It can be fed as green fodder or converted into high quality silage especially for lean period. Sorghum is native to East Africa, probably from Ethiopia (Ecoport, 2011) ^[2], but was also grown in India 700 BC.

Organic manures are natural sources of slow release nutrient and inclusion of organic manures like FYM and bio-compost in fertilizer management has become necessity to improve soil fertility and sustain the productivity. The utilization of composted farmyard manure is a common farming practice worldwide; it is most readily available to farmers and is an inherent source of plant macro and micronutrients. Farmyard manure is known to improve soil fertility and productivity in the long-term, and shows increased potential in conjunction with mineral fertilizers

Biocompost might have played a key role in enhancing the native as well as added fertilizers when it was combined with application of chemical fertilizers to fodder sorghum, there by created the favorable environment in rhizosphere for better expression of the physiological growth parameter like better plant stand, plant height, stem girth and increased dry matter production which ultimately reflected in terms of higher green fodder yield.

Adequate use of fertilizer has played a key role in the modernization of Indian agriculture and in making the country sufficient in fodder production for animals. Nitrogen is indispensable for increasing crop production as it is an important constituent of protoplasm & chlorophyll and associated with the activity of living cells. Nitrogen fertilization lowers the fibre and lignin content of fodder, thereby improves succulence and palatability of fodder.

Second mineral element phosphorous plays a key role in vigorous root growth and proliferation, good quantity of fodder sorghum yield. Plants are profoundly affected by phosphorus deficiency because P is an indispensable constituent of nucleic acids and membrane phospholipids. Moreover, P plays a pivotal role in energy transfer, as a regulator of enzyme activity and signal transduction. So, it can be said that application of P found significantly beneficial for the growth of fodder sorghum crop. It also promotes root growth which leads to the better absorption of nutrients from soil which might be a reason for better growth of the crop.

Nutrient Management involves the use of organic manures and novel organic fertilizer viz. Banana pseudostem sap with a view to reduce the quantity of inorganic sources nutrients. The Banana pseudostem sap is a good source of plant nutrients. It contains essential plant nutrient viz., nitrogen, phosphorous, potassium, calcium, magnesium, sulphur, manganese, copper, zinc and ferrous. It contains not only essential plant nutrient, but also plant growth regulators viz., cytokinin and gibberellic acid. Hence keeping in view the above facts, the present investigation was conducted to study the performance of fodder sorghum under different sources of inorganic and organic nutrients in order to evolve optimized practices under summer conditions.

Materials and Methods

A field experiment was carried out during the summer season of the year 2019 on Plot No.14, Block-C of College Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat). Geographically, University campus is located between 20°57' N latitude, 72°54' E longitude and at an altitude of 10 meter above the mean sea level. The place is located at 3 km away towards west of Navsari and 13 km away in East from great historical place "Dandi" on the Arabian shoreline. The soil of the experimental field was clayey in texture and showed medium in available nitrogen (320.11kg/ha), moderately high in available phosphorus (30.95 kg/ha) and high in available potassium (254.41 kg/ha), slightly alkaline in reaction with normal electrical conductivity. The experiment was arranged in Factorial randomized block design as shown in table 1 with three replications, consisting of twelve treatments viz., T₁ (O₁F₁B₀), T₂ (O₁F₁B₁), T₃ (O₁F₂B₀), T₄ (O₁F₂B₁), T₅ (O₁F₃B₀), T₆ (O₁F₃B₁), T₇ (O₂F₁B₀), T₈ (O₂F₁B₁), T₉ (O₂F₂B₀), T₁₀ (O₂F₂B₁), T₁₁ (O₂F₃B₀), T₁₂ (O₂F₃B₁), each plot being 5.00 m × 3.00 m. Crop was harvested on 30th April, 2019. Statistical analysis of the data on various growth, yield and quality aspects of sorghum during the investigation were subjected to statistical analysis of variance technique as described by Snedecor and Cochran (1967) [4]. The method of analysis of variance for Factorial Randomized Block design was used and treatment effects on all the characters studied were further compared by employing 'F' test (Gomez and Gomez, 1984) [3].

Table 1: Details of treatment

Factor 1	Organic manure (O)
	O ₁ : FYM @ 5.0 t/ha
	O ₂ : Bio compost @ 5.0 t/ha
Factor 2	Inorganic fertilizer (F)
	F ₁ :50% RDF
	F ₂ :75% RDF
Factor 3	Organic liquid fertilizer (B)
	B ₀ : Control
	B ₁ : Banana pseudostem enriched sap (1% spray at 20 and 40 DAS)

Results and Discussion

1.1 Effect on quality

The quality in terms of crude protein content (%) and crude fiber content (%) as influenced by organic manures, inorganic fertilizers and organic liquid fertilizer were studied and presented in Table 2.

1.1.1 Crude protein content

Crude protein content in fodder sorghum was significantly increased with the application of organic manures (Table 2). Significantly the highest protein content (7.04%) was recorded with O₂ (Bio compost @ 5 t/ha) which was found significantly higher over O₁ (FYM @ 5 t/ha) treatments which had the lowest protein content (6.42%). Significantly the highest protein content (7.36%) was recorded with F₃ (100% RDF) over the F₁ (50% RDF) and F₂ (75% RDF). The lowest protein content (6.38%) was obtained by F₁ (50% RDF). Statistically the highest protein content (7.32%) was recorded with B₁ (Banana pseudostem enriched sap) over Treatment B₀ (Control). B₀ treatment had the lowest protein content (6.15%).

1.1.2 Crude fibre content

Numerically higher crude fiber (34.02%) was recorded with O₁ (FYM @ 5 t/ha) or O₂ (Biocompost @ 5 t/ha) treatments which had lower crude fiber (33.96%). A perusal of data in Table 2 indicated that crude fiber was not influenced significantly by the effect of inorganic fertilizers. Numerically higher crude fiber (35.02) was recorded with F₁ (50% RDF) over F₂ (75% RDF) and F₃ (100% RDF). F₃ had the lowest crude fibre (32.58). Numerically highest crude fibre (34.68) was recorded with B₀ (Control) over B₁ (Banana pseudostem enriched sap).

Table 2: Effect of inorganic and organic nutrients on crude protein and crude fiber content of fodder sorghum

Treatments	Crude protein content (%)	Crude fiber Content (%)
Organic manure		
O ₁ : FYM @ 5 t/ha	6.42	34.02
O ₂ : Bio compost @ 5 t/ha	7.04	33.96
S.E.m ±	0.19	0.95
CD at 5%	0.56	NS
Inorganic fertilizer		
F ₁ : 50% RDF	6.38	35.02
F ₂ : 75% RDF	6.46	34.37
F ₃ : 100% RDF	7.36	32.58
S.E.m ±	0.23	1.17
CD at 5%	0.69	NS
Organic liquid fertilizer		
B ₀ : Control	6.15	34.68
B ₁ : Banana pseudostem enriched sap	7.32	33.30
S.E.m ±	0.19	0.95
CD at 5%	0.56	NS
Interactions		
O × F	NS	NS
O × B	NS	NS
F × B	NS	NS
O × F × B	NS	NS
C.V.%	12.14	11.93

1.2 Effect on yield

1.2.1 Green fodder yield

A scrutiny of data presented in Table 3 revealed that different treatments exerted their non-significant influence on green fodder yield. Numerically the higher green fodder yield (314.57 q/ha) was recorded with O₂ (Bio compost @ 5 t/ha) which was

found significantly differ from the O₁ (FYM @ 5 t/ha) treatments which had the lower green fodder yield (298.05 q/ha). Significantly highest green fodder yield (337.98 q/ha) was recorded with F₃ (100% RDF) which was found significantly differ from F₁ (50% RDF) and F₂ (75% RDF) treatments. The lowest green fodder yield (273.14 q/ha) was obtained by F₁ (50% RDF). Significantly the highest green fodder yield (321.45 q/ha) was recorded with B₁ (Banana pseudostem enriched sap) which was found significantly differ from B₀ (Control) treatment which had the lowest green fodder yield (291.17 q/ha).

1.2.2 Dry fodder yield

Numerically the higher dry fodder yield (141.18 q/ha) was recorded with O₂ (Biocompost @ 5 t/ha), which was found significantly differ from O₁ (FYM @ 5 t/ha) treatment which had the lower dry fodder yield (131.34 q/ha). Significantly the highest dry fodder yield (156.38 q/ha) was recorded with F₃ (100% RDF) which was found significantly differ from F₁ (50% RDF) and F₂ (75% RDF). The lowest dry fodder yield (113.35 q/ha) was obtained by F₁ (50% RDF).

Table 3: Effect of inorganic and organic nutrients on green and dry fodder yield of fodder sorghum

Treatments	Green fodder yield (q/ha)	Dry fodder yield (q/ha)
Organic manure		
O ₁ : FYM @ 5 t/ha	298.05	131.34
O ₂ : Biocompost @ 5 t/ha	314.57	141.18
S.Em ±	6.79	3.84
CD at 5%	NS	NS
Inorganic fertilizer		
F ₁ : 50% RDF	273.14	113.35
F ₂ : 75% RDF	307.80	139.05
F ₃ : 100% RDF	337.98	156.38
S.Em ±	8.32	4.71
CD at 5%	24.40	13.82
Organic liquid fertilizer		
B ₀ : Control	291.17	127.06
B ₁ : Banana pseudostem enriched sap	321.45	145.46
S.Em ±	6.79	3.84
CD at 5%	19.92	11.28
Interactions		
O × F	NS	NS
O × B	NS	NS
F × B	NS	NS
O × F × B	NS	NS
C.V.%	9.40	11.98

Conclusion

The green fodder and dry fodder yield were significantly influenced due to increase in inorganic fertilizers. Significantly highest green fodder and dry matter yield obtained by 100% RDF over 50% and 75% RDF. The green fodder and dry matter yields were significantly increased due to application of organic liquid fertilizer (Banana pseudostem enriched sap) to fodder sorghum.

Application of Bio compost @ 5 t/ha realized significantly highest value for protein content than FYM @5.0 t/ha and not significantly affected on crude fiber content. Significantly higher protein content obtained by 100% RDF over 50% RDF and 75% RDF where crude fiber content not affected significantly by different levels of inorganic fertilizers.

Significantly higher protein content in fodder sorghum was recorded by application of organic liquid fertilizer, however, crude fiber content was not affected significantly by organic

liquid fertilizer.

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