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Effect of Different Nutrient Levels on Growth and Yield of Browntop Millet

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A B S T R A C T

An experiment in Browntop millet was conducted during *kharif*2019 in red sandy loamy soil of Zonal Agricultural Research Station, University of Agricultural Sciences, GKVK, Bengaluru with different nutrient levels. Fourteen treatments replicated thrice in randomized complete block design (RCBD). Among the different nutrient levels the treatment with 60 N kg ha^{-1} + 30 P_2O_5 kg ha^{-1} + 20 K_2O kg ha^{-1} (T_{12}) recorded higher plant height (110.33 cm), leaf area (755.57 cm^2), dry matter accumulation (9.55 g), productive tillers (13.93),ear head length (19.33 cm), grain yield (1295 kg ha^{-1}) and straw yield (3131 kg ha^{-1}).

Introduction

Browntop millet (*Brachiaria ramosa*) is an annual warm-season grass and majorly used in forage management systems. Browntop millet is originated in Southeast Asia. It is grown in the regions of scanty and erratic rainfall, poor and marginal soils in southern India. It is popular as a short duration crop, higher yield per unit time, low input requirement, known for its drought and shade tolerance as it can withstand severe moisture stress and suited to wide range of soil conditions.

The Browntop millet can fill narrow growing windows to produce a good quality forage because of its extremely rapid growth. Under ideal conditions, seed will germinate within 5-6 days and forage will be ready to harvest within two months' time. The nutritional composition of Browntop millet is better when compared to other millets. The grain is a rich source of natural fibre (12.5 per cent), carbohydrate, protein (11.5 per cent), minerals (6.21 per cent), calcium (18 per cent) and iron (8.9 per cent). It is a food for patients suffering from diabetes.

Browntop millet is grown under adverse environmental conditions; and best suited under moisture stress deprived soils. However, in reality, the potential of this crop is not attained fully. Browntop millet being low nutrient demanding crops, but responds well for addition of N, P and K. Depleted soil

nutrient status and cultivation of improved varieties in Browntop millet needs balanced fertilizer through external fertilizers. The exact requirement of major nutrients for Browntop millet is not worked out and established so far. As this millet is of short duration and has high canopy growth as compared to other millets, the present investigation is planned to find out the nitrogen, phosphorous and potassium requirement of Browntop millet and their interactions.

Materials and Methods

The experiment to study the performance of the crop to different fertilizer levels on growth and yield in Browntop millet consisted of fourteen treatments replicated thrice in a randomized complete block design (RCBD). This experiment was conducted during *Kharif* 2019 at Gandhi KrishiVignan Kendra (GKVK).

The soil is red sandy loam and the treatment tested were, T_1: 20:20:10 kg N:P:K ha^{-1}, T_2: 20:20:20 kg N:P:K ha^{-1}, T_3: 20:30:10 kg N:P:K ha^{-1}, T_4: 20:30:20 kg N:P:K ha^{-1}, T_5: 40:20:10 kg N:P:K ha^{-1}, T_6: 40:20:20 kg N:P:K ha^{-1}, T_7: 40:30:10 kg N:P:K ha^{-1}, T_8: 40:30:20 kg N:P:K ha^{-1}, T_9: 60:20:10 kg N:P:K ha^{-1}, T_{10}: 60:20:20 kg N:P:K ha^{-1}, T_{11}: 60:30:10 kg N:P:K ha^{-1}, T_{12}: 60:30:20 kg N:P:K ha^{-1}, T_{13}: 40:20:0 kg N:P:K ha^{-1} and T_{14}: Control.

Local variety (Dundukorale) was sown at the spacing of 45 × 10 cm. The gross and net plot sizes were 3.0 × 4.5 m and 2.6 × 2.7 m respectively. Data averaged over three replication and the data on Browntop millet growth parameter and yield parameter were collected.

The data collected on different traits was statistically analysed using the standard procedure and the results were tested at five percent level of significance as given by Gomez and Gomez (1984).

Results and Discussion

Growth attributes

At harvest, application of 60 kg N ha^{-1} + 30 kg P_2O_5 ha^{-1} + 20 kg K_2O ha^{-1} (T_{12}) significantly showed higher plant height (110.33 cm) compared to application of 40 kg N ha^{-1} + 20 kg P_2O_5 ha^{-1} + 0 kg K_2O ha^{-1} (89.50 cm) (T_{13}) and control (84.33 cm) (T_{14}). However, it was on par with application of 60 kg N ha^{-1} + 30 kg P_2O_5 ha^{-1} + 10 kg K_2O ha^{-1} (102 cm) (T_{11}).

Leaf area of treatment (T_{12}) *i.e.*, application of 60 kg N ha^{-1} + 30 kg P_2O_5 ha^{-1} + 20 kg K_2O ha^{-1}showedsignificantly higher leaf area (755.57 cm^2) compared to application of 40 kg N ha^{-1} + 20 kg P_2O_5 ha^{-1} + 0 kg K_2O ha^{-1}(617.34 cm^2) (T_{13}) and control (559.15 cm^2) (T_{14}) at harvest.

Application of 60 kg N ha^{-1} + 30 kg P_2O_5 ha^{-1} + 20 kg K_2O ha^{-1} significantly showed higher dry matter (9.55 g) (T_{12}) compared to application of 40 kg N ha^{-1} + 20 kg P_2O_5 ha^{-1} + 0 kg K_2O ha^{-1} (6.37) (T_{13}) and control (5.52 g) (T_{14}) at harvest.

This increased in growth parameter might be due to availability of sufficient nutrients to plants, which leads to anatomical changes such as increase in size of cells, intercellur spaces, thinner cell walls, lower development of epidermal tissue, better root growth, and better translocation of photosynthates resulting in vigorous plant growth resulted in favourable plant height, leaf area index, dry matter accumulation. Similar finding were reported by Nigade and More (2012), Lingegowda *et al.*, (1986) in finger millet.

Table.1 Plant height (cm), Leaf area (cm^2) and Dry matter accumulation (g) as influenced by different levels of major nutrients in Browntop millet

Treatments	Plant height (cm)	Leaf area (cm^2)	Dry matter accumulation (g)
T_1: 20:20:10 N:P_2O_5:K_2O kg ha^{-1}	86.66	589.19	5.66
T_2: 20:20:20 N:P_2O_5:K_2O kg ha^{-1}	87.96	594.18	6.01
T_3: 20:30:10 N:P_2O_5:K_2O kg ha^{-1}	89.90	600.87	6.33
T_4: 20:30:20 N:P_2O_5:K_2O kg ha^{-1}	93.66	657.47	6.61
T_5: 40:20:10 N:P_2O_5:K_2O kg ha^{-1}	94.66	632.44	6.44
T_6: 40:20:20 N:P_2O_5:K_2O kg ha^{-1}	93.33	637.88	6.48
T_7: 40:30:10 N:P_2O_5:K_2O kg ha^{-1}	98.00	661.42	6.71
T_8: 40:30:20 N:P_2O_5:K_2O kg ha^{-1}	100.60	673.90	7.35
T_9: 60:20:10 N:P_2O_5:K_2O kg ha^{-1}	99.40	665.48	6.80
T_{10}: 60:20:20 N:P_2O_5:K_2O kg ha^{-1}	100.66	681.37	7.44
T_{11}: 60:30:10 N:P_2O_5:K_2O kg ha^{-1}	102.00	684.54	7.87
T_{12}: 60:30:20 N:P_2O_5:K_2O kg ha^{-1}	110.33	755.57	9.55
T_{13}: 40:20:0 N:P_2O_5:K_2O kg ha^{-1}	89.50	617.34	6.37
T_{14}: Control	84.33	559.15	5.52
S. Em±	2.98	22.49	0.54
CD at 5 %	9.05	68.24	1.64

Table.2 Productive tillers, panicle length, grain yield and straw yield as influenced by different levels of major nutrients in Browntop millet

Treatments	Productive tillers	Panicle length (cm)	Grain yield (kg/ha)	Straw yield (kg/ha)
T_1: 20:20:10 N:P_2O_5:K_2O kg ha^{-1}	9.36	16.00	841	1786
T_2: 20:20:20 N:P_2O_5:K_2O kg ha^{-1}	9.46	16.42	850	1875
T_3: 20:30:10 N:P_2O_5:K_2O kg ha^{-1}	10.00	16.48	873	1910
T_4: 20:30:20 N:P_2O_5:K_2O kg ha^{-1}	10.50	16.88	918	2142
T_5: 40:20:10 N:P_2O_5:K_2O kg ha^{-1}	10.30	16.83	911	2033
T_6: 40:20:20 N:P_2O_5:K_2O kg ha^{-1}	10.46	16.83	914	2122
T_7: 40:30:10 N:P_2O_5:K_2O kg ha^{-1}	10.60	16.9	934	2215
T_8: 40:30:20 N:P_2O_5:K_2O kg ha^{-1}	10.86	17.14	1044	2488
T_9: 60:20:10 N:P_2O_5:K_2O kg ha^{-1}	10.73	16.96	935	2370
T_{10}: 60:20:20 N:P_2O_5:K_2O kg ha^{-1}	11.60	17.25	1066	2575
T_{11}: 60:30:10 N:P_2O_5:K_2O kg ha^{-1}	11.86	18.15	1078	2799
T_{12}: 60:30:20 N:P_2O_5:K_2O kg ha^{-1}	13.93	19.33	1295	3131
T_{13}: 40:20:0 N:P_2O_5:K_2O kg ha^{-1}	10.20	16.49	903	1994
T_{14}: Control	9.33	15.71	762	1682
S. Em±	0.61	0.50	65.85	146.28
CD at 5 %	1.85	1.51	199.75	443.76

Yield attributes

Significantly, higher number of productive tillers per plant was noticed in the application of 60 kg N ha^{-1} + 30 kg P_2O_5 ha^{-1} + 20 kg K_2O ha^{-1} (13.93)(T_{12}) compared to other levels of fertilizers. Whereas, the lower number of productive tillers were noticed in control (9.33)(T_{14}) followed by the application of 40 kg N ha^{-1} + 20 kg P_2O_5 ha^{-1}+ 0 kg K_2O ha^{-1} (10.20)(T_{13}).

Ear head length differed significantly with the application of 60 kg N ha^{-1} + 30 kg P_2O_5 ha^{-1} + 20 kg K_2O ha^{-1} (19.33 cm) (T_{12}) compared to application of 40 kg N ha^{-1} + 20 kg P_2O_5 ha^{-1} + 0 kg K_2O ha^{-1}(16.49 cm) (T_{13}) and control (15.71 cm) (T_{14}). However, it was found on par with application of 60 kg N ha^{-1} + 30 kg P_2O_5 ha^{-1} + 10 kg K_2O ha^{-1} (18.15 cm) (T_{11}).

The grain yield (kg ha^{-1}) of treatment (T_{12}) *i.e.*, application of 60 kg N ha^{-1} + 30 kg P_2O_5 ha^{-1} + 20 kg K_2O ha^{-1} (1295 kg ha^{-1}) was a significantly higher compared to application of 40 kg N ha^{-1} + 20 kg P_2O_5 ha^{-1} (903 kg ha^{-1}) (T_{13}) and control (762 kg ha^{-1}) (T_{14}).

The straw yield (kg ha^{-1}) of treatment (T_{12}) *i.e.*, application of 60 kg N ha^{-1} + 30 kg P_2O_5 ha^{-1} + 20 kg K_2O ha^{-1} (3131 kg ha^{-1}) higher compared to other applicational though it was found on par with application of 60 kg N ha^{-1} + 30 kg P_2O_5 ha^{-1} + 10 kg K_2O ha^{-1} (2799 kg ha^{-1}) (T_{11}) but these two were found significantly higher as compared to other treatments and the control has recorded significantly the lower straw yield (1682 kg ha^{-1}) (T_{14}).

The increased in productive tillers, panicle length, grain yield and straw yield was due to interaction effects of nitrogen, phosphorous and potassium, which resulted in higher plant height, leaf area, total dry matter accumulation in plant, and its accumulation in different plant parts like leaf, stem and higher number of tillers. These observations are in line with observation made by Vimalan *et al.*, (2019), Bhomte *et al.*, (2016), Maitra *et al.*, (2001) and Rakesh *et al.*, (2015).

In conclusion the application of 60 kg N ha^{-1} + 30 kg P_2O_5 ha^{-1} + 20 kg K_2O ha^{-1} has shown higher plant height, leaf area, dry matter accumulation, productive tillers, ear head length, grain yield and straw yield in Browntop millet.

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