International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(6): 2715-2716
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Received: 08-09-2020
Accepted: 13-10-2020

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Effect of different nutrient levels on yield and economics of browntop millet

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DOI: https://doi.org/10.22271/chemi.2020.v8.i6am.11192

Abstract
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 highest grain (1295 kg ha^{-1}), straw yield (3131 kg ha^{-1}), Gross monetary returns (Rs. 45310 ha^{-1}), Net monetary returns (Rs. 24240 ha^{-1}) and B:C ratio (2.15).

Keywords: Browntop millet, nutrient levels, yield, economics

Introduction
Browntop millet (*Brachiaria ramosa*) is the rarest cultivated among the millets. 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. Browntop millet spread out from the Deccan plateau to Tamil Nadu in the South. In the United States, it is majorly grown in the South East regions for hay, pasture and game bird feed. Browntop millet is also called as Korale in Kannada, it is mainly grown in rainfed tracts of Chitradurga, Chikkaballapura and Tumakuru districts of Karnataka. The crop is prevalent in this region in terms of cultivation and consumption. The Browntop millet seed is grown in variety of soils and climatic conditions. The Browntop millet can fill narrow growing windows to produce a good quality forage because of its extremely rapid growth. 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. Colour of the millet is also appealing and it is well accepted by the farmers as well as consumers when compared to Kodo millet and Finger millet.

Material and Methods
The experiment to study the performance of the crop to different fertilizer levels on yield and economics 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 Krishi Vignan 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 (Dundu korale) 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 grain and straw yield was collected after the crop harvest. The economics of nutrients levels on the crop was worked out. The data collected on different traits was statistically analysed using the standard procedure and the results were tested at five per cent level of significance as given by Gomez and Gomez (1984) [2].

Gross returns (Rs. ha^{-1})
The gross return per hectare was calculated by multiplying prevailing market price into total yield obtained per hectare. (Market price/unit quantity × grain yield + market price of straw × straw yield).

Net returns
Net returns were calculated by deducting the cost of cultivation from gross returns.
Net return = Gross return – Total cost of cultivation

Benefit cost ratio
Benefit-cost ratio was worked as fallows.

$$\text{B:C ratio} = \frac{\text{Gross returns (Rs. ha}^{-1})}{\text{Cost of cultivation (Rs. ha}^{-1})}$$

Results and Discussion
Yield attributes
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 application although 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 grain and straw yield (Table 1) was due to interaction effects of nitrogen, phosphorous and potassium, which resulted in higher number of leaves per plant, leaf area, total dry matter accumulation in plant, and its accumulation in different plant parts like leaf, stem and higher number of tillers. The above results are in line with the findings of Bhomte *et al.* (2016) [1], Maitra *et al.* (2001) [3] and Rakesh *et al.* (2015) [7] who concluded that grain and straw yield of crops increased with application of NPK fertilizer.

Table 1: Grain yield, straw yield, gross returns, net returns and benefit: cost ratio as influenced by different levels of major nutrients in Brown top millet

Treatments	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Gross returns (Rs. ha^{-1})	Net Returns (Rs. ha^{-1})	Benefit cost ratio
T_1: 20:20:10 N:P_2O_5:K_2O kg ha^{-1}	841	1786	29425	9547	1.48
T_2: 20:20:20 N:P_2O_5:K_2O kg ha^{-1}	850	1875	29769	9624	1.47
T_3: 20:30:10 N:P_2O_5:K_2O kg ha^{-1}	873	1910	30541	10210	1.50
T_4: 20:30:20 N:P_2O_5:K_2O kg ha^{-1}	918	2142	32114	11517	1.55
T_5: 40:20:10 N:P_2O_5:K_2O kg ha^{-1}	911	2033	31889	11774	1.58
T_6: 40:20:20 N:P_2O_5:K_2O kg ha^{-1}	914	2122	31975	11594	1.56
T_7: 40:30:10 N:P_2O_5:K_2O kg ha^{-1}	934	2215	32684	12117	1.58
T_8: 40:30:20 N:P_2O_5:K_2O kg ha^{-1}	1044	2488	36538	15704	1.75
T_9: 60:20:10 N:P_2O_5:K_2O kg ha^{-1}	935	2370	32719	12368	1.60
T_{10}: 60:20:20 N:P_2O_5:K_2O kg ha^{-1}	1066	2575	37316	16698	1.80
T_{11}: 60:30:10 N:P_2O_5:K_2O kg ha^{-1}	1078	2799	37340	16936	1.81
T_{12}: 60:30:20 N:P_2O_5:K_2O kg ha^{-1}	1295	3131	45310	24240	2.15
T_{13}: 40:20:0 N:P_2O_5:K_2O kg ha^{-1}	903	1994	31612	11764	1.59
T_{14}: Control	762	1682	26678	8208	1.44
S. Em±	65.85	146.28	-	-	-
CD at 5%	199.75	443.76	-	-	-

Economics
Economics is the ultimate criteria for acceptance or rejection and wider adoption of any technology (Table 1). Among the various treatments application of application of 60 kg N ha^{-1} + 30 kg P_2O_5 ha^{-1} + 20 kg K_2O ha^{-1} has recorded higher gross returns of Rs. 45310, net returns of Rs. 24240 with benefit: cost ratio (2.15) compared to other treatments. This was attributed due to higher nutrient uptake and efficient use of nutrients which resulted in higher grain. The lowest B:C ratio (1.44) was obtained in the control.

Conclusion
Application of 60 kg N ha^{-1} + 30 kg P_2O_5 ha^{-1} + 20 kg K_2O ha^{-1} has shown higher grain, straw yield, gross returns, net returns and B:C ratio in Browntop millet.

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