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Response of nutrient management on growth and yield attributes of Brown top millet [*Brachiaria ramose*] in red sandy soil

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Abstract

The study was conducted during lait *Rabi* 2019-20 at ICAR- Krishi Vigyan Kendra, Haveri to Effect of nutrient Management on growth and yield of Brown top millet. The experiment was laid out in RCBD comprising of eight treatments replicated thrice. Studies revealed that the growth parameters, yield attributes and grain yield of Brown top millet differed significantly due to foliar application of NPK along with RDF and soil application of micronutrients along with RDF. The results indicated that the application of RDF + FYM 6t/ha + foliar nutrition of 19:19:19 @ 2% at 30 and 45 DAS recorded significantly higher plant height (69.75cm), number of tillers per plant and number of grains per plant (436) at harvest over the other nutrient levels. And also on par with Foliar nutrition of 19:19:19 @ 2% at 30 and 45 DAS + FYM 6 t/ha) In grain yield (7.65 q /ha) and straw yield (14.52 q/ha) recorded significant higher with application of T5 and also on par with RDF of crop + FYM 6 t/ha) over the other treatments levels. The gross returns, net returns and BC ratio were also higher with the same treatments (Rs37865, Rs.21365 and 2.39 respectively) as compared to all other treatments and absolute control.

Keywords: Brown top millet, nutrients, growth and yield

Introduction

Challenges in 21st century like climate changes, water scarcity, increasing world population, rising food prices, and other socioeconomic impacts are main threat to agriculture and food security worldwide, especially for the poor. Hence there is need of alternative nutritive food source. Millets refers to small seeded grasses that are cultivated as grain crops grown on dry regions of temperate, tropical and subtropical situations. Small millets grown in Asia and Africa. Indian subcontinent and the regions from Southern margin of Sahara to the Ethiopian high lands of Africa (Kimata *et al*., 200) [7]. Millets often referred as positive crops, are major food sources of people of arid and semi-arid regions of the world. They are also considered as the positive crops for the dry and rainfed situations. Millets can be used for food, feed and fodder, and they can be used as raw material for industries. Millets are staple food of Asia and African countries. The major millets are sorghum and bajra and other crops referred as minor millets like finger millet, little millet, proso millet, brown top millet, barnyard millet, kodo millet and foxtail millet. These millets referred as "coarse grains" or "poor man's crops". They are not usually traded in the international markets or even in local markets in many countries. The millets are the hardest grains and can sustain and flourish even in the most adverse agro-climates with poorest quality soil, minimum water, most in drought conditions and lastly, the minimum care and management practices compared to wheat and paddy crops.

Millets have superior quality of nutrients when compared to cereals. Finger millet has slightly lower protein content and less fat. Lowest carbohydrate content recorded in barnyard and (Madella *et al.*, 2013) [9]. Millet have higher mineral content. They are rich in iron and phosphorus. Among all the millets finger millet has highest calcium content. Outer bran layer of the grain contains B complex vitamins. Millets contain slightly high amount of anti nutritional factors when compared to rice and wheat. But these anti nutritional factors are plant based phyto chemicals that possess therapeutic qualities and hence are recommended for various degenerative diseases such as diabetes and hypertension (Yenagi *et al.*, 2003).Millets are staple food in some part of Karnataka. Farmers are reviving cultivation of brown top millet, minor millet which can be grown on low fertile soils with limited water. Besides being an answer to climate change crisis, brown top millet has high nutrition content could also be an answer the malnutrition among the rural poor and lifestyle. Browntop millet is one of the rarest millet crop among all the millets. Browntop millet (*Panicum ramosum*) is a native of India. It grows well in the dry regions of Karnataka-Andhra Pradesh areas, covering Tumkur, Chitradurga and Chikkaballapura bellari districts in Karnataka and Andhra Pradesh.

Browntop millet is hardy and heat tolerant crop, and tolerant to drought but can also grow low areas of flooded. The crop grows well even shaded condition also and can grow under tamarind trees. The crop survives under arid conditions and has the potential to spread widely because of its rich nutritional value as well as its ability to adapt to climate change. It can be planted in mid-April until mid-August; later plantings will result in lower yields. It can be planted either as a sole crop or in combination with other seasonal crops. It is also an excellent choice when combined with other millets. In fact, redgram is grown as a mixed crop for every 12 rows of browntop millet. The productivity of brown top millet can be increased by applying of fertilizers. The presence of organic manure along with inorganic fertilizers helps in better availability of nutrients and moisture. For that reason this research was undertaken to find out an effect of nutrient Management on Growth and yield of Brown top millet.

Materials and Methods

The experiment was carried out at Hanumanamatti ICAR-KVK,Haveri of UAS, Dharwad (Karnataka state) during lait *rabi* season, 2019-20, which is located at 25º 40' 94" N latitude and 81^{0} 85' 35" E longitude of 980 meter above mean sea level (MSL). This region comes under the Northern Transitional Zone (Zone 8) of Karnataka. Red sandy loam is the predominate soil of this region. The initial soil estimation revealed that soil was acidic in reaction (pH-5.36), low in organic carbon (3.61 g kg^{-1}), available nitrogen (226.20 kg ha^{-1}) and potassium (121.35 kg ha^{-1}) and medium in available phosphorous (26.57 kg ha^{-1}) (Table.1). The annual rainfall received during the cropping season was 1276.40 mm, which was 26.47 per cent higher than the average annual rainfall of the past 38 years (560 mm). The field experiment with Brow millet variety IIMR-Y-II having duration of 80-90 days was conducted in randomized block design with eight treatments (T_{1}-Control (No Fertilizer), T_{2}-RDF of Finger millet Crop (30:15:15: ha-1),,T_{3}-Foliar nutrition of 19:19:19 @ 2% at 30 and 45 DAS,T_{4}-,RDF of Foxtail millet + Foliar nutrition of 19:19:19 @ 2% at 30 and 45 DAS,T_{5}-RDF of Foxtail millet + Foliar nutrition of 19:19:19 @ 2% at 30 and 45 DAS + 10 kg Zn So_4 ha^{-1},T_{6}-RDF of Foxtail millet + Foliar nutrition of 19:19:19 @ 2% at 30 and 45 DAS + 5 kg Borax ha^{1},T_{7}-RDF of Foxtail millet + Foliar nutrition of 19:19:19 @ 2% at 30 and 45 DAS + 10 kg Zn So_4 ha^{-1} + 5 kg Borax ha^{-1}) with gross plot size 3.0 X 4.5 m with plant spacing 45 X 10 cm. *Liat* 2019-20 Season. Five plants from each plot were selected at random and recorded the observations. Plant height was measured at 30 and 60 days after sowing and at harvest, from the ground level to the base of the node on which the first fully opened leaf from the top and expressed in centimetre. The length of panicle was measured from the same sample of five randomly selected plants from each plot. It was measured from the neck to the tip of the ear heads and the average was computed. Grains from the harvested panicles of each plot of five plants were separated by threshing and weight was measured. The average weight of grains per panicle was computed. The net plots (leaving two borders on each side of the plot, 0.5 meters from each side of the plot) were harvested and sun dried for 3 days in the field and then the total biomass yield was recorded. After threshing, cleaning and drying, the grain yield was recorded and reported at 12 per cent moisture content. The straw yield was obtained by subtracting grain yield with total biomass yield and yield was expressed in q ha^{-1}.

Table 1: Initial soil properties of experimental plot at ICAR-KVK, Hanumanamatti

Parameters	Value	Status
pH (1:2.5)	6.56	Neutral
EC (dS/m)	0.40	Normal
OC(%)	0.42	Low
Available N(kg ha^{-1})	220	Low
Available P_2O_5(kg ha^{-1})	16.25	Low
Available P(kg ha^{-1})	7.40	Low
Available K2O(kg ha-1)	162.0	Medium
Available Zn (ppm)	0.45	Deficient
Available Fe (ppm)	2.15	Deficient

Result

Application of RDF alone to most crops is not sufficient to meet their demand. Soils deficient in micronutrients need external application and foliar application of NPK is also sometimes essential (Table 1). The data given in tables 2 and 3 indicated the importance of the study on integrated use of different sources of nutrients. Nutrients are known to cause physiological and biochemical processes in the plants that are essential for plant growth and development, eventually resulting in substantial yield improvement. Among the application of major nutrients, millets are much responsive to nitrogen and potassium as compared to phosphorous application, as seen in lower uptake by the plant (Shankar, 2017) [11]. It was found to influence significantly the plant height, panicle length, grain per panicle, grain yield and straw yield of Brown top millet. There was a significant increase in plant height of Brown top millet in field observation at different intervals of crop growth) due to the application of different sources of integrated use of fertilizers along with recommended dose of fertilizers (RDF).

The results of the present investigation revealed that the application of RDF of Foxtail millet + Foliar nutrition of 19:19:19 @ 2% at 30 and 45 DAS + 10 kg Zn So_4 ha^{-1} + 5 kg Borax ha^{-1} recorded significantly higher plant height (66.28 cm), number of tillers per plant (7.42) and number of grains per plant (435) at harvest over the other nutrient levels (Table-2). This is because more and liberal availability of nutrients under sufficient moisture regime throughout the crop duration coupled with sufficient solar radiation, created a favourable environment for higher metabolic activity of the plant at higher levels of nutrients. This is attributed to efficient photosynthetic structure that supported a greater synthesis, accumulation, partitioning and translocation of photosynthates to different parts of the plants. This helped in better growth and development of the crop. This production and translocation of synthesized photosynthates depends upon mineral nutrition supplied. Similar observations were concluded by Shankar (2017) [11]. And Ambresha (2017) [1]. In little millet and foxtail millet, respectively. These results agree with the findings of Chittapur *et al.*, (1994) [3]. And Hanumantha Rao *et al.*, (1982) [5].

Grain yield is the functions of several yield attributing characters *viz*., number of productive tillers/m2, number of filled grains/ear head and 1,000 grain weight (g). The cumulative effect of all growth, physiological and yield attributing characters were reflected on grain yield. From the pooled data, it was perceived that grain yield also followed the similar trend like number of productive tillers/m2 and number of filled grains/earhead, and significantly influenced by different sources of NPK and method and doses of micronutrients and their interactions were found to be nonexpressive (Table 4).RDF of Foxtail millet + Foliar nutrition of 19:19:19 @ 2% at 30 and 45 DAS + 10 kg Zn So4 ha-1 (T_5) and -RDF of Foxtail millet + Foliar nutrition of 19:19:19 @ 2% at 30 and 45 DAS + 5 kg Borax ha1 (T_6). Grain yield (7.60 q ha-1), Straw yield (14.57q ha-1), Biological yield (22.26q ha-1) and Economics like Gross return (Rs 37865 ha-1), Net return (Rs 21365 ha-1) and B:C ratio (2.39) also same trend followed over the control. Maximum yield was obtained from the treatment plot, where B was applied as a foliar spray. An increase in yield might be due to foliar spray of B and this improvement was attributed to direct absorption of B from aerial parts of plants (Mohsin *et al*., 2014 [8] and Das *et al*., 2015) [4]. Increased grain yield by application of B might be the direct effect of higher number of grains/earhead due to reduced panicle sterility by B application appreciably. Higher yields were found with foliar spray than soil application due to the fact that B application had been done just before panicle initiation as B nutrition is more important during the reproductive stage as compared to the vegetative stage of the crop (Hussain, *et al*., 2012 [6] and Reddey *et al*., 2018 [10]). In conclusion from the results of the present investigation, keeping in view of brown top millet crop growth, yield attributes and yield, it might be concluded that combination of organic and inorganic nutrient sources (soil and foliar application) proved to be beneficial resulting in significantly higher crop yield and addition of micronutrients. Application of RDF with FYM 6t/ha and foliar nutrition of 19:19:19 @ 2% at 30 and 45 DAS (T5) recorded significantly higher growth and yield parameter. Sole application foliar nutrition of 19:19:19 @ 2% with soil application Zn as well as B proved to be inferior to the combined application of both the micronutrients (Zn and B).So, organic and inorganic combination of NPK (100% RDF + 2.5 t/ha FYM) along with foliar application of both the micronutrients (Zn and B) together can boost up the yield.

Table 2: Response of nutrient management on growth and yield attributes of Brown top millet

Treatments	Plant height (cm) at harvest	No. of Tillers plant-1 at harvest	No. of Grains plant-1	Test weight (g)	Grain Yield (q ha-1)	Straw yield (q ha-1)
T_1-Control (No Fertilizer)	41.28	4.85	340	2.42	3.95	7.85
T_2- RDF of Finger millet Crop (30:15:15: ha-1)	57.80	6.88	401	2.80	6.80	13.92
T_3 -Foliar nutrition of 19:19:19 @ 2% at 30 and 45 DAS	49.21	5.52	378	2.79	4.85	11.80
T_4-RDF of Foxtail millet + Foliar nutrition of 19:19:19 @ 2% at 30 and 45 DAS	57.89	7.00	410	2.88	6.88	14.00
T_5-RDF of Foxtail millet + Foliar nutrition of 19:19:19 @ 2% at 30 and 45 DAS + 10 kg Zn So4 ha-1	60.23	7.10	415	3.00	7.20	14.28
T_6-RDF of Foxtail millet + Foliar nutrition of 19:19:19 @ 2% at 30 and 45 DAS + 5 kg Borax ha1	64.23	7.37	430	3.08	7.38	14.33
T_7- RDF of Foxtail millet + Foliar nutrition of 19:19:19 @ 2% at 30 and 45 DAS + 10 kg Zn So4 ha-1 + 5 kg Borax ha-1	66.28	7.42	436	3.12	7.60	14.66
S.Em±	1.94	0.10	8.42	0.09	0.14	0.53
CD (P=0.05)	6.44	0.33	22.40	NS	0.48	0.38

Table 3: Response of nutrient management on Biological yield and Economics of Brown top millet

Treatments	Biological yield (q/ha)	Gross Returns (Rs/h)	Net Returns (Rs/h)	B:C ratio
T_1-Control (No Fertilizer)	11.80	19738	10488	1.74
T_2- RDF of Finger millet Crop (30:15:15: ha-1)	20.72	34080	19580	2.35
T_3 -Foliar nutrition of 19:19:19 @ 2% at 30 and 45 DAS	16.65	24775	14525	2.42
T_4-RDF of Foxtail millet + Foliar nutrition of 19:19:19 @ 2% at 30 and 45 DAS	20.88	34460	19210	2.26
T_5-RDF of Foxtail millet + Foliar nutrition of 19:19:19 @ 2% at 30 and 45 DAS + 10 kg Zn So4 ha-1	21.48	35970	19470	2.18
T_6-RDF of Foxtail millet + Foliar nutrition of 19:19:19 @ 2% at 30 and 45 DAS + 5 kg Borax ha1	21.71	36793	20543	2.24
T_7- RDF of Foxtail millet + Foliar nutrition of 19:19:19 @ 2% at 30 and 45 DAS + 10 kg Zn So4 ha-1 + 5 kg Borax ha-1	22.26	37865	21365	2.39
S.Em±	0.24	632.8	627.1	0.04
CD (P=0.05)	0.83	1928.1	1903.3	0.17

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