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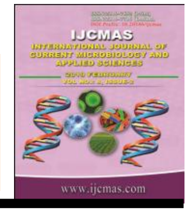

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Effect of Different Nitrogen Levels and Plant Geometry on Yield and Nutrient Uptake by Brown Top Millet [*Brachiaria ramosa* (L.)]

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Experiment was conducted during *Kharif* season 2018 at New Upland Research Station cum Instructional Farm, Lamker under SG college of Agriculture and Research Station, Jagdalpur, Bastar (CG). The experiment was laid out in split plot design with three replications. Main plot was three levels of fertilizer *i.e.* F_1 (75% RDF), F_2 (100% RDF) and F_3 (125% RDF), and sub plot was four different spacing *viz.* S_1 (22.5 x 10 cm), S_2 (30 x 10 cm), S_3 (45 x 10 cm) and S_4 (60 x 10 cm). Grain yield, fodder yield per plot and per ha was recorded significantly highest in F3 among fertility levels. In case of different planting geometry, S4 recorded significantly higher grain yield but it was at par with S3 and S2. Fodder yield recorded significantly maximum in treatment S1 which was on par with S2 and S3. NPK content in grain and straw recorded significantly higher in treatment F3 (125% RDF) but it was on par with F2 (100% RDF) in N and P content in grain. In case of different planting geometry, S4 (60 x 10 cm) recorded statistically higher P content in straw which was at par with treatment S3.Treatment F3 recorded significantly higher NPK uptake in grain, straw and total uptake among fertility treatments but in case of different geometry, S4 recorded higher NK uptake in grain which was on par with S3 and S2.

Introduction

Brown top millet [*Brachiaria ramosa* (L.) Stapf; *Panicum ramosum* L.] is an introduced annual grass that originated in South-East Asia. It is grown in Africa, Arabia, China and Australia, Clayton *et al.*, (2006). It was introduced to the United States from India in 1915 (Oelke *et al.*, 1990). In the US, it is mainly grown in the South-East for hay, pasture and game bird feed. The browntop millet, called korale in Kannada, is specially grown in rainfed tracts of Tumakuru, Chitradurga and Chikkaballapura districts of Karnataka state. The crop is popular in this region in terms of cultivation and consumption. This millet seed is grown in a variety of soils and climates. Like other millets, it is a hardy crop and well suited for dry land (Bhat *et al.*, 2018). Brown top millet is an annual warm-season species that grows 1 to 3 ft tall. The smooth stems have pubescent nodes and may stand erect or ascend from a decumbent base. The leaves are 2.2 to 18cm long and 6-18mm wide; both surfaces are smooth. The inflorescence is indeterminate, open, spreading with simple axis and stalked flowers. It has 3-15 inflorescences and white flowers. Seeds are ellipsoid and tan in colour; they mature in approximately 60 days (Sheahan 2014). Brown top millet, which goes by the scientific name *Brachiaria ramosa* (L.) Stapf. or *Urochloa ramosa* (L.) R.D. Webster is known locally as pedda-sama and korne, and has a limited cultivation largely confined to southern India. Domestic and wild/weedy forms of brown top millet are found in agricultural systems, often within the same field. It is used as both a human food crop and fodder. Outside of India, it is grown in some parts of the USA as a fodder crop, largely to provide food for game birds, and was introduced from India around 1915. Although its distribution is highly relict today, restricted to parts remote parts of Andhra Pradesh, Karnataka, and Tamil Nadu states in southern India (Kimata *et al.,* 2000), it appears to have been a major staple crop in the late prehistory of the wider region of the Deccan (Fuller *et al.,* 2004). Panicle is distinct from Setaria by being looser and non-bristly, the grains themselves are very similar. Grains are ovate to round and have a long embryo, roughly two thirds to three fourths of the length of the grain. They tend to be smaller than *Setaria italica* and squatter in cross section. The surface of well-preserved grains can be used for identification as these have a distinctive undulating pattern, although this again has similarities to *S. italica* (Fuller *et al.,* 2004). The husk has a fine beaded and rugose pattern, which again has some resemblance to that of *Setaria spp.,* but it is somewhat coarser than *S. italica* and finer than. *S. verticillata* (https://www.researchgate.net/publication/286351352). 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. Besides these, other advantages are reduction in seed rate, easy inter cultivation, better weed management and drip irrigation can also be adopted by providing wider spacing than the conventional method of planting (Prakasha *et al.,* 2018). The present investigation was taken to develop a suitable nutrient management packages under upland condition. For that reason this research was undertaken to find out an optimum level of chemical fertilizer like urea and Di-Ammonium Phosphate (DAP) that can maximize growth characters, fodder and grain yield production of brown top millet under climatic and soil conditions of Bastar Plateau Zone of Chhattisgarh, India.

Materials and Methods

Experiment was conducted during Kharif season 2018 at New Upland Research Station cum Instructional Farm, Lamker under SG college of Agriculture and Research Station, Jagdalpur, Bastar, CG. The experiment was laid out in split plot design with three replications. Main plot was three levels of fertilizer ie. F1 (75% RDF), F2 (100% RDF) and F3 (125% RDF), and sub plot was four different spacing viz. S1 (22.5 x 10 cm), S2 (30 x 10 cm), S3 (45 x 10 cm) and S4 (60 x 10 cm). Recommended dose of fertilizer was 40:20:00 kg N: P: K kg ha^{-1}. The soil was stony and calcareous in texture, low in organic carbon (0.48%). available N (213.4 kg ha^{-1}), available phosphorus (12.50 kg ha^{-1}) and medium in available potassium (228.6kg ha-1) with soil reaction (pH 5.5). Olsen’s method (Watanabe and Olsen, 1965), Neutral normal Ammonium Acetate extract using flame photometer (Hanway and Heidel, 1952) and Walkely and Black method (Jackson, 1967) for the determination of available nitrogen (N), phosphorus (P_2O_5) potassium (K_2O) and organic carbon, respectively. The pH of experimental site was determined through 1:2.5 soil and water suspension method (Jackson, 1967).Weather during *kharif* 2018 weekly pattern of different meteorological parameters are shown in figure 1 during *kharif* 2018. Total 1386.50 mm rainfall was recorded against the normal rain fall of 1414.92 mm. Monsoon was active during 24^{th} SMW and received 26.04 mm water with two rainy days. Maximum rainfall was received during 29^{th} SMW (130.7mm with 4 rainy days), 32^{th} SMW (109.9mm with 5 rainy days), 33^{th} SMW (152.7mm with 5 rainy days) and 38^{th} SMW (175.7 mm with 6 rainy days). During cropping season maximum temperature was 34.5^{o}C on 22^{nd} SMW and minimum temperature was recorded 20.40^{o}C on 38^{th} SMW. The data obtained on various parameters were tabulated and subjected to statistical analysis. The difference of treatment was tested with F test, where F test shown their significance, the level of treatment were compared by critical difference at 5% level of probability. The skeleton of analysis of variance and formula used for various estimations are given by Gomez and Gomez (1984).

Data recorded on different parameters are presented in Table 1. Data revealed that grain yield, fodder yield per plot and per ha was recorded significantly highest in F3 (125% RDF) among fertility levels. In case of different planting geometry, S4 (60 x 10 cm) recorded significantly higher grain yield but it was at par with S3 (45 x 10 cm) and S2 (30 x 10 cm). Fodder yield recorded significantly maximum in treatment S1 (22.5 x 10 cm) which was on par with S2 (30 x 10 cm) and S3 (45 x 10 cm). The higher number of tillers at wider spacing intercepted more of solar radiation, water and increased nutrient availability helped to produce significantly higher number of tillers. Again less competition between plants due to wider space allowed the individual plants to develop massive root system. Better aeration at wider spacing resulted in healthy plant growth with higher yield (Prakasha *et al.,* 2018). These results are in conformity with the findings of Narasimhamurthy and Hedge, (1981).

NPK content in grain and straw recorded in Table 2. The data shows that NPK content in grain and straw recorded significantly higher in treatment F3 (125% RDF) but it was on par with F2 (100% RDF) in N and P content in grain. In case of different planting geometry, S4 (60 x 10 cm) recorded statistically higher P content in straw which was at par with treatment S3; remaining treatments were found no significant result Table 3. It might be due to more dry matter production by crop and less nutrient depletion due to better management practices and subsequently more availability of nutrients to crop. These findings corroborate with those of Mukherjee (2008) and Gupta *et al.,* (2007).

NPK uptake in grain, straw and total NPK uptake by brown top millet was recorded in Table 2 and 3. The data reveals that treatment F3 (125% RDF) recorded significantly higher NPK uptake in grain, straw and total uptake among fertility treatments but in case of different geometry, S4 (60 x 10 cm) recorded higher NK uptake in grain which was on par with S3 (45 x 10 cm) and S2 (30 x 10 cm). N and K uptake in straw was found higher in treatment S1 (22.5 x 10 cm) which was at par with S2 (30 x 10 cm) and S3 (45 x 10 cm), and P uptake in grain and straw, and total NPK uptake in plant was found no significant result during experimentation. Higher nutrient content in the produce and higher biomass production of finger millet might be the pertinent reason for higher uptake of nutrients. These results also reported by Mehta *et al.,* (2005), Singh *et al.,* (2011) and Sujatha *et al.,* (2008).

Table.1 Effect of different grain and straw yield of brown top millet

Treatment	Grain weight plot^{-1} (kg)	Fodder yield plot^{-1} (kg)	Test weight (g)	Grain Yield (q ha^{-1})	Straw yield (q ha^{-1})
F1	1.63	3.53	2.88	7.10	15.58
F2	1.69	3.68	2.81	7.45	16.21
F3	1.76	4.16	2.97	8.17	18.32
SEm±	0.02	0.01	0.09	*0.10*	*0.44*
CD at 5%	0.10	0.40	NS	*0.42*	*1.77*
CV%	4.94	9.03	10.72	*4.86*	*9.12*
S1	1.58	4.43	2.70	6.97	19.53
S2	1.70	3.83	2.98	7.51	16.88
S3	1.73	3.77	3.00	7.61	16.64
S4	1.77	3.12	2.88	7.79	13.77
SEm±	*0.04*	*0.24*	*0.1*	*0.16*	*1.06*
CD at 5%	*0.11*	*0.72*	*NS*	*0.48*	*3.18*
CV%	*6.46*	*19.09*	*9.85*	*9.95*	*19.09*

F_1-75% RDF, F_2-100% RDF, F_3-125% RDF, S_1-22.5 x 10 cm, S_2-30x10, S_3-45 x 10 cm and S_4-60 x 10 cm

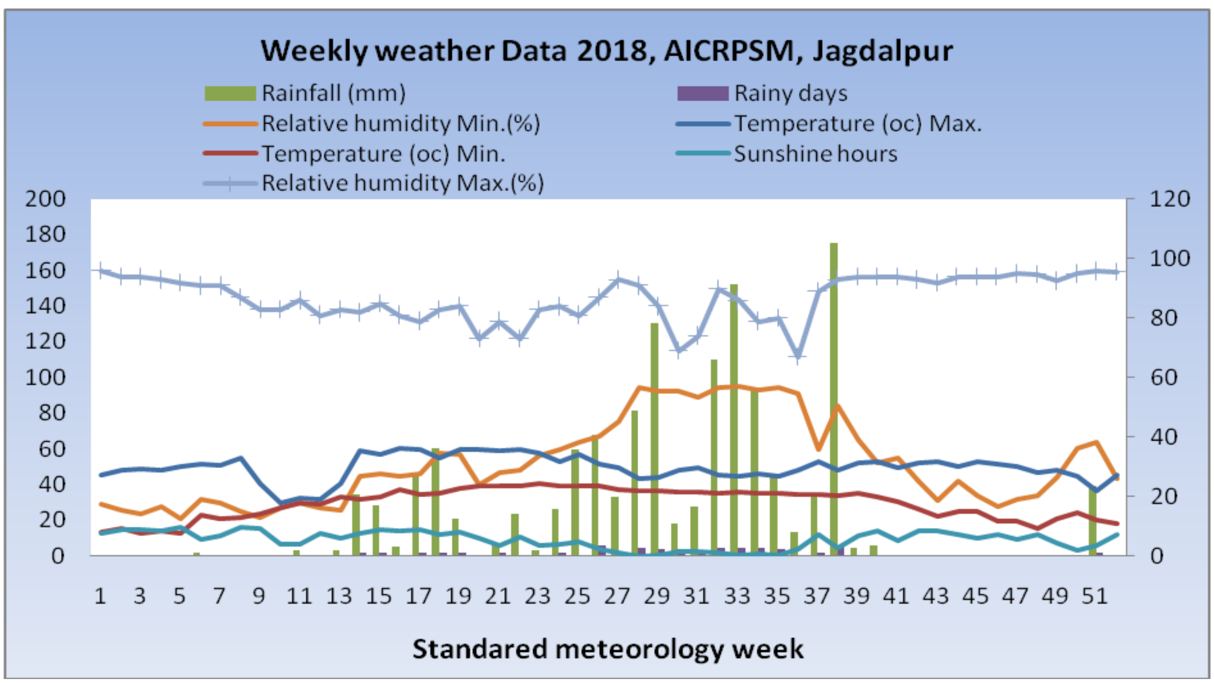
Table.2 NPK content and uptake by grain, straw in brown top millet

Treatment	NPK content in grain (%)			NPK content in straw (%)			NPK uptake in grain (kg)		
	N	P	K	N	P	K	N	P	K
F1	1.53	0.203	0.418	0.322	0.204	0.679	11.02	3.017	4.98
F2	1.61	0.231	0.438	0.347	0.266	0.708	11.10	3.275	5.283
F3	1.63	0.247	0.485	0.384	0.298	0.738	12.67	3.773	5.729
SEm±	*0.01*	*0.008*	0.010	*0.003*	*0.007*	*0.005*	*0.22*	*0.104*	*0.104*
CD at 5%	*0.03*	*0.033*	0.040	*0.013*	*0.030*	*0.019*	0.88	*0.420*	*0.418*
CV%	*1.99*	*13.93*	*7.07*		*6.249*		6.33	10.75	6.77
S1	1.57	0.224	0.440	0.336	0.241	0.692	10.95	3.077	4.840
S2	1.58	0.223	0.436	0.347	0.252	0.707	11.88	3.283	5.314
S3	1.61	0.227	0.454	0.357	0.260	0.712	12.26	3.467	5.429
S4	1.60	0.233	0.459	0.364	0.271	0.722	12.50	3.592	5.630
SEm±	*0.03*	*0.008*	*0.013*	*0.009*	*0.005*	*0.011*	*0.35*	*0.142*	*0.148*
CD at 5%	*NS*	*NS*	*NS*	*NS*	*0.015*	*NS*	*1.06*	*NS*	*0.444*
CV%	*4.87*	*13.93*	*10.00*		*1.976*		*8.92*	*12.75*	*8.39*

Table.3 NPK uptake by grain, straw and total NPK uptake by plant (brown top millet)

Treatment	NPK uptake in straw (kg)			Total NPK uptake plant (kg)		
	N	P	K	N	P	K
F1	4.982	3.154	10.563	16.00	6.17	15.46
F2	5.613	4.293	11.461	17.59	7.57	16.75
F3	6.980	5.468	13.476	19.68	9.24	19.20
SEm±	*0.191*	*0.187*	0.246	*0.23*	*0.16*	*0.221*
CD at 5%	*0.768*	*0.756*	0.993	*0.94*	*0.66*	*0.89*
CV%	***11.27***	***13.81***	***7.21***	**4.56**	***7.43***	***4.46***
S1	6.569	4.752	13.516	17.51	7.83	18.36
S2	5.859	4.321	11.981	17.74	7.60	17.30
S3	5.987	4.422	11.919	18.25	7.89	17.35
S4	5.019	3.723	9.918	17.52	7.31	15.54
SEm±	*0.401*	*0.317*	*0.782*	*0.42*	*0.27*	*0.77*
CD at 5%	*0.768*	*NS*	*2.341*	*NS*	*NS*	*NS*
CV%	***20.55***	***20.22***	***19.82***	***7.01***	***10.72***	***13.52***

Fig.1 Weekly weather data 2018



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