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Quality of finger millet as influenced by nitrogen levels and genotypes

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ABSTRACT
The experiment was conducted at Birsa Agricultural University Farm Ranchi, during kharif (rainy) season of 2009. The experiment was conducted in Randomized Block Design with three replications and twenty treatment combinations consisting of four nitrogen levels (0, 20, 40 and 60 kg N/ha) and five medium duration finger millet genotypes (TNAU-1022, OEB-219, KMR-204, RAU-8 and BM-2). Finger millet genotypes respond positively to nitrogen levels and application of 40 kg N/ha manifested significantly higher grain yield (20.71q/ha) and straw yield (54.12q/ha) of finger millet also improved significantly only upto 60 kg N/ha resulting is significantly higher protein content and nutrient uptake. Among genotypes, BM-2 was found superior to rest of the genotypes except RAU-8 which was comparable to BM-2. Genotype BM-2 has outstanding performance in respect grain yield (19.54 q/ha) and straw yield (52.44 q/ha).
Key words : *Nitrogen uptake, protein, Varieties, and finger millet.*

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INTRODUCTION

Finger millet contains 9.2 per cent protein, 76.32 per cent carbohydrates, 6.24 per cent minerals and 3.6 per cent fiber. No finer cereal is as rich as finger millet in its nutritive qualities. It is good for person suffering from diabeties. These millet are with high fiber content, protein quality and mineral composition contribute significantly to their nutritional security of some of the most disadvantaged groups of people. Finger millet can be considered superior to 'super cereals'. Nitrogen being as essential constituent of protein, plays an important role in increasing protein content in grain. Results obtained clearly revealed that protein content in grain increased as the nitrogen levels increased. At higher levels of nitrogen, phosphorus and potassium content in grain of finger millet was also higher which improves the grain quality. Muthuvel and Krishnamurthy [3] also reported that N content in grain increased with increasing rates of applied nitrogen. The increase in phosphorus and potassium content with increasing nitrogen levels might be due to the synergistic effect of added nitrogen with the utilization of phosphorus and potassium by finger millet plant. Increase in protein content might be attributed to the fact that after application most of the soil nitrogen by passes the leaves and is directly translocated as amides and amino acids from the roots to the developing grain [2]. The increase in protein content in grain with increasing fertility level may be attributed to high nitrogen content in seed. There is direct relationship between nitrogen and protein content of plant because protein molecules are build up through systematically controlled condensation of amino acid molecules in combination with derivatives of carbohydrate obtained as a product of photosynthesis. Accumulation of protein in grain may be increased due to continuous nitrogen supply for protein synthesis and its translocation to the grain which improves the grain quality. However increasing levels of nitrogen increased protein content in grain and was significant.

MATERIALS AND METHODS

The experiment was conducted during kharif (rainy) season of 2009 at Birsa Agricultural University Farm Ranchi, on a representative upland sandy loam soil in texture and acidic in reaction pH (5.30) with poor fertility organic carbon (0.30%), available nitrogen (182.2kg/ha) phosphorus(8.96 kg/ha) and potassium (92.70 kg/ha) representing major soil group of Jharkhand. The total annual rainfall of about 1350 mm, 85 percent is of which received between mid June to mid September. The experiment was laid out in randomized block design comprising twenty treatment combination replicated thrice. Under this investigation, four levels of nitrogen (0, 20, 40 and 60kg N/ha) with five medium duration finger millet new genotype (V_1-TNAU-1022, V_2-OEB-219, V_3-KMR-204, V_4-RAU-8 andV_5-BM-2). The details of the treatment combination are enlisted below: T_1 - V_1N_0, T_2 - V_1N_{20}, T_3 - V_1N_{40}, T_4 - V_1N_{60}, T_5 - V_2N_0, T_6 - V_2N_{20}, T_7 - V_2N_{40}, T_8 - V_2N_{60}, T_9 – V_3N_0, T_{10} – V_3N_{20}, T_{11} – V_3N_{40}, T_{12} – V_3N_{60}, T_{13} – V_4N_0, T_{14} - V4 N_{20}, T_{15} – V_4N_{40}, T_{16} – V_4N_{60}, T_{17} – V_5N_0, T_{18} - V_5N_{20}, T_{19} – V_5N_{40} and T_{20} –V_5N_{60} . The experimental plot was ploughed with tractor drawn disc plough followed by harrowing and planking. Finger millet was sown at 30 cm row spacing with seed rate of 10 kg/ha in the first week of July (4^{th}). The soil was treated with BHC 10% dust at the rate of 25 kg/ha to guard against termite. In finger millet, full dose of 40 kg P_2O_5 and 25 kg K_2O/ha along with half dose of nitrogen as per treatment was applied at the time of sowing. Remaining half dose of nitrogen was applied after weeding (30 days after sowing) as per treatment. One interculturing operation at 15 days and one hand weeding at 30 days after sowing was done.

RESULTS AND DISCUSSION

Protein yield (kg/ha): Data pertaining to protein yield (Table-1) revealed that the maximum protein yield (153.89 kg/ha) was obtained at 60 kg N/ha which was statistically alike to 40 kg N/ha (142.88 kg/ha) but significantly superior to rest of the treatments. Similarly, data further revealed that variation in protein yield in grain due to different genotypes were statistically alike to each other. However, higher protein yield (133.51 kg/ha) was recorded with RAU-8 which was followed by BM-2 (132.73 kg/ha). The lowest protein yield (110.65 kg/ha) was observed with OEB-219.

Protein content(%) in grain: Data on protein content in grain as affected by nitrogen levels and genotypes have been presented in (Table-1)showed that protein content in grain improved significantly due to nitrogen levels. The significant improvement in protein content in grain of finger millet was observed upto 40 kg N/ha. Further increase in nitrogen levels failed to cause significant improvement in protein content of grain. Singh & Verma (1999) reported that increasing N rate increased the protein content in grain. Data further revealed that variation in protein content in grain due to different genotypes were significant. However, RAU-8 recorded maximum protein content (10.09%) in grain while, the lowest protein content in grain was found in TNAU-1022 (9.75%).

Table -1Grain quality of finger millet, as influenced by nitrogen levels and genotypes.

Nitrogen levels (kg/ha)	Protein yield (kg/ha)	Total major nutrient uptakes (kg /ha)			
		Protein	Nitrogen	Phosphorus	Potassium
0	81.25	8.99	37.34	5.98	57.76
20	120.55	9.87	56.79	9.09	73.85
40	142.88	10.28	68.52	11.19	84.59
60	153.89	10.54	74.03	12.20	92.37
SEm±	9.43	0.10	1.02	0.24	1.81
CD (P=0.05)	27.23	0.28	2.91	0.68	5.23
Genotypes					
TNAU-1022	123.46	9.75	58.20	9.49	77.36
OEB-219	110.65	9.86	55.04	8.74	70.64
KMR-204	122.85	10.06	57.57	9.29	75.25
RAU-8	133.51	10.09	61.59	10.04	79.45
BM-2	132.73	9.84	63.47	10.51	83.01
SEm±	10.54	0.11	1.14	0.26	2.02
CD (P=0.05)	30.44	0.32	3.25	0.76	5.84
CV (%)	23.44	3.10	5.32	7.58	7.27

Total major nutrient uptake(kg/ha) by finger millet: Data pertaining to total major nutrient uptake (nitrogen, phosphorus and potassium) as affected by nitrogen levels and genotypes have been presented in (Table-1). Examination of data on nitrogen uptake revealed that nitrogen uptake differed significantly under different nitrogen levels. Nitrogen uptake of finger millet improved significantly with each increment in nitrogen levels and maximum nitrogen, phosphorus and potassium uptake (74.03, 12.20 and 92.37 kg/ha) was recorded at 60 kg N/ha which was significantly superior to rest of the treatments. This is in conformity with the findings of Singh and Verma [6] and Thippeswamy and Shivakumar [7] reported that N uptake was highest in grain compared to straw and confirmed our findings.
Scrutiny of the data revealed that different genotypes varied significantly in nitrogen uptake. The maximum nitrogen, phosphorus and potassium uptake (63.47, 10.51 and 83.01 kg/ha) was recorded with BM-2 which proved its distinct superiority over TNAU-1022, KMR-204 and OEB-219 but, remained at par to RAU-8. Similarly, finger millet genotype RAU-8 registered significantly higher nitrogen uptake over OEB-219 and KMR-204 but remained at par to TNAU-1022. The finger millet genotype TNAU-1022 and KMR-204 also recorded significantly higher nitrogen uptake over OEB-219 but comparable between themselves.
Yield (q/ha) of finger millet: The data pertaining to grain and straw yield (q/ha), as influenced by nitrogen levels and genotypes have been presented in (Table-2). The interaction effect of nitrogen level and genotypes on grain and straw yield and harvest index was not found significant. It is evident from the data (Table-2.) that nitrogen levels caused significant variation in grain yield. The grain yield of finger millet increased with increasing nitrogen levels and the maximum grain yield (21.68 q/ha)) was recorded at 60 kg N/ha. However, significant improvement in grain yield (20.71 q/ha) could be observed only upto 40 kg N/ha. There was an increase of about 48.93, 77.46 and 85.77 per cent in yield due to application of 20, 40 and 60 kg N/ha, respectively as compared to control. This is in conformity with the findings of Saini *et al.,* [5] and Roy *et al.,* [4]. A close examination of the data revealed that different genotypes varied significantly in grain yield. The maximum grain yield (19.54 q/ha) was recorded with BM-2 which proved its distinct superiority over TNAU-1022, KMR-204 and OEB-219 but, remained at par to RAU-8(18.53 q/ha). Similarly, finger millet genotype RAU-8 produced significantly higher yield over OEB-219 but remained at par to TNAU-1022 and KMR-204. However, the grain yield of TNAU-1022, KMR-204 and OEB-219 were comparable among themselves. There was an increase of 7.64, 5.31, 13.19 and19.36 percent in yield of TNAU-1022, KMR-204, RAU-8 and BM-2 over OEB-219 genotypes, respectively. Dubey and Shrivas [1 also supported the findings.

Table 1 Grain and straw yield (q/ha) of finger millet, as influenced by nitrogen levels and genotypes.

Genotypes	Grain yield (q/ha)						Straw yield (q/ha)				
	Nitrogen levels(kg/ha)						Nitrogen levels(kg/ha)				
	N_0	N_{20}	N_{40}	N_{60}	Mean		N_0	N_{20}	N_{40}	N_{60}	Mean
TNAU-1022	12.06	17.45	20.04	20.92	17.62		39.62	48.72	55.56	56.70	50.15
OEB-219	10.42	15.39	19.56	20.11	16.37		40.93	46.12	49.90	51.40	47.09
KMR-204	12.85	15.76	19.40	20.93	17.24		37.54	44.83	54.41	61.50	49.57
RAU-8	11.71	17.27	21.79	23.35	18.53		44.53	49.72	54.50	55.40	51.04
BM-2	11.29	21.01	22.75	23.10	19.54		41.33	52.92	56.25	59.25	52.44
Mean	11.67	17.38	20.71	21.68	-		40.79	48.46	54.12	56.85	-
	Nitrogen(N)	Genotypes (G)					Nitrogen(N)	Genotypes(G)			
SEm±	0.46	0.51					1.23	1.38			
CD (P=0.05)	1.32	1.47					3.56	3.98			
CV (%)	7.92						7.62				

Straw yield (q/ha): Straw yield of finger millet also affected significantly by nitrogen levels (Table-2). The maximum straw yield (56.85 q/ha) was recorded with 60 kg N/ha but significant improvement in straw yield (54.12 q/ha) was obtained only at 40 kg N/ha. There was an increase of 18.80, 32.68 and 39.37 per cent in straw yield due to application of 20, 40 and 60 kg N/ha respectively, as compared to control. Perusal of data clearly showed that different genotypes caused significant variation in straw yield. The maximum straw yield (52.44 q/ha) was recorded with BM-2 followed by RAU-8, TNAU-1022 and KMR-204 which were comparable among themselves. However, BM-2 and RAU-8 were significantly superior to OEB-219 while, finger millet genotype TNAU-1022, KMR-204 and OEB-219 were statistically at par among themselves in respect of straw yield. There was also an increase of 6.50, 5.27, 8.39 and 11.36 per cent in straw yield of TNAU-1022, KMR-204, RAU-8 and BM-2 over OEB-219 genotypes, respectively.

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