ISSN 0258-7122
Bangladesh J. Agril. Res. 38(4): 689-704, December 2013

INFLUENCE OF SEED RATES AND LEVELS OF NPK FERTILIZERS ON DRY MATTER ACCUMULATIONS AND YIELD PERFORMANCE OF FOXTAIL MILLET *(Setaria italica* L. Beauv.)

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Abstract

A study was carried out in the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh, Old Brahmaputra Flood Plains Soil (AEZ-9) during December 2001 to April 2002 to find out the effect of seed rates and NPK levels on dry matter accumulation and grain yield of foxtail millet *(Setaria italica* L. Beauv.). Four seed rates viz., 8,10,12, and 14 kg/ha and five levels of NPK fertilizers viz., $N_0P_0K_0$, $N_{10}P_8K_5$, $N_{20}P_{16}K_{10}$, $N_{30}P_{24}K_{15}$, and $N_{40}P_{32}K_{20}$ were included in a split plot design with three replications. Dry matter accumulation pattern was determined by harvesting 10 plants randomly at 30, 60, 80, and 102 DAS (days after swing). The yield and yield contributing characters of foxtail millet were influenced by seed rates and NPK levels except tillers per plant and 1000-grain weight significantly. Generally its production rate was 0.86 t/ha when it was grown in char lands in sandy loam soils, the highest grain yield (1.62 t/ha) was produced by 10 kg seeds/ha, which was identical with 12 kg seeds/ha. In case of NPK levels, the treatment was $N_{30}P_{24}K_{10}$. In case of interaction, the treatment combination 12 kg seeds/ha and $N_{30}P_{24}K_{15}$ produced the highest grain yield (1.77 t/ha. In case of interaction, the treatment combination 12 kg seeds/ha and $N_{30}P_{24}K_{15}$/ha gave the highest grain yield.

Keywords: Seed rates, NPK fertilizers, dry matter, yield and yield contributing characters, foxtail millet.

Introduction

Foxtail millet *(Setaria italica* L. Beauv.) commonly known as ‘Kaon’ is an important minor cereal crops in Bangladesh. It is also known as Italian millet or German millet which was originated in North China where it was an important cereal till the introduction of wheat and Lorelei (FAO, 1985). In Bangladesh, it can be grown in both rabi and kharif seasons, but it grows better in rabi season. Although low yielding, its short duration and drought tolerance along with low-input requirements ensure its bright prospects under the existing rainfed farmers cropping system (Mannujan *et al.*, 1990). Foxtail millet, a drought resistant

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cereal crop, is extensively cultivated on marginal lands and river beds in Bangladesh where high yielding crops can not be grown profitably. It grows @ 0.86 t/ha (BARI, 1990) in light textured soils due to its genotypic potentiality under adverse condition. The average yield of the crop is low in this country and it can be attributed to low soil fertility, poor management practices, and lack of use of high yielding modern varieties. The farmers generally do not use fertilizers in the cultivation of foxtail millet. Millets are generally grown on frequently emergencies following crops like transplant Aman failure from unfavourable condition like floods and drought. The area under 'Kaon' has been considerably reduced in Bangladesh due to the expansion of HYV wheat and Boro rice and development of irrigation facilities. Foxtail millet may be grown in 'char' areas and also where farmers do not have any scope of irrigation during the post monsoon period, particularly in the river basin in Bangladesh. From nutritional point of view, it is good for health and can increase the life span of human being (Takanohashi, 1993).

Foxtail millet can be stored for a long time without much damage from insect pests (Coscia, 1983). Because of this merit, it plays the role of an emergency crop in the year of bad harvest. Non-adaptation of improve varieties and ultimately use of cultural operations like time of sowing, seed rates, weeding, interculural operations, irrigation facilities, pest and disease management, etc. are the important constraints to achieve higher productivity in millets (Hedge and Gowda, 1986). Adequate information is not available, but as it appears, at least 19,443 hectares of land are put under foxtail millet cultivation every year and its production is about 15,000 m tons (BBS, 1993). People of different areas of Bangladesh grow it without any recommended seed rates and fertilizers doses which results in low grain yield. It may be possible to increase the yield of foxtail millet by using the appropriate combination of seed rate and NPK fertilizer dose. Optimum seed rate ensures normal plant growth because of efficient utilization of moisture, light, uptake of nutrient elements and thus increase the yield of crop. The present study was conducted to evaluate the effect of different seed rates and levels of NPK fertilizer and to determine the optimum combination of seed rate and NPK fertilizer for optimum growth, development and maximum yield of foxtail millet.

Materials and Method

Titas, a cultivar of foxtail millet used for the study was developed by Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur. Pure seeds of Titas were collected from the Agronomy Division, BARI. The experimental plot was sited at the Agronomy field Laboratory, Bangladesh Agricultural University, Mymensingh. The topography of the experimental land was medium high and the soil was sandy loam in texture belonging to non-Calcareous Dark Grey

Floodplain soil. The soil is moderately acidic in nature, moderate in organic matter content and general fertility is low, status of P and cation exchange capacity are medium, K and N status of soils are low (BARC, 1989). Four seed rates 8, 10, 12, and 14 kg/ha and five levels of NPK fertilizers viz., $N_0P_0K_0$ $N_{10}P_8K_5$, $N_{20}P_{16}K_{10}$, $N_{30}P_{24}K_{15}$, and $N_{40}P_{32}K_{20}$ were included in a split plot design with three replications. Each replication was divided into 20 plots assigning four seed rates in the main plots and four levels of NPK fertilizer in the sub-plots. The whole experiment comprises of 60 (3 × 20) unit plots. The size of unit plot was (4 × 2.50 m) 10 m^2. The plot to plot distance was 0.75 m and that from replication to replication was 1 m. Nitrogen, phosphorus, and potassium were applied through urea, TSP, and MP as per schedule of the experiment, respectively. The entire amount of the TSP, MP, and one-third of urea were applied at the time of final land preparation. The rest of urea was applied in two equal splits at 30 and 60 days after sowing (DAS). Seeds of Kaon were sown in lines in the furrows at the rate of 8, 10, 12, and 14 kg/ha as per treatment schedule. Furrows of about 3 cm depth were opened by hand rake and line to line distance was 25 cm. After sowing, the seeds were covered by well pulverized soil followed by a light pressure by hand. Seeds were germinated within 6-7 days after sowing. After 30 DAS, 1st weeding was done in each plot, while the another one was operated at 60 DAS followed by top dressing of urea fertilizer. When the crop was found under moisture stress, irrigation was given on 13 February, 2002. The crop was infested by grasshopper, shoot fly, ear cutworm, etc. at late vegetative stage. It was successfully controlled by growth period and as such no fungicidal spray was needed. All possible plant protection measures were taken as and when necessary. Observations were recorded on 10 randomly selected plants in each plot for dry matter accumulation at 30, 60, 80 DAS and at harvest. Observation on yield and yield contributing characters were also made. The collected data were analyzed and the mean differences were adjusted by the Duncan's Multiple Range Test (DMRT).

Results and Discussion

A. Effects of seed rates and NPK levels on dry matter accumulation

Dry matter of leaves increased more or less up to 80 DAS and afterwards slightly decreased probably due to shedding effect of older leaves (Table 1). However, there was an inverse relationship between seed rates and dry matter accumulation of foxtail millet leaves at all stages of sampling. On the other hand, there was parallel relationship between levels of NPK application and dry matter accumulation of foxtail millet. Result showed that dry matter accumulation varied significantly at all dates of sampling due to seed rates and NPK levels. Leaf dry matter (g/plant**)** accumulation decreased with increasing seed rates and increased with increasing levels of NPK. At harvest, the levels $N_{40}P_{32}K_{20}$ kg/ha and seed rates 8 kg/ha produced the maximum leaf dry matter of 5.175 g/plant and 5.332 g/plant, respectively. Leaf dry matter accumulation increased till 80 DAS and afterward tended to decline (Table 1). After anthesis, development of new leaves stopped and perhaps photosynthates remobilized to the grains. Remobilization of photosynthesis for meeting the sink demand might have reduced leaf dry matter which are in agreement with that of Benner and Bazzaz, 1988. The results revealed that dry matter accumulation in leaf was relatively high at maximum tillering stage. After that, the dry matter was diverted for panicle formation and its developments. Interaction of seed rate and levels of NPK on leaf dry matter was significant at all stages (Table 2).

Table 1. Effects of seed rates and different levels of NPK on leaf dry matter accumulation of foxtail millet.

Treatments	Leaf dry matter (g/plant)			
Seed rates (kg/ha)	30 DAS (At vegetative stage)	60 DAS (At flowering stage)	80 DAS (At dough stage)	102 DAS (At harvest)
8	0.062 a	1.075 ab	3.798 a	5.332 a
10	0.065 a	1.128 a	3.878 b	4.868 ab
12	0.042b	1.012b	3.644a	5.136ab
14	0.049 b	0.847 c	3.032 b	5.000 b
Level of Significance	0.0002	0.0003	0.002 1	0.0239
Sx	0.0017	0.0200	0.0902	0.0764
CV (%)	12.31	9.36	9.73	5.82
Fertilizes (kg/ha)				
$N_0P_0K_0$	0.049 b	0.907 c	3.232b	4.893 c
$N_{10}P_8K_5$	0.050 b	0.963 bc	3.345 b	4.958b c
$N_{20}P_{16}K_{10}$	0.057 ab	1.155 a	3.875 a	5.245 a
$N_{30}P_{24}K_{15}$	0.057 ab	0.986 bc	3.875 a	5.150 abc
$N_{20}P_{16}K_{10}$	0.057 ab	1.155 a	3.875 a	*5.245* a
$N_{30}P_{24}K_{15}$	0.057 ab	0.986 be	3.875 a	5.150 abc
$N_{40}P_{32}K_{20}$	0.060 a	1.066 ab	3.753 a	5.175 ab
Level of significance	0.0009	0.0100	0.0002	0.0280
Sx	0.0019	0.0224	0.1008	0.0854
CV(%)	12.31	9.63	9.73	5.82

In a column, figures having common letter (s) do not differ significantly.

Table 2. Effect of interaction of seed rates and different levels of NPK on leaf dry matter accumulation of foxtail millet.

Interaction of seed rates x levels of NPK	30 DAS	60 DAS	80 DAS	102 DAS
S_1F_0	0.050 cdef	1.250 b	3.360 def	5.550
S_1F_1	0.050 cdef	1.120 b	4.180 abc	5.120
S_1F_2	0.046 def	1.060 bce	2.680 fg	5.510
S_1F_3	0.050 cdef	1.130 bcdef	4.450 ab	5.570
S_1F_4	0.047 def	0.813 bcd	4.320 abc	4.910
S_2F_0	0.073 a	0.390 ghi	3.270 defg	4.900
S_2F_1	0.050 bcde	1.140 hij	40390 ab	5.030
S_2F_2	0.070 ab	1.770 bcd	4.540 a	4.470
S_2F_3	0.050 ab	0.85 a	4.110 abc	4.950
S_2F_4	0.077 a	1.190 fghi	3.080 efg	4.990
S_3F_0	0.037 efg	1.030 bc	3.690 cde	4.880
S_3F_1	0.033 fg	0.990 bcde	2.610 g	4.790
S_3F_2	0.043 efg	0.910 cdef	2.990 fg	5.070
S_3F_3	0.027 g	0.9900 defgh	3.311 def	4.800
S_3F_4	0.070 ab	1.230 bc	4.420 ab	6.140
S_4F_0	0.067 abc	0.660 ij	3.810 bcd	4.330
S_4F_1	0.063 abcd	0.600 j	3.120 efg	4.800
S_4F_2	0.067 abc	0.880 efgh	3.170 defg	5.550
S_4F_3	0.067 abc	1.063 bcde	3.070 efg	5.660
S_4F_4	0.047 def	1.030 bcde	3.190 defg	4.660
Level significance	0.00001	0.00001	0.00001	NS
Sx	0.0039	0.0447	0.2017	0.1708
CV (%)	12.31	9.63	9.73	5.82

The ear dry matter accumulation varied significantly at all dates of sampling due to seed rates, NPK levels (Table 3) and their interaction (Table 4). It was observed that ear dry matter decreased with increasing seed rates and increased with increasing NPK levels (Table 3). Influence of NPK levels in the increment of ear weight was much striking than it was observed for vegetative organs. This was perhaps because of increased photosynthesis and greater remobilization of assimilates to the grains in the fertilizer treated plants after anthesis. After anthesis, ear dry matter increase dramatically in all the treatments. The total dry matter accumulation increase substantially due to increasing ear dry matter in spite of reduction in leaf dry weight. Ear dry matter accumulation was much more striking than it was observed for vegetative organs. This was perhaps because of increased photosynthesis and greater remobilization of assimilates to the grain in the fertilizer treated plants after anthesis.

Table 3. Effects of seed rates and different levels of NPK on ear dry matter accumulation of foxtail millet.

Treatments	Ear dry matter (g/plant)		
Seed rates (kg/ha)	60 DAS (At flowering stage)	80 DAS (At dough stage)	102 DAS (At harvest)
8	0.335 a	2.090 a	5.306 a
10	0.316 a	1.962 b	4.728 b
12	0.159b	1,896b	4,452c
14	0.180 b	1.908 b	4.2440
Level of significance	0.00001	0,0228	0.002
Sx	0.0074	0.0559	0.0735
CV (%)	9.94	10.40	7.38
Fertilizes (kg/ha)			
$N_0P_0K_0$	0.198 b	1.345 b	2.758 d
$N_{10}P_8K_{15}$	0.175 b	1.5990	4.142
$N_{20}P_{16}K_{10}$	0.193 b	2.006 b	4.903 b
$N_{30}P_{24}K_{15}$	0.348 a	2.577 a	5,717 a
$N_{40}P_{32}K_{20}$	0.323 a	2.441	5.892 a
Level of significance	0.00001	0.00001	0.00001
Sx	0.0071	0.0599	0.0998
CV (%)	9,94	10.40	7.38

Total dry matter accumulation also varied significantly at all dates of sampling due to seed rates, different levels of NPK, and their interaction. The highest dry matter accumulation was observed in 8 kg seed/ha (Table 5). The result revealed that the increase in plant population density caused considerable decrease in total matter accumulation of foxtail millet. The observed results was in agreement with the finding of Elias *et al.* (1979). Similarly, $N_{20}P_{16}K_{10}$ hg/ha produced the highest dry matter (Table 5). Naik *et al*. (1995) also reported that total dry matter production increased with increasing NPK rates. Munda *et al.* (1984) also reported that at maturity, nitrogen at 120 kg/ha increased dry matter by 33.10% over no nitrogen. The highest total dry matter accumulation was found in combination 8 kg seed/ha and $N_{30}P_{24}K_{15}$ kg/ha (Table 6). After anthesis total dry matter of a plant was mainly due to the dry matter accumulation of the ear when leaves in most cases started to senescence.

Table 4. Effect of interaction of seed rates and different levels of NPK on stem dry matter accumulation of foxtail millet.

interaction of seed rates x levels of NPK	60 DAS (At flowering stage)	80 DAS (At dough stage)	102 DAS (At harvest)
S_1F_0	2.11 cdef	1.447 def	2.721 g
S_1F_1	0.312 c	1.728 cde	4.390 de
S_1F_2	0.300 cd	2.019 bc	5.820 b
S_1F_3	0.232 cdef	2.945 a	6.740 a
S_1F_4	0.622 b	2.251 b	4.890 cd
S_2F_0	0.121 f	1.151 f	2.530 g
S_2F_1	0.137 f	1.745 cde	3.940 ef
S_2F_2	0.920 a	2.971 a	6.860 a
S_2F_3	0.027 cdef	2.243 b	5.840 b
S_2F_4	0.271 cde	2.357 b	6.440 a
S_3F_0	0.140 f	1.410 def	2.930 g
S_3F_1	0.122 f	1.764 cd	3.760 f
S_3F_2	0.145 f	1.846 c	4.640 d
S_3F_3	0.185 def	2.221 b	5.450 bc
S_3F_4	0.201 cdef	2.238 b	5.408 bc
S_4F_0	0.163 ef	1.372 ef	2.850 g
S_4F_1	0.131 f	1.159 f	4.480 de
S_4F_2	0.163 ef	1.187 f	4.260 def
S_4F_3	0.170 ef	2.901 a	4.840 d
S_4F_4	0.198 cdef	2.920 a	4.790 d
Level significance	0.0010	0.00001	0.00001
Sx	0.0142	0.1197	0.1990
CV (%)	9.94	10.40	7.38

In a column, figures having common letter (s) do not differ significantly

Table 5. Effects of seed rates and different levels of NPK on total dry matter accumulation of foxtail millet.

Treatments	Total dry matter (g/plant)			
Seed rates (kg/ha)	30 DAS (At vegetative stage	60 DAS (At flowering stage)	80 DAS (At dough stage)	102 DAS (At harvest)
8	0.124a	1.904a	10.ll0a	26.63a
10	0.106 b	1.898 a	9.282 b	25.14 b
12	0.104 b	1.760 a	8.832 b	24.34 bc
14	0.075c	1.597 b	7.2020	23.70 c
Level of significance	0.0010	0.0018	0.0010	0.0103
$N_0P_0K_0$	0.099 ab	1.680 cd	7.467 c	21.70 c
$N_{10}P_8K_5$	0.095 b	1.783 bc	8.563 b	23.18 b
$N_{20}P_{15}K_{10}$	0.107 a	1.947 a	9.257 a	27.34 a
$N_{30}P_{24}K_{15}$	0.106 a	1.636 d	9.360 a	26.96 a
$N_{40}P_{32}K_{20}$	0.105 a	1.902 ab	9.640 a	26.57 a
Level of significance	0.0041	0.00001	0.00001	0.00001
Sx	0.0023	0.0344	0.1511	0.3706
CV (%)	8.17	8.65	7.91	7.15

B. Effect on yield and yield contributing characters

The effect of seed rates on plant height was significant. The highest plant height (106.02 cm) was recorded from the seed rate 12 kg/ha whereas, the lowest (101.14 cm) was noted from the seed rate 14 kg/ha (Table 7). The observed result is in agreement with the findings of (BARI, 1985). They observed that seed rates had significant effect on plant height and the plant height increased with the decrease of seed rates. Significant variation was also observed due to different levels of NPK. The treatment $N_{30}P_{24}K_{15}$ kg/ha produced the significantly tallest plant (111.52 cm) (Table 10). The plot with no fertilizer ($N_0P_0K_0$ kg/h) produced significantly shortest plant (91.34 cm), which was inferior to all other treatment (Table 8). The interaction gave significantly tallest plant (111.52 cm) (Table 10). The plot with no fertilizer ($N_0P_9K_0$ kg/ha) produced significantly shortest plant (91.34 cm), which was inferior to all other treatments (Table 8). The interaction effect of seed rates and levels of NPK was significant on plant height. Effective tillers per plant showed no significant variation for different seed rates. The highest tillers/plant (1.05) was recorded in 14 kg seed/ha and the lowest (1.03) from 10kg seed/hill. The response of effective tillers per plant to different levels of NPK was not significant too (Table 10). However, apparently highest tillers per plant was recorded in $N_0P_8K_5$ kg/ha and the lowest in $N_{20}P_{16}K_{10}$ kg/ha The interaction effect of seed rates and levels of NPK had significant effect on effective tillers per plant. The overall results are in agreement with Horliuchi *et al.*, 1986 who reported that tillering of foxtail millet is generally low and could not be altered significantly. The longest (14.44 cm) and the shortest (13.67 cm) panicle length were obtained from 8 kg seed/ha and 14 kg seed/ha, respectively (Table 7). The longest panicle length with 8 kg seed/ha may be due to minimum plant population resulting in good development of the plant and gave longer panicle length. On the contrary, in case of NPK levels, the longest (15.40 cm) and the shortest (12.28 cm) panicle length were produced by the treatment of $N4_0P_{32}K_{20}$ kg/ha and $N_0P_0K_0$, respectively. It was evident from the results that panicle length increased with increasing levels of NPK. The interaction of seed rate and levels of NPK was significant in respect of panicle length (Table 9). In case of number of grains/panicle, the maximum (2506 panicle) and the minimum (2070) number of grains were found in 8 kg seed and 14 kg seed, respectively (Table 7). Number of grains/panicle decreased with increasing seed rate. This might be due to high competition of the crop for light, space, nutrition, and soil moisture, under higher seed rates leading to reduce the number of grains/panicle. In case of NPK application, significantly highest number of grains panicle/ha (2902) was recorded in $N_{30}P_{24}K_{15}$ kg/ha while the lowest value (1591) being noted in $N_0P_0K_0$ treatment (Table 10). Results indicate that number of grains panicle/ha increased when levels of NPK increased. Cereals generally take up a large quantity of nitrogen and phosphorus for grain formulation which influences the plant growth, development, and thereafter number of grains. The number of grains panicle varied significantly due to interaction between seed rates and levels of NPK (Table 9). In case of interaction, 8 kg seed per ha and $N_{30}P_{24}K_{15}$ kg/ha treatment combination produced the highest number of grains. The weight of 1000-seed was not significantly affected by seed rate and different levels of NPK. The 1000-seed weights were 1.51, 1.62, 1.52, and 1.50 for 8, 10, 12, and 14 kg seed/ha, respectively (Table 7). Numerically the highest 1000-seed weight (1.66 g) was obtained in $N_{30}P_{24}K_{15}$ kg/ha. The lowest 1000-seed weight (1.31 g) was found in $N_0P_0K_0$ kg/ha (Table 10). The result are in agreement with (Beketov, 1975) who reported that application of NPK increased 1000-seed, weight. The interaction effect of seed rates and levels of NPK was not significant too in respect of 1000-seed weight.

Table 6. Effect of interaction of seed rates and different levels of NPK on stem dry matter accumulation.

interaction of seed rates x levels of NPK	60 DAS (At vegetative stage)	80 DAS (At flowering stage)	80 DAS (At dough stage)	102 DAS (At harvest)
S_1F_0	0.010 h	1.150 h	5.830 g	18.850 g
S_1F_1	0.090 fg	1.960 cd	9.480 bc	24.450 def
S_1F_2	0.089 fg	1.830 de	7.130 ef	24.360 def
S_1F_3	0.174 a	2.920 a	12.350 a	31.250 a
S_1F_4	0.087 fg	1.587 efg	10.090 b	25.110 def
S_2F_0	0.096 efg	2.120 bc	8.090 de	20.330 g
S_2F_1	0.086 g	1.860 cde	12.160 a	24.670 def
S_2F_2	0.110 cde	1.790 de	9.980 b	26.760 bcd
S_2F_3	0.106 def	j44jg	8.050 de	25.580 cdef
S_2F_4	0.134 ab	2.352 b	12.100 a	28.650 b
S_3F_0	0.094 efg	j74efg	8.400 cd	23 .970 ef
S_3F_1	0.086 g	1.740 de	8.460 d	23.780 f
S_3F_2	0.l03defg		7.4SOdef	26.l7ocdef
S_3F_3	0.O94efg	1.6lOefg	7.88Odef	24.86Odef
S_3F_4	0.097 efg	2.140 bc	11.970 a	30.960 a
S_4F_0	0.120 bcd	1.960 cd	7.550 def	19.630 g
S_4F_1	0.120 bcd	1.160 h	6.740 fg	19.830 g
S_4F_2	0.127 bc		7.570 def	27.790 bc
S_4F_3	0.127 bc	1.703 def	7.420 def	26.460 bcde
S_4F_4	0.127 bc	1.760 de	8.450 de	25.560 cdef
Level significance	0.0020	0.0100	0.0010	0.0010
Sx	0.0046	0.0688	0.3021	0.7413
CV (%)	8.71	8.65	7.91	7.15

In a column, figures having common letter (s) do not differ significantly

Grain yield is the ultimate objectives of crop production. Seed rates significantly affected the grain yield of foxtail millet (Table 9). The highest grain yield (1.62 t/ha) was obtained from 10 kg seed/ha which was identical with 12kg seed/ha. The lowest grain yield (1.41 t/ha) was found in seed rate 8 kg/ha. The result is in conformity with that of Sarder *et al.,* 1987 and Gaffer, 1994 where the maximum grain yield of foxtail millet was found from 10 and 12 kg seed/ha, respectively. In case of NPK levels, the highest grain yield (1.77 t/ha)

Table 7. Effect of seed rates on the yield and yield contributing characters of foxtail millet.

Seed rates (kg/ha)	Crop characters								
	Plant height (cm)	No. of effective tillers/ plant	Panicic length (cm)	No. of grains/ panicle	Weight of 1000-seed (g)	Grain yield (t/ ha)	Straw yield (t/ ha)	Biological yield (t/ ha)	Harvest index (%)
8	104.41 b	1.04	14.44a	2506a	1.51	l.41c	3.88b	5.29bc	26.48b
10	104.54b	t.02	14.12a	2428b	1.62	1.62a	3.79c	5.41b	29.25a
12	106.02 a	1.03	13.99b	2271c	1.52	1.51b	4.09a	5.61a	27.21b
14	101.13c	1.05	13.67b	2070d	1.50	1.48	3.72	5.20c	28.58a
Level of significance	0.233	NS	0.149	0.001	NS	0.002	0.16	0.0085	0.001
Sx	1.50	0.028	0,200	20.00	0.058	2.00	5.77	5.45	0.22
CV (%)	4.17	10.76	5.51	8.34	11.52	8.14	5.77	5,34	5.47

Table 8. Effect of different levels of NPK on the yield and yield contributing characters of foxtail millet.

Fertilizers (kg/ha)	Crop characters								
	Plant height (cm)	No. of effective tillers/ plant	Panicle length (cm)	No. of grains panicle1	Weight of 1000-seed (g)	Grain yield (t/ha)	Straw yield	Biological yield (t/ha)	Harvest index (°%)
$N_0P_0K_0$	9l.34d	1.03	12.28d	1591d	1.31	0.97d	2.65c	3.62d	26.60d
$N_{10}P_8K_5$	102.06c	1.06	13.09c	2044c	1.46	1.55c	3.75b	3.31c	28.94b
$N_{20}P_{16}K_{10}$	106.33b	1.01	14.17b	2281c	1.63	1.65b	3.91b	5.55b	29.64a
$N_{30}P_{24}K_{15}$	II 1.52a	1.06	l5.35a	2902a	1.66	1.77a	4.49a	6.26a	28.18c
$N_{40}P_{32}K_{20}$	108.89ab	1.05	15.40a	2776b	1.64	1.6Obc	4.56a	6.l6a	25.88c
Level of significance	0.0001	NS	0.00001	0.00001	NS	0.00001	0.0001	0.00001	0.00001
Sx	1.252	0.032	0.224	22.36	0.0645	2.24	6.46	6.74	0.199
Cv (%)	4.17	10.76	*5.51*	8.34	14.52	8.14	5.77	5.34	5.47

In a column, figures having common letter(s) do not differ significantly.

NS= Non Significant.

Table 9. Effect of interaction of seed rates and different levels of NPK on the yield and yield contributing characteristics of foxtail millet.

Interaction of seed rates × level of NPK	Plant height (cm)	No. of effective tillers/ plant	Panicle length (cm)	No. of grains/ panicle	Weight of 1000-seed (g)	Grain yield (t/ha)	Straw yield (t/ha)	Biological yield (t/ha)	Harvest index (%)
S_1F_0	91.69 ef	1.000	12.56 fg	1650j	1.36	1.00 i	2.85 hi	3.85 ii	25.97 f
S_1F_1	105.89 abc	1.000	12.82 efg	2307 f	1.40	1.56 fg	4.33 cd	5.91 de	26.72 e
S_1F_2	105.29 abc	1.000	14.91 abcd	2432 f	1.60	1.56 fg	3.91 ef	5.48 f’	28.57 de
S_1F_3	113.43 a	1.060	16.24 a	3319 a	1.55	1.83 cd	4.66 c	6.49 hc	28.20 e
S_1F_4	105.52 abc	1.170	15.69 ab	2824 cd	1.64	1,08 i	3.63 fg	4.71 h	22.95 g
S_2F_0	92.56 ef	1.100	12.06 g	1598j	1.31	0.68j	2.55 ij	3.23k	21.13 h
S_2F_1	111.54 a	1.000	14.18 cde	2044gb	1.89	2.05 ab	4.11 de	6.16 cd	33.24 b
S_2F_2	102.49 bcd	1.030	13.89 cdef	2428 f	1.68	1.80 de	3.41 g	5.21 fg	34.50 a
S_2F_3	111.07 a	1.000	14.73 bcd	2710 de	1.69	1.76 de	4.50 cd	6.26 bcd	28.19 e
S_2F_4	105.06 abc	1.000	15.09 abc	2576 e	1.55	1.80 de	3.36 cd	6.16 cd	29.19 de
S_3F_0	95.11 de	1.000	12.76efg	1848 i	1.30	1.12 i	2.78 hig	3.90	28.96 de
S_3F_1	99.10 cde	1.100	13.76 def	2127 g	1.25	1.08 i	3.03 h	4.11 i	26.32 f
S_3F_2	109.52 ab	1.000	13.94 cdef	231Sf	1.57	1.66 ef	3.91 ef	5.58 ef	29.85 cd

Table 9. Cont'd.

Interaction of seed rates × level of NPK	Plant height (cm)	No. of effective tillers/ plant	Panicle length (cm)	No. of grains/ panicle	Weight of 1000-seed (g)	Grain yield (t/ha)	Straw yield (t/ha)	Biological yield (t/ha)	Harvest index (%)
S_3F_3	113.55 a	1.060	15.O8abcd	2989b	1.81	2.15 a	5.16 b	7.31 a	29.38 cd
S_3F_4	112.83 a	1.000	15.04 abcd	2863 bc	1.67	1.55 fg	5.59 a	7.13 a	21.73 h
S_4F_0	85.74 f	1.00	11.72 g	1268k	1.27	1.06 i	2.41 j	3.48jk	30.62 c
S_4F_1	91.72 ef	1.130	11.58 g	1699j	1.32	1.48 g	3.55 fg	5.03 gh	29.47 cd
S_4F_2	108.03 ab	1.000	13.92 cde	1949 hi	1.67	1.55 fg	4.36 cd	5.91 de	28.20 f
S_4F_3	108.03 ab	1.100	15.36 abc	2592 e	1.59	1.33 h	3.61 fg	4.95 gh	26.940 f
S_4F_4	112.10 a	1.030	15.76 ab	2842 cd	1.69	1.96 bc	4.66 c	6.63 b	29.65 cd
Level of significance	0.0007	NS	0.029	0.0100	NS	0.025	0.0001	0.0001	0.0001
Sx	2.5033	0.064	0.447	44.721	0.129	4.472	12.909	13.739	0.3979
CV (%)	4.17	10.76	5.51	8.34	14.52	8.14	5.77	5.34	5.47

was found in $N_{30}P_{24}K_{15}$ kg/ha which was identical with $N_{20}P_{16}K_{10}$ kg/ha (Table 8). The grain yield gradually increased with increasing levels of NPK. The result is in agreement with (Vyas *et al.*, 1994) who reported that when fertilizer rates increased the yield also increased. The highest grain yield (2.15 t/ha) was recorded from the combination 12 kg seed/ha and $N_{30}P_{24}K_{15}$ kg/ha (Table 9). Straw yield and as well as biological yield were also significantly influenced by seed rates, levels of NPK and their interaction. The highest straw yield (4.09 t/ha) and biological yield (5.61 t/ha) were obtained from seed rate 12 kg/ha. In case of NPK levels, the highest straw yield (4.56 t/ha) and biological yield (6.26 t/ha) were found in $N_{40}P_{32}K_{20}$ and $N_{30}P_{24}K_{15}$ kg/ha treatments, respectively. The highest straw yield (5.34 t/ha) and biological yield (7.31 t/ha**)** were obtained from the combination 12 kg seed/ha and $N_{40}P_{32}K_{20}$ kg/ha which was identically followed by 12 kg seed/ha and $N_{30}P_{24}K_{15}$ kg/ha (Table 11). The results are in partial agreement with (Dhillon and Panwar, 1976) who observed that straw yield and biological yield increased with increasing NPK fertilizer. The impacts of seed rate and NPK application in harvest index of the crop was significant (Table 3 and 4).

The highest harvest index (29.94) was obtained from 10 kg seed/ha which was identically followed by 14 kg seed/ha. In case of NPK levels, the highest harvest index (29.78) was found in $N_{20}P_{16}K_{10}$ kg/ha, which was identical with $N_{10}P_8K_5$ kg/ha. The interaction of seed rates and levels of NPK was significant on harvest index (Table 9).

From the overall results obtained in the study indicated that $N_{30}P_{24}K_{15}$ kg/ha and 10 kg seed/ha might be used to obtain satisfactory yield of foxtail millet cv. Titas under the prevailing agroclimatic conditions of BAU farm of Old Brahmaputra Floodplains soils (AEZ-9).

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