The Andhra Agric. J 60 (4):740-744, 2013

Effect of Nutrient Management on Growth and Yield of Pre-release Finger Millet (Variety PPR-2700)

S M Seemawat, V Sridhar, G Prabhakara Reddy and K V Naga Madhuri
Department of Agronomy, S V Agricultural College, Tirupati 517502

ABSTRACT

An experiment was conducted on sandy loam soils of the Agricultural Research Station Farm, Perumallapalli, Tirupati (AP) during *rabi*, 2011-12 in a randomized block design with twelve treatments (Nutrient management practices) involving combinations with 100% RDF (60N + 30 P_2O_5+ 20 K_2O kg ha^{-1}) and 150 % RDF (60 N + 30 P_2O_5 + 20 K_2O kg ha^{-1}) and replicated thrice. Among the treatments,150 % RDF+$ZnSO_4$ 0.5 % foliar spray + $FeSO_4$ 0.2 % foliar spray resulted in maximum plant height, dry matter production, effective tillers m^{-2}, weight of ear head, test weight and grain yield compared to rest of the treatments, but maximum straw yield was noticed with 150 % RDF + $FeSO_4$ 0.2 % foliar spray compared to 150 %RDF + $ZnSO_4$ 0.5 % foliar spray + 0.2 % $FeSO_4$ foliar spray.

Key words : Finger millet, Nutrient management.

Finger millet (*Eleusine coracana*) is one of the important staple food crops of India, which accounts for nearly 40 per cent of area and 60 per cent of production under small millets. It is grown over an area of 1.268 million hectares with a production of 1.888 million tonnes in the country. Andhra Pradesh ranks sixth in area (0.42 lakh ha) and production (0.50 lakh tonnes) of finger millet in India, with a productivity of 1188 kg ha^{-1}. It is normally grown on poor and marginal soils with less attention to nutrient application. As such, the nutrient management practices in crops like finger millet is gaining importance.

MATERIAL AND METHODS

An experiment was conducted on sandy loam soils of the Agricultural Research Station Farm, Perumallapalli near Tirupati (AP) during *rabi*, 2011-12 in a randomized block design with twelve treatments (Nutrient management practices) and three replications. The treatments were 100 % RDF (T_1), 150 % RDF (T_2), 100% RDF +Zinc sulphate@ 50 kg ha^{-1} as soil application(T_3), 100% RDF + Zinc sulphate 0.5% foliar spray (T_4), 100% RDF + Ferrous sulphate 0.2% foliar spray (T_5), 100% RDF Zinc sulphate @ 50 kg ha^{-1} as soil application + Ferrous sulphate 0.2% foliar spray (T_6),100 % RDF + Zinc sulphate 0.5% foliar spray + Ferrous Sulphate 0.2% foliar spray (T_7),100 % RDF + Zinc sulphate @ 50 kg ha^{-1} as soil application (T_8), 150 % RDF + Zinc sulphate 0.5% foliar spray (T_9), 150 % RDF + Ferrous sulphate 0.2% foliar spray (T_{10}), 150 % RDF+ Zinc sulphate@ 50 kg ha^{-1} as soil application + Ferrous Sulphate 0.2% foliar spray (T_{11}) and 150 % RDF + Zinc sulphate 0.5% foliar spray+ Ferrous sulphate 0.2% foliar spray (T_{12}). The soil of the experimental field had a pH of 7.7 with low organic carbon content (0.29 %) and available nitrogen (219.52 kg ha^{-1}), medium in available phosphorus (23.19 kg ha^{-1}) and potassium (191.40 kg ha^{-1}). Transplanting of Finger millet was done by adopting a spacing of 22.5 cm × 10 cm. The recommended dose (100%) of nutrients was 60 kg N, 30 kg P_2O_5 and 20 kg K_2O ha^{-1}. Nutrients were applied through urea, SSP and muriate of potash respectively as per the treatments. Entire dose of P_2O_5 and K_2O and half of N were applied as basal dose at the time of transplanting and the remaining half of N was applied at 30 days after planting.

RESULTS AND DISCUSSION

Effect of nutrient management on growth characters

Plant height and dry matter production increased progressively with advancement in age of the crop up to harvest, irrespective of the treatments. The nutrient management practices

significantly influenced the plant height at all the stages of observations (Table 1).

In general, maximum plant height and dry matter production were recorded with 150 % RDF + $ZnSO_4$ 0.5 % foliar spray + $FeSO_4$ 0.2 % foliar spray (T_{12}) at all the stages of observations while significantly least values were noticed with 100 % RDF + $ZnSO_4$ either as soil application or as foliar spray. The trends of other treatments for comparative performances with the former (i.e. 150 % RDF + $ZnSO_4$ 0.5 % foliar spray + $FeSO_4$ 0.2 % foliar spray – T_{12}) varied with respect to different stages. Increase in plant height with increasing levels of nitrogen was reported by Misra *et al.*(1973).

Significant differences were noticed in the number of days to 50% flowering and days to maturity of finger millet. Earliness in flowering was observed with 150% RDF + $ZnSO_4$ 0.5% foliar spray (T_9) which was on a par with150 % RDF + $ZnSO_4$ 0.5% foliar spray + $FeSO_4$ 0.2% foliar spray (T_{12}). Flowering was found to be delayed in the case of 100% RDF + $ZnSO_4$ 0.5% foliar spray (T_4) and 150% RDF + $ZnSO_4$ soil application @ 50 kg ha^{-1} (T_8), both of which recorded similar values and were comparable to T_7, T_5, T_{10}, T_6, T_2 and T_{11} treatments indicating that the nutrient levels tried did not exert any definite trend in the flowering behaviour of this genotype.

Early maturity was observed with 100 % RDF alone (T_1) and this treatment differed significantly from all other treatments. Inadequate nutrition might have been the reason for this forced and early maturity. On the other hand, delayed maturity was observed with T_{11}, T_6, T_4, T_{10} and T_7 treatments which were comparable to each other. Maximum delay in the crop maturity was observed with T_{11} (150 % RDF + $ZnSO_4$ @ 50 kg ha^{-1} soil application + $FeSO_4$ 0.2% foliar spray) treatment.

Effect of nutrient management on yield attributes

Effective tillers m^{-2} at harvest were considerably altered due to nutrient management practices (Table 2). The highest number of effective tillers m^{-2} was recorded with 150 % RDF + $ZnSO_4$ 0.5% foliar spray + $FeSO_4$ 0.2 % foliar spray (T_{12}) which was on a par with 150 % RDF + $ZnSO_4$ soil application + $FeSO_4$ 0.2% foliar spray (T_{11}) and both these treatments were significantly superior to all other treatments. The least number of effective tillers m^{-2} was recorded with 100% RDF + 50 kg ha^{-1} $ZnSO_4$ as soil application (T_3) which, in turn, was on a par with 100 % RDF + $ZnSO_4$ 0.5% foliar spray (T_4) and both these treatments were significantly inferior to rest of the treatments. Rama Krishna Reddy *et al*, (1986) reported increased number of productive tillers $hill^{-1}$ with increased nitrogen levels up to 80 kg N ha^{-1} which was on a par with 60 kg N ha^{-1}.

Ear head weight at harvest was found to be significantly influenced due to nutrient management practices. Maximum ear head weight was recorded with 150 % RDF + $ZnSO_4$ 0.5 % foliar spray + $FeSO_4$ 0.2 % foliar spray (T_{12}) which, however, was on a par with 150 % RDF +$ZnSO_4$ @ 50 kg ha^{-1} as soil application + $FeSO_4$ 0.2% foliar spray (T_{11}), 150 % RDF + $ZnSO_4$ 0.5 % foliar spray (T_9), 150 % RDF alone (T_2) and 150 % RDF + $FeSO_4$ 0.2% foliar spray (T_{10}) and all these were superior to rest of the treatments. The lowest weight of ear head was obtained with 100% RDF + 50 kg ha^{-1} $ZnSO_4$ as soil application (T_3). Similar report of significant increase in yield attributes with increased levels of N from 0 to 80 kg was reported by Chakraborty *et al.* (2002).

Ear head weight at harvest was found to be significantly influenced due to nutrient management practices. Maximum ear head weight was recorded with 150 % RDF + $ZnSO_4$ 0.5 % foliar spray + $FeSO_4$ 0.2 % foliar spray (T_{12}) which, however, was on a par with 150 % RDF +$ZnSO_4$ @ 50 kg ha^{-1} as soil application + $FeSO_4$ 0.2% foliar spray (T_{11}), 150 % RDF + $ZnSO_4$ 0.5 % foliar spray (T_9), 150 % RDF alone (T_2) and 150 % RDF + $FeSO_4$ 0.2% foliar spray (T_{10}) and all these were superior to rest of the treatments. The lowest weight of ear head was obtained with 100% RDF + 50 kg ha^{-1} $ZnSO_4$ as soil application (T_3). Similar report of significant increase in yield attributes with increased levels of N from 0 to 80 kg was reported by Chakraborty *et al.*(2002).

Appreciable variation in the test weight of finger millet was observed due to nutrient management practices. As in the case of number of effective tillers and weight of ear head, the maximum test weight was recorded with 150 % RDF + $ZnSO_4$ 0.5 % foliar spray + $FeSO_4$ 0.2 %

Table1. Growth characters of finger millet as influenced by nutrient management practices.

Treatment	Plant height (cm)	Dry matter production (kg ha^{-1})	Days to 50 % flowering	Days to maturity
T_1: 100 % RDF	87.9	6875	40	91
T_2: 150 % RDF	89.9	7518	42	97
T_3: T_1+ Zinc sulphate @ 50 kg ha^{-1} as soil application	84.5	4628	40	95
T_4: T_1+ Zinc sulphate 0.5% foliar spray	85.5	5202	44	103
T_5: T_1+ Ferrous sulphate 0.2% foliar spray	88.5	7363	43	96
T_6: T_1+ Zinc sulphate soil application + Ferrous sulphate 0.2% foliar spray	87.6	7021	43	103
T_7: T_1+ Zinc sulphate 0.5% foliar spray + Ferrous Sulphate 0.2% foliar spray	87.0	6593	43	102
T_8: T_2+ Zinc sulphate @ 50 kg ha^{-1} as soil application	87.8	6473	44	101
T_9: T_2+ Zinc sulphate 0.5% foliar spray	88.8	7269	39	95
T_{10}: T_2+ Ferrous sulphate 0.2% foliar spray	92.0	7076	43	103
T_{11}: T_2+ Zinc sulphate soil application + Ferrous Sulphate 0.2% foliar spray	87.6	7407	42	104
T_{12}: T_2 + Zinc sulphate 0.5% foliar spray+ Ferrous sulphate 0.2% foliar spray	93.3	7684	40	98
S Em±	0.90	169	0.996	1.015
CD (0.05 %)	2.7	499	3	3

foliar spray (T_{12}) which, however, was comparable to 150 % RDF + $FeSO_4$ 0.2 % foliar spray (T_{10}) and 150 % RDF + 50 kg ha^{-1} $ZnSO_4$ soil application + $FeSO_4$ 0.2 % foliar spray (T_{11}) and all these were superior to rest of the treatments. The lowest test weight was recorded under 100 % RDF + 50 kg ha^{-1} $ZnSO_4$ soil application (T_3) and 100 % RDF + $ZnSO_4$ 0.5 % foliar spray (T_4). Both these treatments were significantly inferior to rest of the treatments. Increase in test weight due to increased N levels has also been reported by *Chavan et al.* (1995) and Pilane *et al.*(1997) in finger millet.

Effect of nutrient management on yield

Nutrient management practices significantly influenced the grain and straw yields of finger millet (Table 3). The highest grain yield (3426 kg ha^{-1}) was obtained with 150 % RDF + $ZnSO_4$ 0.5 % foliar spray+ $FeSO_4$ 0.2 % foliar spray (T_{12}) followed by 150 % RDF (T_2), 150 % RDF+ $FeSO_4$ 0.2 % foliar spray (T_{10}), 150 % RDF + 50 kg ha^{-1} $ZnSO_4$ soil application + $FeSO_4$ 0.2% foliar spray(T_{11}). The lowest grain yield was realised from T_3 (100 % RDF + $ZnSO_4$ @ 50 kg ha^{-1} as soil application) which, however, was on a par with 100 % RDF + $ZnSO_4$ 0.5 % foliar spray + $FeSO_4$ 0.2% foliar spray (T_7) and 100 % RDF + 50 kg ha^{-1} $ZnSO_4$ soil application + $FeSO_4$ 0.2 % foliar spray (T_6). The relatively lower response to soil application of $ZnSO_4$ as compared to foliar application might be attributed to the fact that the experimental soil had a higher level of 1.23 ppm of Zn and pH of 7.7, both of which might have been responsible for poor release of Zn from soil to the crop. The increase in grain yield with 150 % RDF + $ZnSO_4$ 0.5 % foliar spray+ $FeSO_4$ 0.2 % foliar spray (T_{12}) over 100% RDF was to a tune of 23.9 per cent while 100 % RDF + $ZnSO_4$ 0.5 % foliar spray + $FeSO_4$ 0.2% foliar spray (T_7) resulted in a reduction in the grain yield by 15.8 percent (-15.8 %) over 100 RDF. Increased grain yield due to varying levels of nutrients have also been reported

Table 2. Yield attributes of finger millet as influenced by nutrient management practices.

Treatment	Number of effective tillers m^{-2}	Weight of ear head (g)	Test weight (g)
T_1: 100 % RDF	126	8.7	3.13
T_2: 150 % RDF	127	9.1	3.19
T_3: T_1+ Zinc sulphate @ 50 kg ha^{-1} as soil application	104	7.7	2.96
T_4: T_1+ Zinc sulphate 0.5% foliar spray	108	8.1	3.04
T_5: T_1+ Ferrous sulphate 0.2% foliar spray	124	8.1	3.20
T_6: T_1+ Zinc sulphate soil application + Ferrous sulphate 0.2% foliar spray	128	7.8	3.42
T_7: T_1+ Zinc sulphate 0.5% foliar spray + Ferrous Sulphate 0.2% foliar spray	131	8.4	3.53
T_8: T_2+ Zinc sulphate @ 50 kg ha^{-1} as soil application	116	7.8	3.06
T_9: T_2+ Zinc sulphate 0.5% foliar spray	136	9.1	3.59
T_{10}: T_2+ Ferrous sulphate 0.2% foliar spray	135	8.9	3.70
T_{11}: T_2+ Zinc sulphate soil application + Ferrous Sulphate 0.2% foliar spray	142	9.4	3.70
T_{12}: T_2 + Zinc sulphate 0.5% foliar spray+ Ferrous sulphate 0.2% foliar spray	144	9.5	3.76
S Em±	1.7	0.4	0.02
CD (0.05 %)	5	0.8	0.07

Table .3 Grain and straw yields of finger millet as influenced by nutrient management practices.

Treatment	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})
T_1: 100 % RDF	2766	4059
T_2: 150 % RDF	3332	4668
T_3: T_1+ Zinc sulphate @ 50 kg ha^{-1} as soil application	1986	3140
T_4: T_1+ Zinc sulphate 0.5% foliar spray	2977	3248
T_5: T_1+ Ferrous sulphate 0.2% foliar spray	2948	4075
T_6: T_1+ Zinc sulphate soil application + Ferrous sulphate 0.2% foliar spray	2643	4321
T_7: T_1+ Zinc sulphate 0.5% foliar spray + Ferrous Sulphate 0.2% foliar spray	2329	4610
T_8: T_2+ Zinc sulphate @ 50 kg ha^{-1} as soil application	2771	4650
T_9: T_2+ Zinc sulphate 0.5% foliar spray	2878	4530
T_{10}: T_2+ Ferrous sulphate 0.2% foliar spray	3226	4980
T_{11}: T_2+ Zinc sulphate soil application + Ferrous Sulphate 0.2% foliar spray	3161	4692
T_{12}: T_2 + Zinc sulphate 0.5% foliar spray+ Ferrous sulphate 0.2% foliar spray	3426	4897
S Em±	243	319
CD (0.05 %)	717	666

by Pilane *et al.*1997 (50 kg N + 25 kg P_2O_5), Tetarwal and Rana, 2006 (80 kg N + 40 kg P_2O_5).

Under the present study there was no negative impact of climatic factors on crop growth and yield. The experimental field, being sandy loam in texture responded to 150 % RDF (90N-45 P_20_5-30 K_2o kg ha^{-1}) either with or without Zn and Fe nutrients. This is evident by higher values of growth and yield attributes with these treatments which ultimately reflected in higher grain yield under T_{12} (150 % RDF + $ZnSO_4$ 0.5 % foliar spray+ $FeSO_4$ 0.2 % foliar spray) treatment.

Maximum straw yield was recorded with 150 % RDF + $FeSO_4$ 0.2 % foliar spray (T_{10}) closely followed by 150 % RDF + $ZnSO_4$ 0.5 % foliar spray + $FeSO_4$ 0.2 % foliar spray (T_{12}) both of which were at par and succeeded by 150 % RDF + $ZnSO_4$ @ 50 kg ha^{-1} as soil application + $FeSO_4$ 0.2 % foliar spray (T_{11}), 150 % R.D.F (T_2) and 150 % RDF + $ZnSO_4$ @ 50 kg ha^{-1} as soil application (T_8). The lowest straw yield was obtained with 100 % RDF + $ZnSO_4$ @ 50 kg ha^{-1} soil application (T_3) followed by 100 % RDF + $ZnSO_4$ 0.5 % foliar spray (T_4) and both these treatments were significantly inferior to rest of all the treatments. Varied responses in straw yield due to varied levels of nutrients have also been reported by several workers viz., Pilane *et al*., 1997 (50 kg N +25 kg P_2O_5), Rama Krishna Reddy *et al*., 1986 (80 kg N) and Sunitha *et al*., 2006 (100 % N through fertilizer).

Thus, it is evident from the present study, that 150 % RDF + $ZnSO_4$ 0.5 % foliar spray + $FeSO_4$ 0.2 % foliar spray (T_{12}) performed better with respect to all the growth and yield attributes studied and accounted for higher straw and grain yields. As such it may be concluded that the finger millet crop requires 90 kg N + 45 kg P_2O_5 and 30 kg K_2O along with application of Zinc and Iron for a higher productivity under sandy loam soil conditions in Southern Agro-Climatic Zone of Andhra Pradesh.

LITERATURE CITED

Chakraborty T, Roy D K and Sounda G 2002 Effect of fertilizer, rock phosphate and *azospirillium* on growth and yield of finger millet (*Elusine corocana* L. Gaertn). *Indian Journal of Agricultural Research,* 36 (3): 192-195.

Chavan A P, Chavan S A and Khanvilkar 1995 Response of finger millet to nitrogen, methods of application and age of seedlings at transplating. *Journal of Maharashtra Agricultural Universities,* 20 (3): 466-467.

Misra A, Patra S S and Patnaik R N 1973 Response of ragi (*Eleusine Coracana* (L.) Gaertn.) to spacings and nitrogen. *Indian Journal of Agronomy, vol*. (18) 265 - 268.

Pilane M S, Salve R B, Pawar V S and Bhoi P G 1997 Response of finger millet (*Eleusine coracana*) varieties to nitrogen and phosphorus. *Indian Journal of Agronomy,* 42 (4): 637 - 640.

Rama Krishna Reddy M G., Rami Reddy S, Ramachandra Reddy P, Subrahmanyam K and Subrahmanyam M V R 1986 Effect of nitrogen on nitrogen and phosphorus uptake of finger millet. *Indian Journal of Agronomy,* 31 (1): 29 - 32.

Ramiah S and Morachan Y B 1978 Growth attributes of finger millet as influenced by different levels and methods of phosphorus application. *Madras Agricultural Journal,* 65 (1): 8 - 13.

Sunitha N, Ravi V and Reddappa Reddy 2006 Nitrogen economy in finger millet through conjunctive use of organic manures and bio-fertilizers. *Indian Journal of Agronomy,* 21 (2): 96 - 98.

Tetarwal J P and Rana K S 2006 Impact of cropping system, fertility level and moisture conservation practice on productivity, nutrient uptake, water use and profitability of pearl millet under rainfed condition. *Indian Journal of Agronomy,* 51 (4): 263 - 266.

(Received on 09.05.2012 and revised on 29.09.2012)