The Andhra Agric. J 67 (2): 21-25, 2020

Effect of Crop Geometry and Nutrient Management Practices on Yield and Yield Attributing Traits of Finger Millet

A Aliveni, B Venkateswarlu, M Sree Rekha, P R K Prasad and K Jayalalitha
Department of Agronomy, Agricultural college, Bapatla, A. P.

ABSTRACT

A field experiment was conducted at Agricultural College Farm, Bapatla to assess the performance of finger millet under different crop geometries and nutrient management practices on yield and yield attributes. The trial comprised three crop geometries with different age of seedlings (30x10 cm with 30 days old seedlings, 30x30 cm with 15 days old seedlings and 45x45 cm with 15 days old seedlings) and seven nutrient management practices (S_0: absolute control, S_1: FYM @ 10 tonnes ha^{-1}+ application of *dravajeevamrutham*, S_2: FYM @ 10 tonnes ha^{-1} + application of *dravajeevamrutham* along with wooden log treatment, S_3: FYM @ 10 tonnes ha^{-1} + 100% RDF, S_4: FYM @ 10 tonnes ha^{-1} + 100% RDF along with wooden log treatment, S_5: FYM @ 10 tonnes ha^{-1} + 125% RDF, S_6: FYM @ 10 tonnes ha^{-1} + 125% RDF along with wooden log treatment) laid in split plot design replicated thrice. The yield components *viz*., productive tillers hill^{-1}, ear head weight, ear head length, no. of fingers ear head^{-1} and test weight were significantly influenced by the wider spacing of 45x45 cm transplanted with 15 days old seedlings. The grain and straw yields were significantly higher at 30x10 cm spacing transplanted with 30 days old seedlings. Significantly higher yield parameters *viz*., productive tillers hill^{-1}, ear head weight, ear head length, no. of fingers ear head^{-1}, test weight and grain and straw yields were recorded with the application of FYM @ 10 tonnes ha^{-1} + 125% RDF along with wooden log treatment but were on par with FYM @ 10 tonnes ha^{-1} + 125% RDF.

Key words: *Crop geometry, Nutrient management practice and finger millet, Yield and Yield attributes.*

Finger millet, a highly nutritive cereal rich in carbohydrate, energy and nutrition is an important ingredient of dietary and nutritional balanced foods. The low productivity of the crop is attributed to late transplanting, improper methods of cultivation besides imbalanced use of fertilizers. Most of the crop improvement strategies are adopted towards staple cereals such as rice, wheat and maize and thus attention on crops such as finger millet is neglected. Hence achieving higher yield of finger millet needs the adoption of newer approaches. Suitable planting and nutrient management practices are imperative for boosting the growth and production of finger millet.

Plant geometry plays an important role on growth, development and yield of crops. Improper spacing reduces the yield but optimum spacing ensures plants to grow properly making better utilization of sunlight and nutrients. Hence, maintenance of an optimum level of finger millet plant population in the field is necessary to maximize the grain yields. For sustainable production system in intensively growing areas, use of organic manures have become a priority, instead of heavy and imbalanced use of chemical fertilizers. Therefore, to sustain the soil health and to attain the production potential of crops, a complementary usage of organic manures and chemical fertilizers is important. The importance of FYM, in enriching the soil health should be stressed due to their self nutrient contribution and its role as a soil conditioner in strengthening the soil structure and amelioration of water holding capacity of soil. An experiment was conducted to explore the possibilities of these factors on yield and yield attributes of finger millet.

MATERIAL AND METHODS

Field trials laid out in split plot design with three replications were conducted to study the effect of crop geometry and nutrient management practices on yield and yield attributes of finger millet during *kharif* season of 2018 and 2019. The experimental site was sandy clay loam in texture, slightly alkaline in reaction with low organic carbon, available nitrogen and medium in available phosphorous and potassium content, respectively. The treatments comprised two factors, *viz*., crop geometries with different age of seedlings (M_1: 30x10 cm with 30 days old seedlings, M_2: 30x30 cm with 15 days old seedlings and M_3: 45x45 cm with 15 days old seedlings) and seven nutrient management practices (S_0: absolute control, S_1: FYM @ 10 tonnes ha^{-1}+ application of *dravajeevamrutham*, S_2: FYM @ 10 tonnes ha^{-1} + application of *dravajeeva - mrutham* along with wooden log treatment, S_3: FYM @ 10 tonnes ha^{-1} + 100% RDF, S_4: FYM @ 10 tonnes ha^{-1} + 100% RDF along with wooden log treatment, S_5: FYM @ 10 tonnes ha^{-1} + 125% RDF, S_6: FYM @ 10 tonnes ha^{-1} + 125% RDF along with wooden log treatment). Yield parameters like productive tillers hill^{-1}, ear head weight, length, number of fingers ear head^{-1} and test weight were recorded. Grain and straw yields of finger millet was calculated to kg ha^{-1}. The data was statistically analyzed at 0.05 level of probability following the procedure outlined by Panse and Sukhatme (1978).

RESULTS AND DISCUSSION

Higher yield attributes *viz*., productive tillers hill^{-1} (10.31 and 10.24), ear head weight (4.39 and 4.05 g), ear head length (8.20 and 7.94 cm), no. of fingers ear head^{-1} (6.96 and 7.12) and test weight (3.15 and 3.19 g) recorded during 2018-19 and 2019-20, respectively were registered in 45x45 cm spacing, transplanted with 15 days old seedlings (M_3), though the number of fingers ear head^{-1} and ear head length were found non significant. The lower productive tillers hill^{-1} (2.46 and 2.59), ear head weight (2.65 and 2.32 g), ear head length (7.64 and 7.22 cm), number of fingers ear head^{-1} (6.76 and 6.89) and test weight (2.79 and 2.86 g) were registered in 30x10 cm crop geometry transplanted with 30 days old seedlings (M_1) during 2018-19 and 2019-20, respectively.

Following wider spacing concept might have provided a favourable microclimate to the crop rendering effective utilization of growth factors, resulting in superior partitioning of photosynthates to reproductive parts facilitating recording of ameliorative yield attributes. Ram *et al*. (2014) and Anitha (2015) also reported similar findings.

Maximum number of productive tillers hill^{-1} (8.43 and 8.51), the highest ear head weight (4.55 and 4.22 g), ear head length (8.32 and 8.06 cm), number of fingers ear head^{-1} (7.64 and 7.83) and test weight (3.16 and 3.21 g) were associated with the application of FYM @ 10 tonnes ha^{-1} + 125% RDF along with wooden log treatment (S_6) during 2018-19 and 2019-20, respectively but was significantly higher than other treatments except S_5 and S_4 treatments. The absolute control recorded lower yield attributing traits.

Enhanced supply of nutrients through application of FYM blended with chemical fertilizers resulted in optimum availability of nutrients to the crop at the right time in right proportion thus improving the yield attributes, which is the outcome of refined growth, augmented photosynthetic activity besides translocation of photosy nthates from source to sink (Prashantha *et al*., 2019).

The grain (2668 and 2773 kg ha^{-1}) and straw yields (6538 and 6722 kg ha^{-1}) of finger millet were significantly higher at the closer spacing of 30x10 cm, which was distinctly superior to the other two spacings but the lowest grain (2079 and 2172 kg ha^{-1}) and straw yields (4350 and 4504 kg ha^{-1}) were amalgamated at the spacing of 45x45 cm during both the years of study.

Though wider spacing favored for most of the yield attributes compared to closer spacing, it could not compensate the yield on a unit area basis exhibiting the superiority of closer spacing over wider spacing since number of plants unit area^{-1} are higher in closer spacing, which reflected in resulting higher yield ha^{-1}. Similar findings were also reported by Borkar *et al*. (2008), Rajesh, (2011), Kalaraju *et al*. (2011) and Anitha (2015).

Application of FYM @ 10 tonnes ha^{-1} + 125% RDF along with wooden log treatment (S_6) registered significantly higher grain (3079 and 3191 kg ha^{-1}) and straw yields (7729 and 7903 kg ha^{-1}) which were statistically comparable with S_5 treatment. The absolute control recorded significantly lower grain (1213 and 1324 kg ha^{-1}) and straw yields (2483 and 2520 kg ha^{-1}) during both the years of study.

Sustained release of available nutrients during the crop growth period attributed to increased availability of fertilizers along with organic sources significantly increased the growth and yield components of finger millet, which in turn propagated the grain and straw yields (Rani Perumal *et al*., 1991, Goudar, 2014 and Senthilkumar *et al*., 2018).

Harvest index was not affected significantly either by the crop geometries or their interaction, but was markedly influenced due to nutrient management practices.

Wider spacing of 45x45 cm transplanted with 15 days old seedlings (M_3) registered numerically higher values (33.92 and 33.70 during 2018-19 and 2019-20, respectively).

Harvest index was conspicously influenced by its genetic makeup and hence crop geometry exhibited a very little impact to effect it significantly. These findings are in accordance with the earlier research findings of Biswas *et al*. (2015) who reported non significant effect of spacing on harvest index and numerically the highest harvest index with wider spacing over narrow spacing.

The effect of nutrient management practices were found significant on the harvest index of finger millet and the values ranged from 27.73 to 33.34 during 2018-19 and 28.79 to 37.83 during 2019-20. At higher nutrient levels, there was less increase in grain yield corresponding to increase in biological yield. Similar results were also reported by Goudar (2014) who reported highest harvest index in absolute control than 100 % RDF + organic matter.

Table 1. Yield parameters of finger millet as influenced by crop geometry and nutrient management practices during *kharif*, 2018-19 and 2019-20

Treatments	Productive tillers $hill^{-1}$		Number of fingers ear $head^{-1}$		Ear head length (cm)		Ear head weight (g)		Test weight (g)	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
Crop geometry										
M_1- 30x10 cm with 30 days old seedlings	2.46	2.59	6.76	6.89	7.64	7.22	2.65	2.32	2.79	2.86
M_2- 30x30 cm with 15 days old seedlings	6.10	6.56	6.89	7.00	7.89	7.53	3.93	3.59	3.03	3.10
M_3- 45x45 cm with 15 days old seedlings	10.31	10.24	6.96	7.12	8.20	7.94	4.39	4.05	3.15	3.19
S.Em±	0.17	0.26	0.11	0.20	0.15	0.18	0.13	0.12	0.05	0.05
CD (p = 0.05)	0.67	1.01	NS	NS	NS	NS	0.53	0.48	0.22	0.19
CV(%)	12.51	18.21	7.62	12.92	8.73	11.20	16.80	16.72	8.42	7.29
Nutrient management										
S_0-Absolute control	3.74	3.94	6.14	6.05	7.4	6.98	2.71	2.36	2.83	2.88
S_1- FYM @ 10 tonnes ha^{-1} + *dravajeevamrutham*	4.74	4.9	6.21	6.26	7.66	7.14	3.07	2.74	2.86	2.94
S_2- S_1+ passing wooden log	5.21	5.4	6.32	6.57	7.73	7.42	3.34	3.01	2.93	2.97
S_3- FYM @ 10 tonnes ha^{-1} + 100% RDF	6.61	6.81	6.93	7.23	7.87	7.64	3.67	3.34	3.03	3.08
S_4- S_3+ passing wooden log	7.46	7.63	7.27	7.43	8.1	7.8	3.96	3.63	3.06	3.11
S_5- FYM @ 10 tonnes ha^{-1} + 125% RDF	7.84	8.03	7.54	7.66	8.32	7.91	4.3	3.96	3.07	3.16
S_6- S_5+ passing wooden log	8.43	8.51	7.64	7.83	8.32	8.06	4.55	4.22	3.16	3.21
S.Em±	0.42	0.43	0.15	0.21	0.22	0.22	0.21	0.19	0.07	0.06
CD (p = 0.05)	1.2	1.23	0.43	0.61	0.63	0.64	0.62	0.55	0.19	0.19
CV (%)	19.96	19.83	6.6	9.04	8.34	8.9	17.63	17.3	6.59	6.37
Interaction										
M x S	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
S x M	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 2. Yield and harvest index of finger millet as influenced by crop geometry and nutrient management practices during *kharif,* 2018-19 and 2019-20

Treatments	Grain yield (kg ha^{-1})		Straw yield (kg ha^{-1})		Harvest index (%)	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
Crop geometry						
M_1- 30x10 cm with 30 days old seedlings	2668	2773	6538	6722	29.36	30.99
M_2- 30x30 cm with 15 days old seedlings	2258	2363	5757	5896	28.91	30.43
M_3- 45x45 cm with 15 days old seedlings	2079	2172	4350	4504	33.92	33.7
S.Em±	91.61	48.79	147.14	200.83	1.34	1.16
CD (p = 0.05)	360	192	578	789	NS	NS
CV (%)	17.98	9.18	12.15	16.13	19.97	16.78
Nutrient management						
S_0-Absolute control	1213	1324	2483	2520	33.34	37.83
S_1- FYM @ 10 tonnes ha^{-1} + *dravajeevamrutham*	1765	1837	3603	3738	33.18	35.62
S_2- S_1+ passing wooden log	2051	2102	4884	4944	30.93	30.35
S_3- FYM @ 10 tonnes ha^{-1} + 100% RDF	2521	2668	6131	6338	29.68	30.09
S_4- S_3+ passing wooden log	2761	2884	6358	6737	31.13	30.17
S_5- FYM @ 10 tonnes ha^{-1} + 125% RDF	2955	3046	7652	7770	27.73	28.79
S_6- S_5+ passing wooden log	3079	3191	7729	7903	29.12	29.11
S.Em±	136.3	128.22	325.33	388.27	1.83	1.93
CD (p = 0.05)	391	368	933	1114	5.26	5.54
CV (%)	17.51	15.79	17.59	20.41	17.9	18.29
Interaction						
M x S	NS	NS	NS	NS	NS	NS
S x M	NS	NS	NS	NS	NS	NS

CONCLUSION

It can be concluded that transplanting 30 days old seedlings at 30x10 cm spacing and applying FYM @ 10 tonnes ha^{-1} + 125% RDF along with or without wooden log treatment resulted in producing higher yield of finger millet in Krishna Agro-climatic conditions of Andhra Pradesh.

LITERATURE CITED

Anitha D 2015 Finger millet [*Eleusine coracana* (l.) Gaertn] productivity as influenced by crop geometry and age of seedlings. *M.Sc. (Ag.) Thesis*. Acharya N.G. Ranga Agricultural University, Hyderabad.

Biswas K, Hussain I, Abuyusuf A, Hassan Md Z and Jannat N 2015 Hill spacing and number of seedlings per hill on the yield of t. Aman rice (var. BRRI dhan52) in the tidal ecosystem. *American Research Thoughts*. 1(11): 2725-2744.

Borkar L S, Khawale V S, Raut P B, Patil T S and Kolte H S 2008 Studies on spacing and nitrogen management under system of rice intensification (SRI). *Journal of Soils and Crops*. 18(2): 438-441.

Goudar P K 2014 Effect of rotation, use of organic and inorganic sources of nutrients on growth and yield of finger millet (*Eleusine coracana* L. GAERTN.). *M.Sc. (Ag.) Thesis*. University of Agricultural Sciences, GKVK, Bangalore.

Kalaraju K, Deva Kumar N, Nagaraja N and Ningappa K B 2011 Effect of methods of planting on growth and yield of finger millet genotypes under organic farming. *Research on Crops*. 10(1): 20-24.

Panse V G and Shukhatme P V 1978 Statistical methods for agricultural workers, ICAR, New Delhi. 145-150.

Prashantha G M, Prakash S S, Umesha S, Chikkaramappa T, Subbarayappa C T and

Rajesh K 2011 System of Crop Intensification in finger millet (*Eleusine coracana* (L.) Gaertn.) under irrigated condition. *M.Sc. (Ag.) Thesis*. Tamil Nadu Agricultural University, Coimbatore.

Ram H, Singh J P, Bohra J S, Rajiv Singh K and Sutaliya J M 2014 Effect of seedlings age and plant spacing on growth, yield, nutrient uptake and economics of rice (*Oryza sativa*) genotypes under system of rice intensification. *Indian Journal of Agronomy*. 59 (2): 256-260.

Rani Perumal, Francis H, Duraisamy P, Kandaswamy P and Palaniappan S P 1991 Integrated nutrient management in Tamil Nadu. *Technical Bulletin of Department of Soil Science and Agricultural Chemistry*. T.N.A.U., Coimbatore, Tamil Nadu.

Senthilkumar N, Poonkodi P and Prabhu N 2018 Response of pearl millet to integrated use of organics and fertilizers. *Journal of Ecobiotechnology*. 10: 01-04.

Received on 27.07.2020 and revised on 27.09.2020