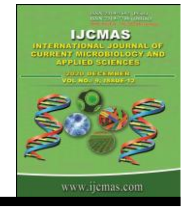
Int.J.Curr.Microbiol.App.Sci (2020) *9*(12): 532-537



International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 9 Number 12 (2020)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2020.912.063

Physiological and Yield Response of Finger Millet Grown under Different Crop Geometries and Nutrient Management Practices

A. Aliveni* and B. Venkateswarlu

Department of Agronomy, Agricultural College, Bapatla, Andhra Pradesh, India

**Corresponding author*

A B S T R A C T

Keywords

Yield, CGR, RGR, NAR, Crop geometry, Nutrient management practice and finger millet

Article Info

Accepted:
07 November 2020
Available Online:
10 December 2020

An experiment was conducted during the *kharif* seasons of 2018 and 2019 at Agricultural college farm, Bapatla to study the physiological and yield performance of finger millet under different crop geometries and nutrient management practices. The trial comprised of 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 tons ha^{-1} + application of *dravajeevamrutham*, S_2: FYM @ 10 tons ha^{-1} + application of *dravajeevamrutham* along with wooden log treatment, S_3: FYM @ 10 tons ha^{-1} + 100% RDF, S_4: FYM @ 10 tons ha^{-1} + 100% RDF along with wooden log treatment, S_5: FYM @ 10 tons ha^{-1} + 125% RDF, S_6: FYM @ 10 tons ha^{-1} + 125% RDF along with wooden log treatment) laid in split plot design and replicated thrice. The results revealed that the closer spacing of 30x10 cm, transplanted with 30 days old seedlings along with application of FYM @ 10 tons ha^{-1} + 125% RDF along with wooden log treatment had superiority in CGR, RGR and yield. Whereas the wider spacing of 45x45 cm spacing transplanted with 15 days old seedlings along with absolute control had superiority in NAR.

Introduction

The agricultural productivity and availability of nutritious food at household level can be improved by identifying and improving the yield of traditional or native crops that are highly adaptive to local climate and having high nutrient value. These crops are largely consumed by indigenous communities and are often referred to as coarse cereals. Finger millet is one such crop, for addressing malnutrition and hidden hunger worldwide, grown in arid regions and adapted to adverse climatic conditions and possess superior nutritional properties. Among the different agronomic practices, crop geometry and nutrient management practices play a prominent role in improving yield levels of crops. An ideal crop geometry is essential for obtaining optimum plant stand in the field as the yield of a crop depends on the final plant density with effective utilization of growth resources.

Conjunctive use of chemical fertilizers and organic manures is important to maintain and sustain soil fertility and crop productivity. Organic manures enrich soil organic matter, improve soil physical and biological environment and act as store house of nutrients. Since integrated nutrient management system is gaining importance among the farmers in rainfed agro ecosystem, it is advisable to optimize the use of inorganic fertilizers along with organic manures such as FYM, for getting high yields of better quality besides keeping the production cost at sustainable level. Therefore the present experiment was conducted to study the physiological and yield performance of finger millet under different crop geometries and nutrient management practices.

Materials and Methods

Field trial was conducted to study the effect of crop geometry and nutrient management practices on physiological and yield performance of finger millet during *kharif* season of 2018 and 2019. The soil of experimental site was sandy clay loam in texture with slightly alkaline reaction, low organic carbon content, low available nitrogen and medium in available phosphorous and potassium. The layout of the trial was split plot design with three replications. The treatments comprised of 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 tons ha^{-1}+ application of *dravajeevamrutham*, S_2: FYM @ 10 tons ha^{-1} + application of *dravajeevamrutham* along with wooden log treatment, S_3: FYM @ 10 tons ha^{-1} + 100% RDF, S_4: FYM @ 10 tons ha^{-1} + 100% RDF along with wooden log treatment, S_5: FYM @ 10 tons ha^{-1} + 125% RDF, S_6: FYM @ 10 tons ha^{-1} + 125% RDF along with wooden log treatment). The observations on physiological parameters like CGR, RGR and NAR were recorded at 30 - 60 DAT and 60 DAT – harvest intervals. Yield of finger millet was calculated based on the yield obtained from each net plot and further converted to kg ha^{-1}. To calculate CGR (Crop growth rate), RGR (Relative growth rate) and NAR (Net assimilation rate) following formula were used:

$$\text{CGR} = \frac{w_2 - w_1}{t_2 - t_1} \times \frac{1}{A}$$

Where, w_1 = Total dry weight of plant (g) at time t_1, w_2 = Total dry weight of plant (g) at time t_2, $t_2 - t_1$ = time interval (days), A = Land area (m^2)

$$\text{RGR} = \frac{\text{Log}_e w_2 - \text{Log}_e w_1}{t_2 - t_1}$$

Where, w_1 = Total dry weight of plant (g) at time t_1, w_2 = Total dry weight of plant (g) at time t_2, $t_2 - t_1$ = time interval (days)

$$\text{NAR} = \frac{w_2 - w_1}{t_2 - t_1} \times \frac{\text{Log}_e l_2 - \text{Log}_e l_1}{l_2 - l_1}$$

Where, w_1 = Total dry weight of plant (g) at time t_1, w_2 = Total dry weight of plant (g) at time t_2, l_1= Leaf area at time t_1, l_2= Leaf area at time t_2, $t_2 - t_1$ = time interval days).

Results and Discussion

CGR and RGR were significantly higher at closer plant geometry of 30×10 cm transplanted with 30 days old seedlings compared to the wider plant geometry of 45×45 cm and 30×30 cm, transplanted with 15 days old seedlings recorded at 30 - 60 DAT and 60 DAT - harvest intervals of the crop (Tables 1). RGR was not distinguishable during 30 - 60 DAT interval. The higher CGR values at closer spacing might be due to taller plants and more dry matter production per unit area. The results are in agreement with Nayak *et al.*, (2003) and Oghalo (2011). Rajput *et al.*, (2017) observed higher CGR and RGR values at closer spacing. The CGR recorded was the highest with older seedlings over younger seedlings. The present findings are in accordance with the earlier study conducted by Tilahun *et al.*, (2013) in rice.

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

Treatments	Crop growth rate (g m^{-2} day^{-1})						Relative growth rate (g g^{-1} day^{-1})					
	30 - 60 DAT			60 DAT - HARVEST			30 - 60 DAT			60 DAT - HARVEST		
Crop geometry	**2018-19**	**2019-20**	**Pooled data**	**2018-19**	**2019-20**	**Pooled data**	**2018-19**	**2019-20**	**Pooled data**	**2018-19**	**2019-20**	**Pooled data**
M_1- 30×10 cm with 30 days old seedlings	10.11	11.24	10.67	4.98	5.38	5.18	0.0152	0.0172	0.0162	0.0053	0.0060	0.0056
M_2- 30×30 cm with 15 days old seedlings	8.87	10.50	9.68	3.72	4.00	3.86	0.0143	0.0183	0.0163	0.0045	0.0048	0.0047
M_3- 45×45 cm with 15 days old seedlings	7.13	8.33	7.73	3.51	3.50	3.51	0.0145	0.0181	0.0163	0.0050	0.0051	0.0051
S.Em±	0.32	0.31	0.26	0.11	0.15	0.09	0.0002	0.0007	0.0003	0.0001	0.0002	0.0001
CD (p = 0.05)	1.25	1.22	1.00	0.43	0.60	0.37	NS	NS	NS	0.0005	0.0006	0.0005
CV (%)	16.79	14.24	12.51	12.41	16.33	10.35	7.50	16.70	7.27	12.39	13.70	12.11
Nutrient management												
S_0-Absolute control	4.61	5.67	5.14	1.79	1.68	1.74	0.0141	0.0193	0.0167	0.0036	0.0040	0.0038
S_1- FYM @ 10 tonnes ha^{-1} + *dravajeevamrutham*	5.80	7.45	6.62	2.60	2.36	2.48	0.0141	0.0190	0.0166	0.0043	0.0041	0.0042
S_2- S_1+ passing wooden log	7.89	9.20	8.54	3.03	3.48	3.25	0.0145	0.0182	0.0163	0.0044	0.0049	0.0046
S_3- FYM @ 10 tonnes ha^{-1} + 100% RDF	9.36	10.73	10.05	4.62	4.79	4.70	0.0147	0.0173	0.0160	0.0054	0.0056	0.0055
S_4- S_3+ passing wooden log	10.08	11.63	10.85	4.90	5.15	5.02	0.0147	0.0173	0.0159	0.0055	0.0059	0.0057
S_5- FYM @ 10 tonnes ha^{-1} + 125% RDF	11.20	12.65	11.93	5.69	6.19	5.94	0.0148	0.0172	0.0160	0.0056	0.0062	0.0059
S_6- S_5+ passing wooden log	11.99	12.81	12.40	5.85	6.44	6.14	0.0155	0.0170	0.0162	0.0059	0.0063	0.0061
S.Em±	0.56	0.65	0.57	0.22	0.25	0.20	0.0005	0.0008	0.0005	0.0003	0.0004	0.0003
CD (p = 0.05)	1.62	1.85	1.63	0.64	0.72	0.56	NS	NS	NS	0.0009	0.0010	0.0009
CV (%)	19.42	19.32	18.21	16.43	17.50	14.03	10.63	13.26	8.40	19.39	19.95	18.28
Interaction												
M x S	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
S x M	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

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

Treatments	Net assimilation rate (g m^{-2} day^{-1})						Yield (kg ha^{-1})					
	30-60 DAT			60 DAT - HARVEST			Grain			Straw		
Crop geometry	**2018-19**	**2019-20**	**Pooled data**	**2018-19**	**2019-20**	**Pooled data**	**2018-19**	**2019-20**	**Pooled data**	**2018-19**	**2019-20**	**Pooled data**
M_1- 30×10 cm with 30 days old seedlings	0.037	0.041	0.039	0.013	0.014	0.014	2668	2773	2721	6538	6722	6630
M_2- 30×30 cm with 15 days old seedlings	0.057	0.067	0.062	0.019	0.020	0.020	2258	2363	2310	5757	5896	5827
M_3- 45×45 cm with 15 days old seedlings	0.071	0.080	0.075	0.030	0.029	0.029	2079	2172	2126	4350	4504	4427
S.Em±	0.002	0.003	0.002	0.0006	0.0009	0.001	91.61	48.79	61.18	147.14	200.83	177.42
CD (p = 0.05)	0.008	0.010	0.008	0.003	0.003	0.002	360	192	240	578	789	697
CV (%)	17.54	18.28	16.28	14.27	18.97	12.81	17.98	9.18	11.75	12.15	16.13	14.45
Nutrient management												
S_0-Absolute control	0.067	0.083	0.075	0.024	0.023	0.023	1213	1324	1268	2483	2520	2502
S_1- FYM @ 10 tonnes ha^{-1} + *dravajeevamrutham*	0.069	0.078	0.074	0.023	0.024	0.023	1765	1837	1801	3603	3738	3671
S_2- S_1+ passing wooden log	0.063	0.070	0.066	0.024	0.024	0.024	2051	2102	2076	4884	4944	4914
S_3- FYM @ 10 tonnes ha^{-1} + 100% RDF	0.053	0.057	0.055	0.021	0.022	0.022	2521	2668	2595	6131	6338	6234
S_4- S_3+ passing wooden log	0.050	0.057	0.053	0.022	0.022	0.022	2761	2884	2822	6358	6737	6547
S_5- FYM @ 10 tonnes ha^{-1} + 125% RDF	0.048	0.051	0.049	0.019	0.021	0.020	2955	3046	3000	7652	7770	7711
S_6- S_5+ passing wooden log	0.037	0.044	0.041	0.012	0.013	0.013	3079	3191	3135	7729	7903	7816
S.Em±	0.003	0.004	0.003	0.0011	0.0014	0.001	136.30	128.22	98.73	325.33	388.27	320.07
CD (p = 0.05)	0.009	0.011	0.010	0.003	0.004	0.003	391	368	283	933	1114	918
CV (%)	16.55	17.88	17.21	16.20	19.70	14.83	17.51	15.79	12.42	17.59	20.41	17.06
Interaction												
M x S	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
S x M	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

With regard to the nutrient management practices, application of FYM @ 10 tons ha^{-1} + 125% RDF along with wooden log treatment recorded the higher CGR and was comparable with FYM @ 10 tons ha^{-1} + 125% RDF (S_5). The influence of various nutrient management treatments were significant regarding the RGR at 60 DAT-harvest interval only and higher RGR values were observed with FYM @ 10 tons ha^{-1} + 125% RDF along with wooden log treatment (S_6) and was on a par with all other integrated nutrient management practices with and without wooden log treatment (S_3, S_4 and S_5). Higher doses of nutrients resulting in higher availability of nutrients in the soil for plant nourishment and combined use of nutrients in desired quantity may be attributed to improvement in physico-chemical and biological properties of soil which maintained continuous supply of nutrient to crop which increased plant growth attributes (Singh *et al.*, 2018).

The highest NAR was recorded with wider spacing of 45×45 cm and planting 15 days aged seedlings (M_3), followed by M_2 and M_1 treatments. The NAR increased with increase in spacing. Similar results were reported by Mohabbesi *et al.*, (2011), Sridhara *et al.*, (2011) and Rajput (2013).

With regard to the nutrient management treatments higher NAR values were registered with absolute control compared to the other management treatments. A decrease in net assimilation rate was observed with increased levels of nutrients may be attributed to the effect of this nutrients on relative rates of photosynthesis and respiration. Increase in vegetative growth significantly with increased doses of nutrients might be expected to increase the respiration of plants markedly and have resulted in an increase in mutual shading of leaves with a resultant decrease in photosynthetic activity. The overall net photosynthesis per unit of photosynthesizing tissue thus came down. Similar results were also observed by Varghese *et al.*, (1976) in sunflower.

The grain and straw yield were significantly higher at the closer spacing of 30x10 cm, which was significantly superior over the other two spacings and the lowest grain and straw yield were registered at the spacing of 45x45 cm during both the years of study and in pooled data. 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 showing the superiority of closer spacing over wider spacing as number of plants per unit area are more in closer spacing which is reflected in yield ha^{-1}. Similar findings at closer spacing was also reported by Borkar *et al.*, (2008), Rajesh, (2011), Kalaraju *et al.*, (2011) and Anitha (2015).

Application of FYM @ 10 tons ha^{-1} + 125% RDF along with wooden log treatment (S_6) registered significantly higher grain and straw yield and statistically comparable with S_5 treatment. The absolute control recorded significantly lower grain and straw yields during both the years of study and in pooled data.

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

In conclusion the results from the study inferred that transplanting of 30 days old seedlings at closer spacing of 30x10 cm and application of FYM @ 10 tons ha^{-1} + 125% RDF along with or without wooden log treatment resulted in the higher CGR, RGR and yield of finger millet and NAR increase with spacing under Krishna Agro-climatic conditions of Andhra Pradesh.

References

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

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.). *M.Sc. 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.

Mohabbesi A., Abbasian A., Bakhshipour, S and Hashem, A. 2011. Effect of different level of nitrogen and plant spacing on yield, yield components and physiological indices in high yield rice. *American Eurasian Journal of Agriculture & Environment Science*. 10 (5): 893-900.

Nayak, B.C., Dalei, B.B and Choudhury, B.K. 2003. Response of hybrid rice (*Oryza sativa*) to date of planting, spacing and seedling rate during wet season. *Indian Journal of Agronomy*. 48 (3): 172-174.

Oghalo, S.O. 2011. Effect of population density on the performance of upland rice (*Oryza sativa*) in a forest-Savanna transition zone. *International Journal of sustainable Agriculture*. 3 (2): 44-48.

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

Rajput, A. 2013. Effect of planting geometries on growth and yield of improved rice varities under depth of planting in system of rice intensification. *Ph.D Thesis*. Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur. M.P.

Rajput, A., Rajput, S.S and Jha, G. 2017. Physiological parameters leaf area index, crop growth rate, relative growth rate and net assimilation rate of different varieties of rice grown under different planting geometries and depths in SRI. *International Journal of Pure and Applied Biosciences*. 5 (1): 362-367.

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.

Singh., Singh, M. K., Sachin Tyagi and Singh, S.S. 2018. Effect of integrated nutrient management on growth and yield of rice (*Oryza sativa* L.). *International Journal of Current Microbiology and Applied Sciences*. 7: 3671-3681.

Sridhara, C.J., Ramachandrappa, B.K., Kumarswamy, A.S and Gurumurthy, K.T. 2011. Effect of genotypes, planting geometry and methods of establishment on root traits and yield of aerobic rice. *Karnataka Journal of Agriculture Science*. 24 (2): 129-132.

Tilahun, T.F., Nigussie, D.R., Wondimu, B and Setegn, G. 2013. Effect of farmyard manure and inorganic fertilizers on the growth, yield and moisture stress tolerance of rain-fed lowland rice. *American Journal of Research Communication*. 1 (4): 275-301.

Varghese, P.T., Sadanandan, N and Nair, R.V. 1976. A study on leaf area index and net assimilation rate of sunflower variety Peredovik as affected by graded doses of nitrogen and phosphorous. *Agricultural Research Journal of Kerala*. 14 (1): 53-57.

How to cite this article:

Aliveni, A. and Venkateswarlu, B. 2020. Physiological and Yield Response of Finger Millet Grown under Different Crop Geometries and Nutrient Management Practices. *Int.J.Curr.Microbiol.App.Sci.* 9(12): 532-537. doi: https://doi.org/10.20546/ijcmas.2020.912.063