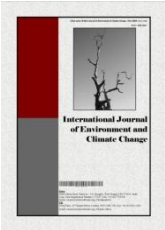

International Journal of Environment and Climate Change

12(9): 201-205, 2022; Article no.IJECC.86393
ISSN: 2581-8627
(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)

Effect of Establishment Methods and Nutrient Levels on Growth and Yield of Finger Millet (*Eleusine coracana* L.)

Bhavani Reddy Vanukuri [a*†], Vikram Singh [b#], Shruti Grace George [a‡] and Vivek [cφ]

[a] Department of Agronomy, NAI, SHUATS, Prayagraj- (U.P.), India.
[b] Directorate of Seed and Farm, NAI, SHUATS, Prayagraj- (U.P.), India.
[c] Department of Agronomy, Narain College, Shikohabad, Firozabad- (U.P.), India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJECC/2022/v12i930755

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/86393

Original Research Article

Received 14 February 2022
Accepted 18 April 2022
Published 21 April 2022

ABSTRACT

A field experiment was conducted during kharif season at Crop Research Farm, Department of Agronomy, SHUATS, Allahabad (U.P.). The soil of experimental plot was sandy loam in texture. The treatment consisted of T_1-Transplanting+75% RDF, T_2-Transplanting+100% RDF, T_3-Transplanting+125 % RDF, T_4- Broadcasting+75% RDF, T_5-Broadcasting+100% RDF, T_6-Broadcasting+125% RDF, T_7-Line sowing +75%RDF, T_8-Line sowing +100%RDF, T_9- Line sowing +125%RDF.The experiment was laid out in Randomized Block Design, with 9 treatments replicated thrice. Results revealed that maximum plant height (94.7 cm), numbers of tillers per plant (7.5), plant dry weight (22.97 g/plant), Effective tillers per m^2 (172.3), test weight (3.8 g), number of grains per finger (2240), finger weight (11.4 g), grain yield (3.2 t/ha), straw yield (4.48 t/ha) It can be concluded, that the treatment Transplanting + 125 % RDF was more productive.

[†] M.Sc. Scholar;
[#] Associate Professor;
[‡] Ph.D. Scholar;
[φ] Associate Professor and Head;
**Corresponding author: E-mail: vanukuri.bhavani111@gmail.com;*

Keywords: Finger millet; planting methods; nutrient levels; yield attributes; kharif.

1. INTRODUCTION

Finger millet (*Eleusine coracana* L.) belongs to family Poaceae. It is an annual herbaceous plant widely grown as a cereal crop in the arid and semiarid areas of Africa and Asia and has been an indispensable componenent of farming system [1]. Finger millet is a tufted annual cereal crop growing 40-150 cm tall, taking between 2.5 and 6 months to mature. In India, it is cultivated in Karnataka, Tamil Nadu, Andhra Pradesh, Orissa, Jharkhand, Uttaranchal, Maharashtra, and Gujarat, Finger millet occupied an area of 1.19 million hectares accounting for a production of 1.98 million tonnes [2]. The grain contains 9.2% proteins, 1.29% fats, 76.32% carbohydrates, 2.2% mineral, 3.90% ash, and 0.33% calcium.

The main reasons for low productivity is due to an imbalance in nutrients coupled with adverse climatic conditions, late transplanting, faulty methods of cultivation and little or no use of fertilizers. The secret of boosting its yields mainly lies in suitable planting method and properly fertilizing the crop. Method of sowing is important agronomic factor affecting the productivity of crop. Proper sowing method is the important non-monetary input in crop production, which affects the crop growth, yield and quality to greater extent. Method of establishment play important role to fully exploit all available resources for growth as it provides optimum growing condition [3].

Nitrogen is a vital plant nutrient and a major yield determining factor required for production of growth. It is essential for carbohydrates metabolism within plants and stimulates vegetative and along with development uptake of other nutrients [4]. Phosphorus plays an important part in many physiological processes occur within a developing and maturing stages of plant. It is also involved in enzymatic reaction and essential for cell division. An adequate amount of phosphorus is necessary for earlier maturity, rapid growth and improves the quality of vegetative growth [5]. Potassium plays a significant role in biochemical functions of the plant like activating various enzymes, improvement of protein, carbohydrates and fat concentration, developing tolerance against drought and resistance to frost, lodging, pests and disease attack [6].

Therefore, it is important to optimize nutrient management practices and selection of best sowing method for obtaining better yield. Because, of the need to know the proper establishment method and nutrient requirement this study was conducted to evaluate the effect of establishment methods and nutrient levels on growth and yield of finger millet.

2. MATERIALS AND METHODS

The experiment was carried out during *Kharif* season of 2021, at the CRF (Crop Research Farm) SHIATS, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh. The Crop Research Farm is situated at 25.75^0 N latitude, 87.19^0 E longitude and at an altitude of 98m above mean sea level. Prayagraj has a subtropical and semi-arid climatic condition, with both extremes of temperature, *i.e*., winter and summer. The soil of the experiment field contains soil Ph of about 6.9, available nitrogen 278.93 Kg/ha, available phosphorus 10.8 Kg/ha, available Potassium 206.4 Kg/ha. The experiment was laid out in Randomized Block Design (RBD) with three replications and nine treatments: T_1- Transplanting + 75 % RDF, T_2- Transplanting + 100 % RDF, T_3- Transplanting + 125 % RDF, T_4- Broadcasting + 75 % RDF, T_5- Broadcasting + 100 % RDF, T_6- Broadcasting + 125 % RDF, T_7- Line sowing + 75 % RDF, T_8- Line sowing + 100 % RDF, T_9- Line sowing + 125 % RDF. The recommended RDF for the crop is 60:30:30 Kg/ha. Finger millet GPU- 28 variety was used with spacing of 30×10 cm with an area of 3 × 3 m for each plot. A well – drained fertile soil with good irrigation facility is selected for growing nursery, and 17 days age seedlings were used for transplanting and transplanting was done with 2 seedlings per hill. One quadrate was harvested in every plot for the determination of results and data was subjected to statistical analysis separately by using analysis of variance technique (ANOVA). The difference among treatment means was compared by using least significant difference test at 5% probability levels.

3. RESULTS AND DISCUSSION

3.1 Growth Parameters

Growth parameters of finger millet were measured in terms of Plant height (cm), number of tillers per plant, plant dry weight (g/plant) at harvesting were shown in the Table1.

3.1.1 Plant height

Significantly taller plant height (94.7 cm) was recorded with application of 125% RDF + Transplanting. However, treatment of Line sowing + 125 % RDF (92.7 cm) was statistically at par with the treatment 125 % RDF + Transplanting. Increase in plant height might be due to the transplanting shock, which helps in vigorous plant growth and development of new roots. Application of 125 % RDF provides sufficient nutrient to the plant which leads to anatomical changes such as increase in size of cells, intercellular spaces, thinner cell walls and lower development of epidermal tissue resulted to increase in plant height. Similar findings were reported by Raundal et al. [7].

3.1.2 Number of tillers

significantly highest number of tillers was recorded with the treatment of Transplanting+125% RDF (7.5). However, treatment with Line sowing + 125% RDF (6.9) was statistically at par with treatment of Transplanting + 125 % RDF. Transplanted plants would have utilized the available sources such as spacing, forage area for root system, light utilization further enhanced the tiller development. Increased RDF provides much availability of nutrients which helps in development of axillary bud from which tillers are emerged. Similar findings were observed in Sunitha et al. [8]. Deshmukh [9] and Pradhan et al. [10].

3.1.3 Plant dry weight (g)

Significantly highest plant dry weight was recorded with treatment of Transplanting + 125 % RDF (22.97 g). However, treatment with Line sowing + 125 % RDF (22.02 g) and Broadcasting + 125 % RDF (21.55 g) were statistically at par with treatment of Transplanting+ 125 % RDF. Highest dry matter accumulation was observed because of highest plant height and number of tillers due to the fact that increase in levels of RDF. Similar findings were observed in Triveni et al. [11].

Table 1 Effect of establishment methods and nutrient levels on growth attributes of Finger millet

Treatment details	Plant height (cm)	No of tillers	Plant dry weight (g/plant)
Transplanting + 75% RDF	86.9	6.1	18.74
Transplanting + 100% RDF	90.1	6.6	20.25
Transplanting + 125% RDF	94.7	7.5	22.97
Broadcasting + 75% RDF	82.4	4.0	18.13
Broadcasting + 100% RDF	85.4	4.4	19.93
Broadcasting + 125 % RDF	89.0	4.6	21.55
Line Sowing + 75% RDF	85.2	5.3	19.50
Line Sowing + 100% RDF	87.7	6.2	21.12
Line Sowing + 125 % RDF	92.7	6.9	22.02
F- test	S	S	S
SEm (±)	0.99	0.16	0.84
CD (5%)	2.98	0.49	2.52

Table 2. Effect of establishment methods and nutrient levels on yield attributes of Finger millet

Treatment details	Tillers per m^2	Number of grains per ear-head	Finger weight (g)	Test weight(g)
Transplanting + 75% RDF	142.3	1837.3	8.3	2.9
Transplanting + 100% RDF	165.3	2001.3	9.6	3.3
Transplanting + 125% RDF	172.3	2240.0	11.4	3.8
Broadcasting + 75% RDF	125.0	1661.3	6.1	2.4
Broadcasting + 100% RDF	134.3	1748.0	7.4	2.6
Broadcasting + 125 % RDF	143.3	1853.3	8.4	3.2
Line Sowing + 75% RDF	136.0	1953.3	8.2	2.7
Line Sowing + 100% RDF	149.3	1985.7	9.4	3.1
Line Sowing + 125 % RDF	164.0	2057.0	10.6	3.5
F- test	**S**	**S**	**S**	**S**
SEm (±)	2.14	36.27	0.29	0.07
CD (5%)	6.44	108.74	0.86	0.20

Table 3. Effect of establishment methods and nutrient levels on yield of Finger millet

Treatment details	Grain yield (t/ha)	Stover yield (t/ha)	Harvest index (%)
Transplanting + 75% RDF	2.78	3.88	41.8
Transplanting + 100% RDF	3.01	4.20	41.8
Transplanting + 125% RDF	3.16	4.48	42.7
Broadcasting + 75% RDF	2.51	3.52	39.8
Broadcasting + 100% RDF	2.68	3.62	41.7
Broadcasting + 125 % RDF	2.88	3.84	42.5
Line Sowing + 75% RDF	2.63	3.74	42.0
Line Sowing + 100% RDF	2.91	4.09	41.7
Line Sowing + 125 % RDF	3.12	4.41	41.2
F- test	S	S	NS
SEm (±)	0.08	0.07	0.86
CD (5%)	0.23	0.22	----

3.2 Yield Attributes

Yield attributes of Finger millet was measured in terms of number of tillers per m2, number of grains per ear-head, finger weight (g), test weight (g) at harvesting was shown in the Table 2.

3.2.1 Number of tillers per m2

Significantly highest number of effective tillers per m2 was recorded with treatment Transplanting + 125 % RDF ((172.3). However, treatment with Transplanting + 100 % RDF (165.3) was statistically at par with the treatment of Transplanting + 125 % RDF.

3.2.3 Number of grains per ear-head

Significantly highest number of grains per ear-head was recorded with treatment Transplanting + 125 % RDF (2240). However, treatment with Line sowing + 125 % RDF (2057) was statistically at par with the treatment Transplanting + 125 % RDF.

3.2.4 Finger weight (g)

Significantly highest finger weight was recorded with treatment Transplanting + 125 % RDF (11.4g). However, treatment with Line sowing + 125 % RDF (10.6g) was statistically at par with the treatment of Transplanting + 125 % RDF.

3.2.5 Test weight (g)

Significantly highest test weight was recorded with treatment Transplanting + 125 % RDF (3.8 g). However, treatment with Broadcasting + 75 % RDF (3.5 g) was recorded minimum. Highest test weight is due to the fact that higher sink to source relationship leads to higher values of test weights. Similar results were found by Raundal et al. [7].

3.3 Yield

Yield of Finger millet was measured in terms of grain yield, stover yield, harvest index. Significantly highest grain yield was recorded with treatment Transplanting + 125 % RDF (3.16 t/ha). However, treatment with Line sowing + 125 % RDF (3.12 t/ha) was statistically at par with the treatment Transplanting + 125%RDF. Increase in grain yield is due to the increased growth parameters and yield attributes. It is fact that yield per unit area is higher with decreased plant population. Increased application of nutrients results in high chlorophyll synthesis and also it effects source to sink relationship which reflects higher yields. Similar findings were found by Raundal *et al*. [7] and Sarwale *et al*. (2017). Significantly highest stover yield (4.48t/ha) was recorded with treatment Transplanting + 125 % RDF. However, treatment with Line sowing + 125 % RDF (4.41 t/ha) was statistically at par with Transplanting + 125 % RDF.Increase of straw yield is due to the fact that the crop absorbed proportionately higher amount of N, P and K due to their higher availability under lower plant population and less competition among the plants for growth resources. Similar findings were observed by Sarwale *et al*. (2017). Treatment with Transplanting + 125 % RDF was recorded maximum Harvest index (42.7 %). Higher harvesting index was noticed due to the increment in both grain and stover yield in turn resulted in higher harvest index. Similar findings were observed in Girisha *et al.* [12].

4. CONCLUSION

From the above findings it is concluded that Transplanting + 125 % RDF was found more productive in terms of growth, yield attributes and yield [13].

FUTURE SCOPE

As there was less research happened in the field, further research should be done to obtain proper results and help farmers to choose better performing treatment. Since the findings are based on the research done in one season, further trails are needed to confirm the results of this experiment.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Goron TL, Raizada MN. Genetic diversity and genomic resources available for the small millet crops to accelerate a new green revolution. Frontier Plant Science. 2015;6:157.
2. Sakamma s, Umesh KB, Girish MR, Ravi SC, Kumar MS, Veerabhadrappa.. Finger millet (*Eleusine corocana L. Gaertn.)* Production system: Status, Potential, Constraints and Implications for Improving Small Farmers Welfare. Journal of Agricultural Science. 2018;10(1):1916-9760.
3. Sarawale PP, Rajemahadik VA, Shendage GB, Mane SV. Effect of different varieties and establishment methods on growth and yield of finger millet (*Eleusine coracana (L.) Gaertn.)* under konkan condition. Journal of the Indian Society of Coastal Agricultural Research. 2016; 34(2):22-26.
4. Khan F, Khan S, Fahad S, Faisal S, Hussain S, Ali S et al. Effect of different levels of nitrogen and phosphorus on the phenology and yield of maize varieties. American Journal of Plant Sciences. 2014;5:2582-2590.
5. Onasanya RO, Aiyelari OP, Onasanya A, Oikeh S, Nwilene FE, Oyelakin OO. Growth and yield response of maize (*Zea mays L.)* to different rates of nitrogen and phosphorus fertilizers in southern Nigeria. World Journal of Agricultural Sciences. 2009;5(4):400-407.
6. Marschner H. Mineral nutrition of higher plants. Academic Press Inc., San Diego, USA. 1995; 148-73.
7. Raundal PU, Patil Vidya U. Response of Little Millet Varieties to Different Levels of Fertilizers under Rainfed Condition. 2017. International Advanced Research Journal in Science. Engineering and Technology 2007;4(8):3297.
8. Sunitha N, Ravi V, Reddappa Reddy. Nitrogen economy in finger millet through conjunctive use of organic manures and biofertilizers. Indian Journal of Dryland Agricultural Research & Development. 2004;19(2):172-174.
9. Deshmukh GM. Studies on effect of FYM, Lime, NP Fertilizer and Boron on yield, nutrient uptake and quality of nagli (*Eluesine coracana G.*). M.Sc. (Agri.) Thesis submitted to the Dr.B.S.K.K.V.,Dapoli;2007.
10. Pradhan A, Thakur A, Patel S, Mishra N. Effect of different nitrogen levels on kodo millet (*Paspalum scrobiculatum L.)* under rainfed condition. Research Journal of Agricultural Science. 2011;2(1):136-38.
11. Triveni U, Sandhya Rani Y, Patro TSSK, Anuradha N, Divya M. Fertilizer responsiveness of short duration improved finger millet genotypes to different levels of NPK fertilizers. Indian Journal of Agricultural Research. 2018;52(1):97- 100.
12. Girisha K, Singh S, Swathi P, Moharana SK. Response of establishment methods on growth, yield and economics of finger millet (*Eleusine coracana L.*) Varieties. The Pharma Innovation Journal. 2021;10(10):1117-1121.
13. Hebbal N, Ramachandrappa BK, Mudalairiyapp, Thimmegouda MN. Yield and Economics of Finger Millet with Establishment Methods under Different Planting Geometry and Nutrient Source. Indian Journal of Dryland Agricultural Research and Development. 2018;33(1):54-58.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/86393