International Journal of Plant & Soil Science

Volume 37, Issue 2, Page 366-371, 2025; Article no.IJPSS.130200
ISSN: 2320-7035

Performance of Finger Millet Varieties to Different Crop Establishment Techniques in Rice-fallows

K. Jaya Sri [a*], S. Prathibha Sree [b++], K. Srinivasulu [a] and P. Mohan Rao [c]

[a] Department of Agronomy, Agricultural College, Bapatla (ANGRAU), India.
[b] Department of Agronomy, RARS, Lam, (ANGRAU), India.
[c] Department of Soil Science, Agricultural College, Bapatla (ANGRAU), India.

Authors' contributions

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

Article Information

DOI: https://doi.org/10.9734/ijpss/2025/v37i25338

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://pr.sdiarticle5.com/review-history/130200

Original Research Article

Received: 15/01/2025
Accepted: 09/02/2025
Published: 04/03/2025

ABSTRACT

Aim: A field experiment was conducted to study the effect of finger millet varieties to different crop establishment techniques under rice fallow situations.
Study Design: The experiment was laid out in split plot design with three main plots (Crop establishment techniques) and four sub plots (Varieties) that were allocated randomly and replicated thrice.
Place and Duration of study: *Rabi*, 2023-24 at Agricultural College Farm, Bapatla.
Methodology: The main plot treatments were Crop establishment techniques i.e., Transplanting (22.5 cm x 10 cm), Dibbling (22.5 cm x 10 cm) and Broadcasting. The sub plot treatments were Varieties which include Vegavathi, Indravathi, Gosthani and Gowthami.

[++] Principal Scientist (Weed Science);
**Corresponding author: E-mail: jayasri.kovvuri29@gmail.com;*

Cite as: *Sri, K. Jaya, S. Prathibha Sree, K. Srinivasulu, and P. Mohan Rao. 2025. "Performance of Finger Millet Varieties to Different Crop Establishment Techniques in Rice-Fallows". International Journal of Plant & Soil Science 37 (2):366-71. https://doi.org/10.9734/ijpss/2025/v37i25338.*

Results: Finger millet grown under broadcasting method of establishment under rice fallow situation recorded higher growth parameters (plant height at harvest 92.0 cm) and drymatter accumulation at harvest (9535 kg ha^{-1}), grain yield (2663 kg ha^{-1}) and straw yield (6183 kg ha^{-1}) over dibbling and transplanting methods of crop establishment. Among the finger millet varieties tested in rice - fallows, Vegavathi recorded significantly higher growth parameters (plant height at harvest 89.4 cm) and drymatter accumulation at harvest (9162 kg ha^{-1}), Grain yield (2622 kg ha^{-1}) and straw yield (6079 kg ha^{-1}) in Krishna zone of Andhra Pradesh. The highest gross returns (112013 Rs. ha^{-1}), net returns (700734 Rs ha^{-1}) and Benefit-Cost ratio (1.71) were recorded in Broadcasting method of crop establishment. Vegavathi variety of finger millet recorded higher gross returns (109792 Rs. ha^{-1}), net returns (65143 Rs. ha^{-1}) and Benefit Cost ratio (1.49) in the study.
Conclusion: Broadcasting method recorded higher growth parameters, yield, gross returns, net returns and B:C ratio. Among the varieties tested, Vegavathi recorded the highest growth parameters, yield, gross returns, net returns and B:C ratio under rice fallow situations of coastal Andhra Pradesh.

Keywords: Rice fallow; crop establishment technique; broadcasting; transplanting; dibbling.

1. INTRODUCTION

Millets are a group of small-seeded grasses that are highly nutritious, drought-resistant, staple food grains and have been consumed as staple food grains in many parts of Asia and Africa for thousands of years. With climate change and a growing focus on sustainable agriculture, millets are increasingly gaining attention as valuable food source that require minimal water and is resilient to challenging environmental conditions.

Finger millet, also known as *Eleusine coracana* or "ragi" in India, is a small-seeded cereal crop widely grown in Africa and Asia. Finger millet is packed with nutrients, especially calcium, making it unique among cereals. It is also a good source of iron, protein, fibre, and essential amino acids, particularly methionine, which is often lacking in other cereals. It has a low glycemic index, making it an excellent option for persons with diabetes. Finger millet is a hardy crop that can grow in semi-arid areas with low rainfall. It is highly resistant to pests and diseases making it economically feasible crop for farmers in challenging climates. The yield of any crop depends on the production potential of the variety, climatic, edaphic and management practices. Among the different agronomic practices, selection of suitable variety and establishment technique play major role in increasing the productivity of crop.

One of the cultural practices that affects the crop growth and development is the method of establishment (Gopi et al., 2006). Adopting a proper establishment technique ensures uniform germination and plant spacing, leading to a better crop stand and optimized yield. Different varieties are bred to perform well in specific climates, soil types, and geographic areas. Choosing a variety suited to the local environment helps ensure good crop establishment, growth, and yield, reducing the risks posed by unfavourable conditions like poor soil or inconsistent rainfall (Veeraputhiran et al., 2009).

2. MATERIALS AND METHODS

The experiment was conducted at Agricultural College Farm, Acharya N. G. Ranga Agricultural University, Bapatla during *rabi*, 2023-24. The experimental site is situated at an altitude of 5.49 meters above mean sea level (MSL), 15^0 54' North latitude, 80^0 25' East longitude and about 8 km away from the Bay of Bengal in the Krishna Agro Climatic Zone of Andhra Pradesh state of India. The experimental soil was sandy loam in texture, neutral in reaction, non-saline, low in organic carbon content, low in available nitrogen (161 kg ha^{-1}), medium in available phosphorous (32.98 kg ha^{-1}) and available potassium (270 kg ha^{-1}). The experiment was laid out in split-plot design with three main plots, four sub plots replicated three times. The main plots include three crop establishment techniques (E_1: Transplanting 22.5 cm x 10 cm, E_2: Dibbling 22.5 cm x 10 cm and E_3: Broadcasting) and sub plots include four finger millet varieties (V_1: Vegavathi, V_2: Indravathi, V_3: Gosthani and V_4: Gowthami). The Recommended Dose of Fertilizer was 60 kg N, 30 kg P_2O_5 and 30 kg K_2O ha^{-1}. Nitrogen was applied in two equal splits *viz*. Half of the dose (30 kg of N ha^{-1}) was applied as basal and the remaining half of the dose (30 kg of N ha^{-1}) was applied after 30 days after sowing in the form of urea. Entire quantity of phosphorus (30 kg P_2O_5 ha^{-1}) and potassium (30 kg K_2O ha^{-1}) was applied as basal through Single Super Phosphate (SSP) and Muriate of Potash (MOP).

Seeds were sown on well-prepared nursery bed on the same day of sowing in the main field and nursery was raised up to the age of 25 days with proper care and management. Irrigation was supplemented one day before transplanting in order to ensure plant stand and at alternate days after transplanting till proper establishment of the seedlings. Furthermore, irrigation was given at weekly intervals based on soil conditions. Two hand weddings each at 15 and 40 days after sowing were taken up in dibbling and broadcasting methods to check weed growth whereas in transplanting method two hand weedings after 15 and 30 days after transplanting were carried out.

Growth parameters were recorded at harvest. Plant height was measured from the basal node of the plant to the tip of the topmost leaf at harvest and mean height was presented as centi meter. In each treatment, one m^2 area was demarcated in the net plot with small pegs. The above ground portion of the plant was collected and dried in hot air oven at 65°C till the constant weight was obtained and were weighed separately, then converted to kg ha^{-1}. Plants in the net plot area were harvested separately in each plot threshed and grains were separated, dried under sun and the grain yield per plot was recorded after cleaning. After threshing the grain, the remaining straw was dried under sun and the yield per hectare was computed. By using all the inputs, total cost of cultivation was calculated for each treatment. Based on prevailing market price of the output, gross returns were calculated. The net returns from each treatment were calculated by deducting the cost of cultivation worked out based on the prevailing costs of inputs incurred and labour wages from gross returns. The Benefit: Cost Ratio (BCR) for all the treatments was worked out on the basis of net returns in terms of rupees after deducting the cost of cultivation from gross returns. The data obtained on the different parameters were analyzed statistically by the method of analysis of variance as per the procedure outlined for split plot design given by Gomez and Gomez (1984). Statistical significance was tested by F value at 0.05 level of probability and critical difference was worked out where ever the effects were significant.

3. RESULTS AND DISCUSSION

3.1 Plant Height

Broadcasting method of crop establishment recorded the highest plant height (92.0 cm) at harvest which was statistically on par with dibbling (82.5 cm). Lowest plant height was noticed in transplanting method (77.7 cm) of establishment in finger millet. Among the finger millet varieties tested, the highest plant height was observed with V_1- Vegavathi (89.4 cm) which is at par with V_2- Indravati (86.7 cm). The lowest plant height was noticed in V_4- Gowthami (78.4 cm) in finger millet under rice fallows. Difference in plant height among various establishment techniques under a given agro-ecological condition was given by several researchers (Gopi et al*.,* 2006, Thavaprakash et al*.,* 2008, Sarawale et al*.,* 2017 and Narayan et al*.,* 2018). The increase in plant height might be due to inherited disparity of the variety under investigation. Crop productivity increases with the number of effective tillers and plant height as suggested by Johnson et al. (1955). Similar results were also reported by Miko and Manga (2008) in sorghum crop reported that higher the number of plants in a unit area, greater is the height of the plant.

3.2 Drymatter Accumulation

Among the crop establishment techniques, at harvest E_3- Broadcasting (9535 kg ha^{-1}) was recorded with highest drymatter accumulation followed by E2- Dibbling (8365 kg ha^{-1}). Significantly the lowest drymatter accumulation was observed with E_1- Transplanting (7896 kg ha^{-1}). At harvest, among the varieties tested significantly the highest drymatter accumulation was recorded in V_1- Vegavathi (9162 kg ha^{-1}) which was found statistically similar with V_2- Indravathi (8795 kg ha^{-1}) followed by V_3- Gosthani (8464 kg ha^{-1}). The variety V_4- Gowthami (7973 kg ha^{-1}) was noticed with the lowest drymatter accumulation during the study. Variety with rapid growth during initial stages produced taller plants during growing period and also higher leaf area at early stage of plant results in higher production and accumulation of drymatter (Andhale et al*.,* 2003).

3.3 Grain Yield

In rice fallow finger millet among the crop establishment techniques, E_3- Broadcasting resulted in highest grain yield (2663 kg ha^{-1}) followed by E_2- Dibbling (2168 kg ha^{-1}) method. Significantly the lowest grain yield was recorded in E_1- Transplanting (1969 kg ha^{-1}) method of crop establishment. Among the varieties, significantly higher grain yield was recorded with V_1- Vegavathi (2622 kg ha^{-1}) followed by V_2-

Indravathi (2337 kg ha^{-1}) and V_3- Gosthani (2214 kg ha^{-1}). Grain yield was recorded to be the lowest in V_4- Gowthami (1893 kg ha^{-1}) variety of finger millet under rice fallows. Similar results were observed by Hugar and Halikatti (1998) and Leila et al. (2008). These results are in accordance with Shinggu and Mani (2012) and Bello et al. (2022).

3.4 Straw Yield

Among the crop establishment techniques, the highest straw yield was recorded with E_3- Broadcasting method (6183 kg ha^{-1}) which was on par with E_2- Dibbling (5621 kg ha^{-1}). Vegavathi variety of finger millet recorded the highest straw yield (6079 kg ha^{-1}) which was at par with Indravathi variety (5811 kg ha^{-1}) in rice fallow finger millet under the study.

3.5 Gross Returns

Among the crop establishment techniques investigated, highest gross returns were noticed with E_3- Broadcasting (112013 Rs. ha^{-1}) followed by E_2- Dibbling (91917 Rs. ha^{-1}) and the lowest was recorded with Transplanting (83812 Rs. ha^{-1}). Among the finger millet varieties, V_1- Vegavathi (109792 Rs. ha^{-1}) recorded the highest gross returns which was statistically similar with V2- Indravathi (98699 Rs. ha^{-1}) under rice fallow situations in Krishna zone of Andhra Pradesh.

3.6 Net Returns

In rice fallow finger millet among the crop establishment techniques, significantly the highest net returns were recorded with E_3- Broadcasting method (70731 Rs. ha^{-1}) over the other methods of crop establishment. Among the varieties tested, V_1- Vegavathi (65143 Rs ha^{-1}) recorded significantly highest net returns which was followed by V_2- Indravathi (54050 Rs ha^{-1}) variety of finger millet.

3.7 B: C Ratio

Among the crop establishment techniques investigated in rice fallow finger millet the highest B:C Ratio was noticed with E_3- Broadcasting (1.71) method in rice fallow finger millet. V_1- Vegavathi variety (1.49) of finger millet recorded significantly highest B:C ratio followed by V_2- Indravathi (1.23) while the lowest B:C was recorded with V_4- Gowthami (0.84) variety under rice – fallows.

Table 1. Growth parameters and yield of finger millet varieties as influenced by different crop establishment techniques in rice fallows

Treatments	Plant height at harvest (cm)	Drymatter accumulation at harvest (kg ha^{-1})	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})
Crop establishment techniques				
E_1: Transplanting	77.7	7896	1969	5115
E_2: Dibbling	82.5	8365	2168	5621
E_3: Broadcasting	92.0	9535	2663	6183
SEm±	2.1	185	69	114
CD (*P* = 0.05)	8.4	727	269	448
CV (%)	8.8	7.5	10.5	7.0
Varieties				
V_1: Vegavathi	89.4	9162	2622	6079
V_2: Indravathi	86.7	8795	2337	5811
V_3: Gosthani	81.8	8464	2214	5483
V_4: Gowthami	78.4	7973	1893	5187
SEm±	2.4	185	76	144
CD (*P*= 0.05)	7.2	551	225	427
CV (%)	8.6	6.5	10.0	7.6
Interaction				
SEm±	4.2	321	131	249
CD at 5% E × V	NS	NS	NS	NS
CD at 5% V× E	NS	NS	NS	NS

Table 2. Economics of finger millet varieties as influenced by different crop establishment techniques in rice fallows

Treatments	Gross returns (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	B:C ratio
Crop establishment techniques			
E_1: Transplanting	83812	35870	0.75
E_2: Dibbling	91917	47195	1.06
E_3: Broadcasting	112013	70731	1.71
SEm±	2658	2658	0.06
CD (p = 0.05)	10437	10437	0.25
CV (%)	9.6	18	18.5
Varieties			
V_1: Vegavathi	109792	65143	1.49
V_2: Indravathi	98699	54050	1.23
V_3: Gosthani	93946	49298	1.13
V_4: Gowthami	81218	36569	0.84
SEm±	2880	2880	0.06
CD (p = 0.05)	8558	4074	0.19
CV (%)	9.0	17	16.4
Interaction			
SEm±	4989	4989	0.11
CD at 5% E ×V	NS	NS	NS
CD at 5% V × E	NS	NS	NS

4. CONCLUSION

Finger millet grown under broadcasting method of crop establishment showed better performance throughout the crop growth stages and recorded higher growth parameters, yield and economics over dibbling and transplanting methods in rice fallows. Among the finger millet varieties tested Vegavathi recorded higher growth parameters, yield and economics followed by Indravathi under rice fallow situations of coastal Andhra Pradesh.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies have been used during writing or editing of this manuscript.

ACKNOWLEDGEMENTS

My deep sense of gratitude to my chairman, Dr. S. Prathibha Sree and all my advisory committee members for the constant guidance throughout my research work.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Andhale, R. P., Shinde, S. H., & Pawar, V. S. (2003). Effect of sowing dates on growth and yield of pearl millet during the summer season. *Journal of Agrometeorology, 5*(2), 102-105.

Bello, T. T., Mahadi, M. A., & Lado, A. (2022). Effect of weed control treatments, sowing date, and sowing method on growth and yield of finger millet (*Eleusine coracana* L. Gaertn) in Sudan savanna of Nigeria. *Journal of Agriculture and Agricultural Technology, 8*(1), 30-37.

Gomez, K. A., & Gomez, A. A. (1984). *Statistical procedures for agricultural research* (2nd ed.). John Wiley & Sons.

Gopi, R., Ramesh, S., Pandian, B. T., Chandrarekaran, B., & Kumar, S. T. (2006). Evaluation of crop establishment and split application of N and K on growth, yield attributes, yield, and economics of hybrid rice Co RH2. *Asian Journal of Plant Science, 5*(6), 1022-1026.

Hugar, A. Y., & Halikatti, S. I. (1998). Influence of sowing dates and row spacing on growth of finger millet (*Eleusine coracana*). *Karnataka Journal of Agricultural Sciences, 15*(2), 512-51.

Johnson, H. W., Robinson, H. F., & Comstock, R. E. (1955). Estimates of genetic and environmental variability in soybeans. *Agronomy Journal, 47*, 314-318.

Leila, M., Khan, F., Ghani, & Yousafzai, H. K. (2008). Response of millet varieties to different planting methods. *Sarhad Journal of Agriculture, 17*(2), 159-163.

Miko, S., & Manga, S. S. (2018). Effect of intra-spacing and nitrogen rates on growth and yield of sorghum (*Sorghum bicolor* L.). *Production Technology and Agriculture Journal, 4*(2), 66-73.

Narayan, H., Ramachandrappa, B. K., Mudalairiyappa, & Thimmegouda, M. N. (2018). Yield and economics of finger millet with establishment methods under different planting geometry and nutrient source. *Indian Journal of Dryland Agriculture Research and Development, 33*(1), 54-58.

Sarawale, V. A., Rajmahadik, G. B., Shendage, B., Lal, B., Kumhar, & Mote, A. D. (2017). Effect of different establishment methods and varieties on yield, quality, and nutrient uptake of kharif finger millet. *International Journal of Current Microbiology and Applied Sciences, 6*(4), 1285-1289.

Shinggu, C. P., & Gani, M. (2012). Effects of planting methods, sowing dates, and spacing on weed and the productivity of finger millet (*Eleusine coracana* L. Gaertn) in the northern guinea-savanna of Nigeria. *Global Journal of Bio-Science and Biotechnology, 1*, 160-162.

Thavaprakash, N., Sangeetha, S. P., Devasenapathy, P., & Natarajan, S. (2008). Performance evaluation of SRI in comparison with the method of planting under organic farming in rice. In *3rd Symposium on "System of Rice Intensification in India–Extended summaries"* (pp. 200-202). TNAU-Coimbatore.

Veeraputhiran, R., Chellamuthu, V., & Pandian, B. J. (2009). Performance of fingermillet varieties in the coastal region of Karaikal. *International Journal of Agricultural Sciences, 5*(1), 190-192.

Peer-review history:
The peer review history for this paper can be accessed here:
https://pr.sdiarticle5.com/review-history/130200