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

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ABSTRACT

A field experiment was carried out on loamy sand soils during *rabi*, 2023-2024 at Agricultural College Farm, Bapatla to assess the Response of finger millet (*Eleusine coracana* L.) varieties to different crop establishment techniques in rice-fallows. The experiment was laid out in split plot design with three main plots and four sub plots and replicated thrice. The results of the investigation revealed that among the establishment techniques, broadcasting method of crop establishment recorded higher initial population m^{-2} (85), final population m^{-2} (83), plant height at harvest (92. cm), drymatter accumulation at harvest (9535 kg ha^{-1}), number of earheads m^{-2} (98), grain yield (2663 kg ha^{-1}) and straw yield (6183 kg ha^{-1}) whereas, higher number of grains $earhead^{-1}$ (1530) were noticed under transplanting method of establishment. In rice fallow finger millet, Vegavathi variety recorded higher initial population m^{-2} (57), final population m^{-2} (56), growth parameters *viz*., plant height (89.4) and drymatter accumulation (9162 kg ha^{-1}), yield attributes *viz*., number of earheads m^{-2} (90), number of grains $earhead^{-1}$ (1528), grain yield (2622 kg ha^{-1}) and straw yield (6079 kg ha^{-1}) over other varieties of finger millet.

Key Words : *Broadcasting, Transplanting, Crop establishment techniques and Dibbling*

Millets are a group of small grain cereal crops and important staple crops for millions of dryland farmers across Asia and Sub-Saharan Africa. Its significance extends across several domains including nutrition, agriculture and economy. Finger millet is known for its drought tolerance and can adapt to a wide range of soil and climatic conditions. Finger millet has high fiber (18%), phenolic compounds (0.3–3.0 %) and sulphur containing amino acids and it is also the richest source of calcium (300-350 mg 100 g $grain^{-1}$). Iodine content in finger millet is found to be the highest among food grains (Carletto and Banerjee, 2014). In Krishna zone of Andhra Pradesh, Finger millet *(Eleusine coracana* L.) can emerge as potential crop under rice fallows, because of its drought tolerance with highest water use efficiency especially in water scarce conditions and flexibility in time of sowing as a fallow crop after *kharif* rice. Rice fallow finger millet has many economic benefits and can contribute to sustainable farming practices over other crops in fallows such as less labour requirement, irrigation, fertilizer needs etc. One of the cultural practices that affects the crop growth and development is the method of establishment (Gopi *et al*., 2006). It is essential to efficiently use all resources available for growth since it provides the crop with the optimal conditions for growth. Selection of suitable variety for a particular location is paramount importance to realize the higher yield potential of finger millet as they show fluctuation in growth and yield attributes when grown under different environmental conditions (Veeraputhiran *et al*., 2009). In this context, present investigation was carried out to study Growth and yield of finger millet varieties as influenced by different crop establishment techniques in rice- fallows.

MATERIAL AND METHODS

A field experiment was conducted at Agricultural College Farm, Bapatla, Andhra Pradesh during *rabi*, 2023-24. The soil of the experimental field was loamy sand in texture, neutral in reaction with pH 6.8 with electrical conductivity of 0.34 dS m^{-1}, low in organic carbon (0.27%) and available nitrogen (159 kg ha^{-1}), high in available phosphorus (32.98 kg ha^{-1}) and medium in available potassium (270 kg ha^{-1}). Average mean maximum temperature

was 32.2 p C and minimum temperature was 21.7 p C during the crop growth period. The total amount of rainfall received was 3.1 mm received in one rainy day**.** Experiment was laid out in split plot design replicated thrice. Crop establishment techniques were allocated to main plots (E_1: Transplanting @ 6.25 kg $ha^{-1}$with the spacing of (22.5 cm × 10 cm), E_2: Dibbling @ 7.5 kg ha^{-1} (22.5 cm × 10 cm) and E_3: Broadcasting @ 10 kg ha^{-1}) and newly released finger millet varieties were allocated to subplots (V_1: Vegavathi, V_2: Indravathi, V_3: Gosthani and V_4: Gowthami). Recommended Dose of NPK was 60-30-30 kg ha^{-1} were applied in the form of urea, Single Super Phosphate (SSP) and Murate of Potash (MOP) respectively. Nitrogen was applied in two equal splits viz., first dose applied as basal and second dose at 30 DAS. Entire dose of phosphorus and potassium was applied as basal in all the plots. Nursery was sown on the same day of sowing as in dibbling and broadcasting plots. Transplanting was done in the main field with 25 days old seedlings. Irrigation was given to all the plots immediately after sowing in broadcasting and dibbling methods whereas in transplanting method 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. The recommended plant protection measures were followed whenever necessary. Five plants from each plot were selected randomly to record the biometric observations like plant height, drymatter accumulation (kg ha^{-1}), number of earheads^{-1}, number of grains earhead^{-1} and test weight. After harvest, grain yield (kg ha^{-1}) and straw yield (kg ha^{-1}) were taken. All the data was analyzed statistically following the standard procedures as described by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Growth parameters: Growth parameters were significantly affected by different treatments. The higher initial population (85 m^{-2}) and final plant population (83 m^{-2}) was noticed with broadcasting method of establishment. Among the varieties tested higher initial population (57 m^{-2}) and final population (56 m^{-2}) was recorded in vegavathi variety of finger millet. Among the crop establishment techniques investigated, highest plant height was recorded in broadcasting method of establishment (92.0 cm) while the lowest was recorded in transplanting method (77.7 cm). Vegavathi variety of finger millet recorded higher plant height (89.4 cm) which is at par with Indravathi (86.7 cm) in rice fallows. The similar results were reported by Shinggu and Mani (2012). Broadcasting method (9535 kg ha^{-1}) of establishment recorded higher drymatter accumulation over dibbling (8365 kg ha^{-1}) and transplanting (7896 kg ha^{-1}) methods of establishment methods tested. In rice fallow finger millet vegavathi variety (9162 kg ha^{-1}) recorded significantly the highest drymatter accumulation at all crop growth stages which is at par with indravathi (8795 kg ha^{-1}) at harvest and lowest drymatter accumulation was noticed with gowthami variety (7973 kg ha^{-1}) under rice fallow conditions. These findings are similar with Andhale *et al.* (2003).

Yield attributes and yield

Among the crop establishment methods tested, significantly the highest number of earheads^{-2} (98 m^{-2}) were noticed with broadcasting method followed by dibbling (77 m^{-2}) and lowest was recorded with transplanting (73 m^{-2}) method of establishment. These findings are in accordance with the results of Maobe *et al.* (2014). In rice fallow finger millet, among the varieties, Vegavathi (90) recorded higher number of earheads m^{-2} which is statistically similar with indravathi (88) over gosthani and gowthami. The highest number of grains earhead^{-1} were significantly highest in transplanting (1530) method followed by dibbling (1186) while the lowest number of grains earhead^{-1} were recorded in broadcasting (1103) establishment technique. The influence of varieties with regard to number of grains earhead^{-1} were found to be significant, Vegavathi variety (1528) recorded highest number of grains earhead^{-1} over other varieties tested in rice fallow finger millet. Among the crop establishment techniques and varieties tested, there was no significant difference on test weight of finger millet. However, the results revealed that there is a slight increase in test weight under transplanting method (2.83 g) and in Vegavathi (2.83 g) among the varieties tested. The highest grain (2663 kg ha^{-1}) and straw yield (6183 kg ha^{-1}) were recorded in broadcasting method over dibbling and transplanting methods of establishment. Among the varieties, the highest grain and straw yield were noticed with Vegavathi (2622 kg ha^{-1}) which is statistically at

Table 1. Initial and final population (m^{-2}), Plant height (cm) and drymatter accumulation of finger millet varieties as influenced by different crop establishment techniques in rice fallows.

Treatments	Initial Population (m-2)	Final Population (m-2)	Plant height (cm)	Drymatter accumulation (kg ha-1)
E1: Transplanting	41	40	77.7	7896
E2: Dibbling	42	41	82.5	8365
E3: Broadcasting	85	83	92	9535
SEm±	1.1	1.2	2.1	185.2
CD (p = 0.05)	4.3	4.5	8.4	727
CV (%)	6.7	7.2	8.8	7.5
Varieties				
V1: Vegavathi	57	56	89.4	9162
V2: Indravathi	57	55	86.7	8795
V3: Gosthani	56	55	81.8	8464
V4: Gowthami	55	54	78.4	7973
SEm±	1.2	1.3	2.4	185.7
CD (p = 0.05)	NS	NS	7.2	551.7
CV (%)	6.6	7.3	8.6	6.5
INTERACTION				
SEm±	2.1	2.2	4.2	321.6
CD at 5% E× I	NS	NS	NS	NS
CD at 5% I× E	NS	NS	NS	NS

Table 2. Number of earheads (m^{-2}), number of grains earhead^{-1}, test weight (g), grain yield (kg ha^{-1}) and straw yield (kg ha^{-1}) of finger millet varieties as influenced by different crop establishment techniques in rice fallows.

Treatments	No. of earheads m-2	No. of grains earhead^{-1}	Test weight (g)	Grain yield (kg ha-1)	Straw yield (kg ha-1)
Crop establishment techniques					
E_1: Transplanting	73	1530	2.83	1969	5115
E_2: Dibbling	77	1186	2.8	2168	5621
E_3: Broadcasting	98	1130	2.77	2663	6183
SEm±	3.3	39	0.02	69	124
CD (p = 0.05)	13	153.3	NS	269	488
CV (%)	13.8	10.6	2.9	10.5	7
Varieties					
V_1: Vegavathi	90	1528	2.83	2622	6079
V_2: Indravathi	88	1329	2.82	2337	5811
V_3: Gosthani	79	1205	2.79	2214	5483
V_4: Gowthami	75	1030	2.75	1893	5187
SEm±	2.7	47.7	0.1	76	144
CD (p = 0.05)	8	142	NS	225	427
CV (%)	9.7	11.2	3.6	10	7.6
Interaction					
SEm±	4.7	82.6	0.06	131	249
CD at 5% E× V	NS	NS	NS	NS	NS
CD at 5% V× E	NS	NS	NS	NS	NS

par with indravathi with regard to straw yield under rice fallow condition. Furthermore, establishment of finger millet will possibly vary depending on the kind of environment conditions in which the crop had been grown. These results are in accordance with Shinggu and Mani (2012) and Bello *et al.* (2022).

CONCLUSION

Based on the findings, it could be concluded that broadcasting method of establishment recorded significant results on crop growth and yield. Among the varieties tested Vegavathi recorded highest growth parameters, yield attributes and yield over other varieties in Krishna zone of Andhra Pradesh under rice fallow conditions.

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