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Effect of varieties and establishment methods on grain and fodder yield of finger millet (*Eleusine coracana* L.)

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Abstract

A field experiment was conducted at the Instructional cum Research (ICR) Farm, AAU, Jorhat during the Sali season (2022-23) with a view to study the “Effect of varieties and establishment methods on grain and fodder yield of finger millet (*Eleusine coracana* L.)”. The experiment was laid out in Factorial-RBD which was replicated thrice. The treatments consisted of 4 (Four) establishment methods viz., broadcasting (M₁), line sowing (M₂), transplanting (M₃), and SFMI {System of finger millet intensification} (M₄) and 3 (Three) varieties namely- GPU-67 (V₁), CFMV-2 (V₂) and AAU-GSG-Maruvadhan (V₃). Based on results obtained from the present investigation, it was concluded that finger millet grown in the transplanting method with a combination of CFMV-2 variety must obtain higher yield of finger millet.

Keywords: Establishment methods, variety, yield attributes, SFMI, finger millet

1. Introduction

Millets are a group of cereal food grain crops that are small-seeded, adapted to cultivation over a range of tropical and subtropical climates, and can be grown with very low inputs. They were the first crops to be domesticated by mankind in Asia and Africa which later spread across the globe as critical food sources to the evolving civilizations. Major millet crops include Jowar or sorghum, bajra or pearl millet, and small millets comprising of mandua/ragi or finger millet, kangni or foxtail millet, kutki or little millet, kodo millet, jhangora or barnyard millet, cheena or proso millet, and korale or brown top millet.

Among the minor millets, finger millet (*Eleusine coracana* L.) is an important minor crop and commonly known as “wonder grain” because of its high nutritional values and unique nutraceutical properties. Finger millet is being used as food (grains) in developing countries and as animal feed (straw) in developed countries indicating that it is considered as a poor man’s food (Ceasar *et al.*, 2018; Wambi *et al.*, 2020) [3, 14]. It is a major crop in the arid and semiarid regions of developing countries of Asia and Africa (Krishna *et al.*, 2018, 2020) [7]. Among the various millets, finger millet ranks fourth on a global scale of production next to sorghum (*Sorghum bicolor*), pearl millet [*Cenchrus americanus* (new name), *Pennisetum glaucum* (old name)] and foxtail millet (*Setaria italica*) (Upadhyaya *et al.*, 2007) [13].

Crops such as rice and wheat provide food security, but finger millet provides nutritional security to the world (Devi *et al.*, 2014; Ceasar *et al.*, 2018) [4, 3]. Among the millets- finger millets, proso millet, and foxtail millets are found to be cultivated in Assam but it is limited to a few districts only. Out of which areas under finger millet is found to be more as compared to the others. These are generally cultivated by resource-poor farmers with low input when the cultivation of rice and other economically important crops is not feasible or profitable. Productivity in such areas is low due to the use of local cultivars, late sowing/transplanting, faulty methods of cultivation, and little or no use of fertilizers. To obtain a higher yield of quality finger millet, newly released high-yielding varieties should be adopted with appropriate management practices.

Varieties play an important role in crop production and the potential yield of a variety within genetic limit is determined by its environment. The release of high-yielding varieties has contributed a great deal toward the improvement of finger millet yield. The yield of any crop depends on the production potential of the cultivar and climatic, edaphic, and management

practices to which the cultivar is exposed. The proper age of seedlings has a tremendous influence on tiller production, grain formation, and other yield-contributing characteristics. In view of the above, a field experiment was conducted.

2. Materials and methods

2.1. Experimental locations

The experiment was conducted at the Instructional-cum-Research Farm, Assam Agricultural University, Jorhat during the kharif season, 2022-2023. The present experiment was conducted on the "Effect of varieties and establishment methods on grain and fodder yield of finger millet (*Eleusine coracana* L).

2.2. The experiment design

The experiment was laid out in a Factorial randomized block design (F-RBD) with three replications. Four Establishment methods: Broadcasting. Line sowing spacing (22.5 × 10 cm) Transplanting spacing (25 × 15 cm). System of finger millet intensification (SFMI) spacing (25 × 25 cm). and Three Varieties GPU-67 (V₁) (114-118 days, 30-35q/ha, National level) ii) CFMV-2 (V₂) (115-120 days, 35.56q/ha, National level) iii) AAU-GSG-Muruadhan 1 (V₃) (125-130 Days, Local variety, Assam). The finger millet nursery area was manured with FYM and it was mixed thoroughly in soil at the time of seedbed preparation. Before sowing seeds are treated with Bavistin (Carbendazim) Then, nursery beds of 2 m × 1 m area for the Transplanting method nursery 25 days old seedlings used for transplanting, for SFMI nursery we are grown in pro trays, pro trays are filled with coco pit, vermicompost, and soil with a ratio of 1:1:2 after that we have sown seedlings in pro trays 12 days old seedlings, we used for SFMI method. and the same day of nursery preparation we did line sowing and Broadcasting directly sown the seeds in the main field. in the line, we maintained 22.5×10cm, in transplanting two seedlings hill-1 was transplanted at 25 x 15 cm spacing as per the treatments in the experimental field. In SFMI 12 days old seedlings we used 1 seedling per/hill.

2.3. Yield and growth components.

yield attributing characters like length per finger (cm), number of fingers per ear head, number of ear heads per m², the weight of ear head, test weight, grain yield (t/ha), fresh stover yield (kg/ha) dry stover yield (kg/ha) and harvest index were analyzed, and growth parameters plant height, number of tillers/m², plant population, dry matter production per plant, crop growth rate (CGR), leaf area index (LAI), specific leaf area (SLA).

3. Research Analysis and Reasoning

During the course of the present study, the yield attributing characters, namely, length per finger (cm), number of fingers per ear head, number of ear heads per m², weight of ear head, test weight, grain yield (t/ha), fresh stover yield (kg/ha) dry stover yield (kg/ha) harvest index, were analyzed. (Tables 1 & 2).

3.1 Effect of Establishment Methods: (M)

Number of Ear Heads per m²: Transplanting (M₃) resulted in the highest number of ear heads per square meter at 76.93 followed by SFMI (M₄) with 62.67, line sowing (M₂) with 50.82, and broadcasting (M₁) with 40.32. Number of Fingers per Ear Head: Transplanting (M₃) also resulted in the highest number of fingers per ear head with 7.82, followed by SFMI (M₄) with 7.07, line sowing (M₂) with 6.29, and broadcasting (M₁) with 4.67. Length per Finger: The length per finger was similar among the establishment methods, with transplanting (M₃) having the highest length (7.18 cm), followed by SFMI (M₄) (6.73 cm), line

sowing (M₂) (6.41 cm), and broadcasting (M₁) (5.53 cm). Weight of Ear Head: Transplanting (M₃) resulted in the highest weight of the ear head (15.75 g), followed by SFMI (M₄) (14.31 g), line sowing (M₂) (9.14 g), and broadcasting (M₁) (5.28 g). Test Weight: The test weight was similar among the establishment methods, with transplanting (M₃) having the highest test weight (2.84 g), followed by SFMI (M₄) (2.82 g), line sowing (M₂) (2.71 g), and broadcasting (M₁) (2.63 g). A glimpse of data presented in Table 1 among all establishment methods transplanting showed better results and the increased yield attributes might be due to increased growth and development parameters and increased grain yield might be due to increased yield attributes. In SFMI yield is less as compared to transplanting it might be due to 12 days old seedlings dose-not producing good root growth and not being tolerant to transplanting shock, this result was in conformity with the finding of Vikas G Aghara, (2022) ^[1] in finger millet. Moreover, the lower yield parameters and yield were observed under treatment (transplanting of 12 days old seedling) which might be due to early transplanted seedlings resulting in poor root development. In spite of the high plant population in broadcasting and line sowing plots, the yield ha⁻¹ was adversely affected. As a matter of fact, the yield of unit area basis was higher with a lower plant population. In other words, lower yield plant⁻¹ was not nullified because of a high number of plants under broadcasting, and line sowing method, Transplanting produced maximum and significantly higher grain yield (23.46 q ha⁻¹), straw yield (32.95q ha⁻¹) and fresh stover yield (59.32 q ha⁻¹), over rest of the establishment methods. This might be due to increased morphological characters viz., plant height, number of leaves plant⁻¹ and hill-1, number of tillers sqm-1 and dry matter production plant⁻¹, hill-1, and sqm-1 observed under transplanting. The present results are in consonance with those of Ravi (1984) ^[11] and Newase *et al.* (1995) ^[9] in finger millet and Tippanagoudar (2009) ^[12] in proso millet.

3.2 Effect of Varieties: (V)

Number of Ear Heads per m²: There were no significant differences among the three varieties (V₁ - GPU-67, V₂ - CFMV-2, and V₃ - AAU-GSG-Muruadhan 1) in terms of the number of ear heads per square meter. Number of fingers per ear head: The number of fingers per ear head was also similar among the varieties; with V₂ - CFMV-2 having the highest value (6.78) followed closely by variety V₁ - GPU-67 (6.40) and V₃ - AAU-GSG-Muruadhan 1 (6.20). Length per Finger: The length per finger was not significantly different among the three varieties, with V₂ - CFMV-2 having the highest length (7.64 cm), followed by V₁ - GPU-67 (5.92 cm), and V₃ - AAU-GSG-Muruadhan 1 (5.83 cm). Weight of Ear Head: The weight of the ear head was similar among the varieties, with V₂ - CFMV-2 having the highest weight (12.01 g), followed by V₁ - GPU-67 (10.74 g), and V₃ - AAU-GSG-Muruadhan 1 (10.61 g). Test Weight: The test weight of the grains was not significantly different among the three varieties; with V₂ - CFMV-2 having the highest test weight (2.84 g), followed by V₁ - GPU-67 (2.77 g), and V₃ - AAU-GSG-Muruadhan 1 (2.63 g). Among three varieties of CFMV-2 shows good results it might be due to the genetic character of that variety.

3.3 Interaction Effect: (V × M)

There are no significant interaction effects between varieties and establishment methods on any of the yield parameters except length per finger, length per finger high in transplanting with a combination of CFMV-2 variety shows better results.

Table 1: Effect of varieties and establishment methods on yield parameters of finger millet

Treatments	Number of ear heads per m ²	Number of fingers per ear head	Length per finger (cm)	Weight of ear head (g)	Test weight (g)
Varieties					
V ₁ - GPU-67	57.39	6.40	5.92	10.74	2.77
V ₂ - CFMV-2	58.68	6.78	7.64	12.01	2.84
V ₃ - AAU-GSG-Muruadhan 1	56.99	6.20	5.83	10.61	2.63
SEm (±)	0.68	0.23	0.16	0.18	0.05
CD(p=0.05)	NS	NS	0.46	0.52	0.14
Establishment methods					
M ₁ - Broadcasting	40.32	4.67	5.53	5.28	2.63
M ₂ - Line sowing	50.82	6.29	6.41	9.14	2.71
M ₃ - Transplanting	76.93	7.82	7.18	15.75	2.84
M ₄ - SFMI	62.67	7.07	6.73	14.31	2.82
SEm (±)	0.79	0.26	0.18	0.20	0.05
CD(p=0.05)	2.31	0.76	0.54	0.60	0.16
Interaction	NS	NS	S	NS	NS

**= Significant NS= Non-significant

Table 2: Effect of varieties and establishment methods on yield of finger millet

Treatments	Grain yield (q/ha)	Fresh stover yield (q/ha)	Dry stover yield (q/ha)	Harvest index (%)
Varieties				
V ₁ - GPU-67	20.55	52.00	28.18	41.90
V ₂ - CFMV-2	21.42	52.54	30.16	41.40
V ₃ - AAU-GSG-Muruadhan 1	19.88	51.70	28.33	41.18
SEm (±)	0.10	0.17	0.23	0.36
CD (p=0.05)	0.30	0.49	0.68	NS
Establishment methods				
M ₁ - Broadcasting	17.81	46.14	25.75	40.84
M ₂ - Line sowing	18.75	48.59	26.81	41.17
M ₃ - Transplanting	23.46	59.32	32.95	42.12
M ₄ - SFMI	22.44	54.27	30.05	41.83
SEm (±)	0.12	0.19	0.27	0.42
CD (p=0.05)	0.35	0.57	0.78	NS
Interaction	NS	NS	NS	NS

**= Significant NS= Non-significant

4. Discussion

4.1 Yield attributing characters and yield

Significant variations in the yield attributes were noticed among the different establishment methods. All yield attributes recorded the highest number of ear heads/m² the length per finger (cm), number of fingers per ear head weight of ear head test weight grain yield fresh stover yield dry stover yield harvesting index highest in transplanting method followed by SFMI and line sowing. However, sterility percent, a negative yield attribute was found highest in the broadcasting and line sowing method. Higher ear head length, number of fingers /ear head, and weight of ear head in transplanting might be due to optimum crop geometry availability of proper moisture and nutrients during the critical growth stages like ear head emergence, flowering, and grain filling periods and due to higher tillers/m² in earlier sown dates. The lower number of fingers per ear head observed in the broadcasting method might be due to more plant population its leads to more competition between the plants which decreases the ear head length and finger length.

Statistically higher ear lengths were observed in the CFMV-2 (V₂) and statistically lowest ear length was observed in the AAU-GSG-Maruvadhan 1 (V₃). A similar result was reported by Negi (2015) [8] and Hebbal (2018) [6].

Significantly more finger/earheads were observed in CFMV-2 and the lowest number of fingers per ear was reported in AAU-GSG Maruvadhan 1. In the method of establishment, the transplanting method showed statistically higher value over the SFMI, line

sowing, and broadcasting. The number of fingers per ear is a principal yield contributing parameter in finger millet, similar results were reported by R. Veeraputhiran *et al.* (2009) and Revathi (2016)

The results of an experiment showed that number of fingers/earhead, length of fingers (cm), earhead weight (g), grain weight/earhead (g), and test weight (g) of finger millet were achieved significantly higher with transplanting of 21 days old seedling (A2). As far as spacing is concerned, transplanting of finger millet at 30 cm x 15 cm (S4) recorded higher yield parameters. However, Grain and straw yield was recorded higher under treatment combination A2S3 (transplanting of 21-days-old seedlings at 30 cm x 10 cm). Vikas G Aghara, VJ Patel, PS Panchal and MP Dohat (2023) [1].

The higher grain yield is the result of enhanced yield attributes, forming a larger sink size in addition to efficient translocation of photosynthates to the sink was reported in the transplanting method. Transplanting method recorded the highest grain yield fresh stover yield, dry stover yield, and harvesting index. Similar results were reported by Suryanarayana *et al.* (2014), Bisht *et al.* (2015) [2], and Negi, S. (2015) [8] while working in finger millet. Test weight height obtained in the transplanting method it might be due to the efficient utilization of resources. Interaction between the transplanting method and the CFMV-2 variety recorded the highest test weight as compared to other establishment methods and varieties. Similar results were reported by Krishnanappa *et al.* (2001) [7] and Negi, S. (2015) [8] while working on finger millet.

5. Conclusion

Based on the findings, it can be concluded that, among the establishment methods, M₃-Transplanting shows better results compared to other establishment methods, similarly among the varieties CFMV-2 yields favourable outcomes in comparison to the other varieties. Interestingly when combining variety (CFMV-2) with the transplanting method showed good results.

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