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Analysis of agronomic traits of different quantitative morphology of finger millet genotypes

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Abstract
The present study was conducted on 15 genotypes of Finger millet collected from Hill Millet Research Station, NAU, Waghai, Dang, using a CRD design with three replications. Morphological and yield-related traits were evaluated including Plant height, Productive Tillers, Ear head length, Numbers of Fingers, Grain yield, Fodder yield and Test weight alog with qualitative characters. Significant variability was observed among the genotypes for all traits studied. Plant height ranged from 100.10 to 127.10 cm, with CFMV-2 being the tallest, while productive tillers varied from 1.30 to 1.80, highest in CFMV-1. Ear head length and numbers of fingers also showed considerable variation. Fodder yield ranged from 6519 to 9383 kg/ha with WN-587 recording the highest whereas grain yield varied from 2127 to 3285 kg/ha with GN-10 performing best. Test weight differed significantly (2.35-3.54 g) again highest in GN-10. The study highlights the existence of substantial genetic variability, suggesting that superior genotypes such as GN-10, WN-587 and CFMV-2 can be effectively utilized in breeding programs to enhance yield and quality in finger millet.

Keywords: Finger millet, genotypes, agronomic traits, plant height

Introduction
"Millets" are a diverse group of annual cereal crops characterized by small seeds and remarkable adaptability to various agro-climatic conditions. This group includes several species cultivated for food, fodder and biofuel, such as foxtail millet (*Setaria italica*), finger millet (*Eleusine coracana*), pearl millet (*Pennisetum glaucum*), proso millet (*Panicum miliaceum*), kodo millet (*Paspalum scrobiculatum*), barnyard millet (*Echinochloa esculenta*) among others (Dwivedi *et al.* 2012) [4]. Finger millet (*Eleusine coracana* L. Gaertn. subsp. *coracana*) is a vital cereal crop predominantly grown in East Africa and India. It is a tetraploid species with a chromosome number of 2n = 36. The domestication of finger millet traces back to approximately 5000 years ago in the highlands of western Uganda and Ethiopia. From there, it spread to India nearly 3000 years ago, where it has since become an integral part of the agricultural and dietary systems (Raizada and Goron, 2015; Upadhyay *et al*., 2007) [11, 12]. Morphologically, finger millet is a tufted annual cereal that grows to a height ranging from 30 to 150 cm and matures within 75 to 160 days. It is an excellent source of protein (5–8%), minerals (2.5–3.5%) like calcium (344 mg 100 g^{-1}, which is 8-10 times higher calcium than wheat or rice). It has iron and amino acid (methionine, an amino acid lacking in the diets of hundreds of millions 4 of the poor who live on starchy foods such as cassava, plantain, polished rice and maize meal) ether extractives (1–2%), dietary fiber (15–20%) and carbohydrates (65–75%).

Finger millet carbohydrates are reported to have the unique property of slower digestibility. The excellent malting qualities have added to the uniqueness of the grain in expanding its utility range in food processing and value addition. Adapted predominantly to tropical, rainfed conditions, finger millet is highly suitable for dryland farming due to its exceptional tolerance to drought and adverse environmental conditions. It thrives in a wide range of altitudes, particularly performing better at higher elevations than most other tropical cereals. This resilience is attributed to its diverse set of morpho-physiological, molecular and biochemical traits that confer enhanced tolerance to both biotic and abiotic stresses, making it a crucial crop for food security in marginal environments. Its consumption has been linked to improved management of blood glucose levels, reduction of cholesterol and prevention of constipation due to its high soluble fiber content and low-fat levels (Hittalmani, 2004) [7]. The presence of tryptophan, an essential amino acid, contributes to appetite control by promoting satiety, thereby aiding in weight management (Mall and Tripathi, 2016) [10]. Its slow digestibility also helps regulate calorie intake and maintain a steady release of glucose, offering significant health benefits over more rapidly digestible cereals.

Materials and Methods

The experiment was conducted on the 15 genotypes of finger millet, which were collected from Hill Millet Research Station (HMRS), Navsari Agricultural University, Waghai, Dang. The plants were shown in the gross plot size of 2.25 m x 3.00 m, net plot size of 1.80 m x 2.80 m and with row and plant spacing of 22.5 cm x 10 cm respectively. For morphological characters four plants were selected from each replication and average data was recorded. Genotypes were selected for study with 3 replication CRD design. Quantitative morphological characters were measured by following methods; During dough stage, the plant height was measured with the help of meter scale from the bottom of the plant to the tip of ear (inflorescence) [1]. The length of ear head was measured in centimetres from the collar of ear up to the tip of ear [2]. The number of productive tillers in each plant was counted at maturity stage [3]. Number of fingers was counted from four randomly selected plants from each plot [4]. Weight of total grain yield of plants was recorded and grain yield was calculated in kg ha^{-1} unit [5]. Test weight-Thousand seeds were taken randomly in four replications and weighed up to two decimal places. The mean weight of a thousand seeds was expressed in grams [6]. The weight of total fodder yield of plants was recorded and fodder yield was calculated in kg ha^{-1} unit [7]. Qualitative morphological characters included: Plant type [1], Foliage colour [2], Ear head habit [3] Seed colour [4].

Following 15 genotypes of finger millet (Photo.1) were used in this experiment:

G_1: WN-583	G_9: WN-665
G_2: WN-586	G_{10}: DN-6
G_3: WN-587	G_{11}: CFMV-1 (NC)
G_4: WN-599	G_{12}: CFMV-2 (NC)
G_5: WN-601	G_{13}: GNN-6 (LC)
G_6: WN-609	G_{14}: GN-8 (LC)
G_7: WN-657	G_{15}: GN-10 (LC)
G_8: WN-664	

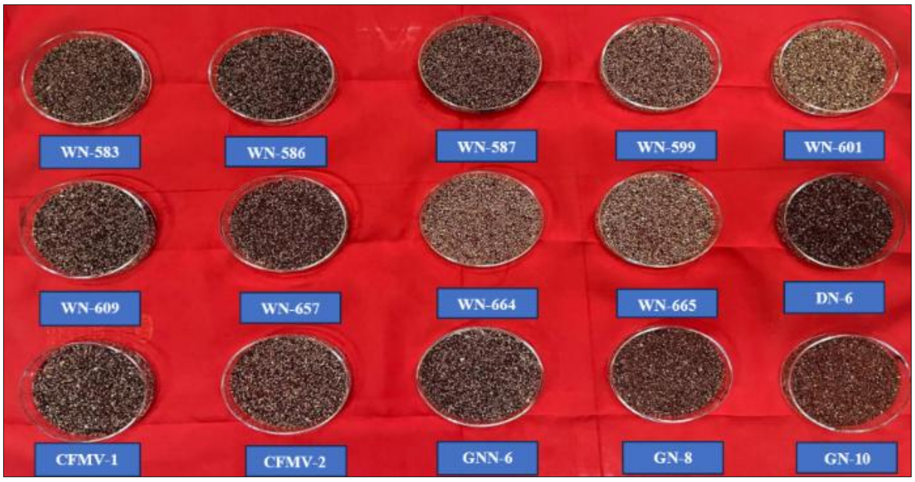

Photo 1: Seeds of finger millet genotypes

Results and Discussion

Evaluation of quantitative morphological characters of finger millet genotypes

Plant height (cm)

The plant height of finger millet genotypes ranged from 100.10 to 127.10 cm, presenting a significant difference (Table 1). Maximum plant height was recorded in variety CFMV-2, whereas the minimum was in genotype DN-6. Plant height is considered a good indicator of growth and development with considerable variation observed in finger millet as also reported by Goswami *et al*. (2015) [6].

Productive tillers per plant

The number of productive tillers per plant ranged from 1.30 to 1.80 and the variation was found to be significant among the genotypes (Table 1). The maximum number of productive tillers was recorded in CFMV-1 whereas the minimum was observed in WN-665. The number of productive tillers per plant varied from 1.30 to 1.80 which aligns with the findings of Ganapathy *et al*. (2011) [5]. This trait although showing variation was statistically significant in the present study.

Ear head length (cm)

Ear head length ranged from 6.20 cm to 11.00 cm showing a significant difference among the genotypes (Table 1). The longest ear head was observed in the genotype WN-601 while the shortest was recorded in WN-586 Similarly, the number of fingers per ear head also ranged from 6.20 to 11.00 and the present findings are consistent with Kadam *et al*. (2009) [8].

Fingers per ear head

The number of fingers per ear head showed significant variation among genotypes and was found in the range of 6.20 to 11.00 (Table 1). The maximum number of fingers per ear head was found in WN-601 and the minimum in WN-586. Result was similarly to observations of Lule *et al.* (2012) [9].

Fodder yield (kg ha^{-1})

Fodder yield was found in the range of 6519 to 9383 kg ha^{-1} with significant variation among genotypes (Table 2). Maximum fodder yield was found in WN-587 whereas the minimum was in WN-609. This result corroborating the earlier findings of Anonymous (2016) [1]. The substantial variability in fodder yield highlights the potential for selecting genotypes with better biomass production.

Grain yield (kg ha^{-1})
Grain yield also exhibited a significant variation, ranging from 2127 kg/ha to 3285 kg/ha (Table 2). The maximum grain yield was observed in GN-10, whereas the minimum was recorded in CFMV-1. Result was in agreement with the results reported by Goswami *et al.* (2015) [6] indicating good variability among the genotypes for yield potential.

Test weight (g)
Test weight (1000-seed weight) showed significant variation among the genotypes with values ranging from 2.35 g to 3.54 g (Table 2). The highest test weight was recorded in GN-10 while the lowest was found in WN-601. Test weight is influenced by factors such as embryo size and seed storage reserves which directly affect germination and seedling vigour. Higher test weight is associated with better germination, seedling emergence and yield-contributing attributes as also reported by Cordazzo (2002) [3].

Evaluation of qualitative morphological characters of finger millet genotypes
Plant type
The finger millet genotypes were categorized into two plant types *viz.*, erect and semi-erect. The erect plant type was observed in WN-583, WN-586, WN-587, WN- 599, WN-609, WN-657, WN-664, WN-665, DN-6, CFMV-1, CFMV-2 and GN-8 while semi-erect plant type observed in WN-601, GNN-6 and GN-10 finger millet genotypes (Table 3)

Foliage colour
Plant was categorized into three categories *viz.*, green, light green and dark green according to foliage colour. Among all them green colour observed in WN-583, WN-587, WN-599, WN-601, WN-657, WN-664, WN-665, CFMV-1, GNN-6 and GN- 8 genotypes. Light green observed in WN-609 and DN-6 genotypes of finger millet. Dark green colours of foliage was found in WN-586, CFMV-2 and GN-10 finger millet genotypes (Table 3)

Ear head type
Ear head habit was categorized into three categories *viz.*, open, compact and semi-compact. Among them semi-compact type of ear head was found in WN-583, WN-587, WN-599, WN-657, WN-664, DN-6, CFMV-2, GN-8 and GN-10 finger milletgenotypes. Compact type ear head was found in WN-586, CFMV-1 and GNN-6 genotypes. Open ear head type was observed in WN-601, WN-609 and WN-665 finger millet genotypes (Table 3)

Grain colour
Grain colour an important trait for assessing genetic diversity, was recorded in three distinct colours *viz.*, copper brown, light brown and dark brown. The copper brown grain colour was observed in WN-583, WN-599, WN-601, WN-609, WN-657, WN664, WN-665, CFMV-2 and GN-10 finger millet genotypes. Light brown grain colour was observed in WN-586, WN-587, DN-6 and CFMV-1 genotypes. While dark brown colour was found in GNN-6 and GN-8 finger millet genotypes. (Table 3). Qualitative morphological characters, including plant type, foliage colour, ear head type, and grain colour effectively differentiated all finger millet genotypes based on observable morphological traits. Such qualitative descriptors are highly valuable for genotype screening and assessing genetic diversity in finger millet, as previously noted by Bezaweletaw *et al*. (2007) [2].

Table 1: Quantitative morphological characters of finger millet genotypes

Sr. No.	Genotypes	Plant height (cm)	No. of Productive tillers per plant	Ear head length (cm)	No. of Fingers per ear head
1.	WN-583	120.50	1.40	8.30	8.30
2.	WN-586	104.00	1.50	6.20	6.20
3.	WN-587	112.50	1.40	8.50	8.50
4.	WN-599	104.30	1.40	6.90	6.90
5.	WN-601	123.90	1.50	11.00	11.00
6.	WN-609	101.50	1.40	7.10	7.10
7.	WN-657	118.10	1.40	10.30	10.30
8.	WN-664	114.40	1.40	8.90	8.90
9.	WN-665	117.40	1.30	8.00	8.00
10.	DN-6	100.10	1.40	7.70	7.70
11.	CFMV-1	114.50	1.80	7.60	7.60
12.	CFMV-2	127.10	1.50	8.10	8.10
13.	GNN-6	120.50	1.40	7.50	7.50
14.	GN-8	109.70	1.70	7.90	8.00
15.	GN-10	121.20	1.70	9.10	8.90
	S.Em. ±	3.85	0.65	0.09	0.64
	CD (0.05)	11.13	1.88	0.26	1.87
	CV%	5.86	13.76	10.63	13.72

Table 2: Yield and yield attributes of finger millet genotypes

Sr. No.	Genotypes	Fodder yield (kg ha^{-1})	Grain yield (kg ha^{-1})	Test weight (g)
1.	WN-583	8866	2893	3.28
2.	WN-586	8357	2465	2.85
3.	WN-587	9383	2467	2.64
4.	WN-599	8856	2693	2.90
5.	WN-601	8507	2674	2.35
6.	WN-609	6519	2806	2.96
7.	WN-657	6726	2364	2.50
8.	WN-664	8749	2325	2.57
9.	WN-665	9006	2531	2.40
10.	DN-6	7251	2823	2.50
11.	CFMV-1	7593	2127	3.47
12.	CFMV-2	8319	3106	3.03
13.	GNN-6	8281	2823	2.80
14.	GN-8	7435	2414	2.40
15.	GN-10	8250	3285	3.54
	S.Em. ±	60.55	405.82	0.10
	CD (0.05)	174	1177	NS
	CV%	5.46	7.01	9.04

Table 3: Qualitative morphological characters of finger millet genotypes

Sr. No.	Genotypes	Plant type	Foliage color	Ear head habit	Grain color
1.	WN-583	Erect	Green	Semi compact	Copper Brown
2.	WN-586	Erect	Dark Green	Compact	Light Brown
3.	WN-587	Erect	Green	Semi compact	Light Brown
4.	WN-599	Erect	Green	Semi compact	Copper Brown
5.	WN-601	Decumbent	Green	Open	Copper Brown
6.	WN-609	Erect	Light Green	Open	Copper Brown
7.	WN-657	Erect	Green	Semi compact	Copper Brown
8.	WN-664	Erect	Green	Semi compact	Copper Brown
9.	WN-665	Erect	Green	Open	Copper Brown
10.	DN-6	Erect	Light Green	Semi compact	Light Brown
11.	CFMV-1	Erect	Green	Compact	Light Brown
12.	CFMV-2	Erect	Dark Green	Semi compact	Copper Brown
13.	GNN-6	Decumbent	Green	Compact	Dark Brown
14.	GN-8	Erect	Green	Semi compact	Dark Brown
15.	GN-10	Decumbent	Dark Green	Semi compact	Copper Brown

Conclusion

The study revealed significant variability was observed among Finger millet genotypes for growth and yield traits. GN-10 excelled in grain yield and test weight, WN-587 in fodder yield and CFMV-2 in plant height indicating their potential use for future breeding and improvement programs.

References

1. Anonymous. Annual report. Hill Millet Research Station, Waghai, Dangs; 2016.
2. Bezaweletaw K, Sripichitt P, Wongyai W, Hongtrakul V. Phenotypic diversity of Ethiopian finger millet in relation to geographical regions as an aid to germplasm collection and conservation strategy. Kasetsart J Soc Sci. 2007;41:7-16.
3. Cordazzo CV. Effect of seed mass on germination and growth of three dominant species in Southern Brazilian coastal dunes. Braz J Biol. 2002;62:427-35.
4. Dwivedi S, Upadhyaya H, Senthilvel S, Hash C, Fukunaga K, Diao X, *et al*. Millets: genetic and genomic resources. In: Janick J, editor. Plant Breeding Reviews. Vol. 35. Hoboken: Wiley; 2012. p. 247-75.
5. Ganapathy S, Nirmalakumari A, Muthiah AR. Genetic variability and interrelationship analyses for economic traits in finger millet germplasm. World J Agric Sci. 2011;7(2):185-8.
6. Goswami AP, Prasad B, Joshi VC. Characterization of finger millet (*Eleusine coracana* (L.) Gaertn.) germplasm for morphological parameters under field conditions. J Appl Nat Sci. 2015;7(2):836-8.
7. Hittalmani S. Development of high yielding, disease resistant, drought tolerant finger millet (*Eleusine coracana* L. Gaertn.). Progress report of the McKnight Foundation funded project. 2004;1:82.
8. Kadam DD, Kulkarni SR, Jadhav BS. Variability, correlation and path analysis in finger millet. J Maharashtra Agric Univ. 2009;34(2):131-4.
9. Lule D, Kassahun T, Masresha F, Santie DV. Inheritance and association of quantitative traits in finger millet (*Eleusine coracana*) landraces collected from Eastern and South Eastern Africa. Int J Genet. 2012;2(2):12-21.
10. Mall TP, Tripathi SC. Millets—the nutrimental potent ethno-medicinal grasses: a review. World J Pharm Res. 2016;5(2):495-520.
11. Raizada MN, Goron TL. Genetic diversity and genomic resources available for the small millet crops to accelerate a green revolution. Front Plant Sci. 2015;6:157.
12. Upadhyaya HD, Gowda CLL, Reddy VG. Morphological diversity in finger millet germplasm introduced from Southern and Eastern Africa. J SAT Agric Res. 2007;3(1):1-3.