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PERFORMANCE OF SOWING TIME AND SUITABLE VARIETIES ON GROWTH AND YIELD ATTRIBUTES OF SUMMER FINGER MILLET (*ELEUSINE CORACANA* L.)

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ABSTRACT

A field experiment was done under summer season 2024 at Agronomy Farm, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat to establish the performance of finger millet varieties under different sowing times in summer season (*Eleusine coracana* L.). The study involved twelve treatment combinations comprising four sowing times (S_1: 2nd week of February; S_2: 3rd week of February; S_3: 4th week of February and S_4: 1st week of March) and three varieties (V_1: GNN 8; V_2: CFMV 2 (Gira) and V_3: CFMV 3), laid out in a Factorial Randomized Block Design (FRBD) with three replications. Experimental results revealed that sowing time was important in controlling growth and yield attributes of summer finger millet. Sowing on 2nd week of February resulted in significantly the higher periodical plant height at 30, 60 DAS and at harvest (35.8 cm, 79.9 cm and 102.7 cm) however, the Number of days to 50 per cent flowering (81.1 days) has also found significant effect as compared to late sown crop. Additionally, 2nd week of February sowing produced significantly the highest number of fingers per plant (9.3), fingers length (8.5 cm) and test weight (2.82 g). Regarding the effect of different varieties, variety CFMV 2 produced significantly higher number of fingers per plant (9.1), test weight (2.78g) followed by variety GNN 8 and CFMV 3. The study concluded that the treatment combination S_1V_2 (variety CFMV 2 sown in the 2nd week of February) emerged as the most effective and profitable for higher finger millet productivity.

Keywords **:** Summer finger millet, sowing time, variety, growth and yield attributes.

Introduction

In India, finger millet (*Eleusine coracana* L.) is also referred to as ragi and mandua. It is a minor cereal that originated in Ethiopia and is widely cultivated throughout India and Africa. It serves as a staple food, providing a significant amount of calories and protein to large segments of the population in these regions, particularly among low-income groups. Finger millet is the fourth most important millet globally following sorghum, pearl millet and foxtail millet. It is cultivated extensively across Africa and South Asia under diverse agro-climatic conditions (Chandra *et al*., 2016). In terms of the area under finger millet cultivation in India, Karnataka leads with 785 hectares followed by Tamil Nadu, Uttarakhand and Maharashtra. Karnataka also ranks first in total production with 1,370 metric tons. However, in terms of productivity, Tamil Nadu ranks first with 3,841 kg/ha. In the state of Gujarat the highest area under finger millet cultivation is in Dang district. The average productivity of finger millet in Gujarat is 900 kg/ha (Joshi and Joshi, 2023). The crop derives its common name "finger millet" from the unique shape of its panicles, which resemble human fingers and thumbs. Finger millet is a nutritionally rich cereal, notably high in essential minerals such as calcium and iron as well as protein and carbohydrates (Thakur, 2023). Historically, finger millet grains were used to produce both alcoholic and non-alcoholic beverages, while its flour has been employed in the

preparation of diverse food products, including bread, biscuits, porridge and snacks (Dida & Kebero, 2023). During the summer season, finger millet requires approximately 350–375 mm of water, which can typically be supplied through eight to nine irrigations depending on the soil type (Satapathy *et al*., 2023). The timing of sowing plays a vital role in determining crop growth, development and yield by influencing the crop exposure to climatic conditions such as temperature, rainfall and photoperiod during critical stages of development (Gowda *et al*., 2009). Similarly, the choice of variety, which determines genetic potential, disease resistance and duration to maturity significantly interacts with sowing time and environmental conditions ultimately affecting yield performance.

Materials and Methods

A field experiment was conducted during the summer season of 2024 at the Agronomy Farm, B. A. College of Agriculture, Anand Agricultural University, Anand (22.58° N latitude and 72.92° E longitude, with an altitude of 45.1 meters above mean sea level). The experimental site is located under the Middle Gujarat Agro-Climatic Zone (AES-III) of Gujarat. The experimental field has an even topography with a gentle slope having good drainage. The soil samples were taken randomly from experimental plot to a depth of 0-15 cm and the experimental soil was loamy sand in texture, slightly alkaline in reaction (pH 8.20) and had an EC of 0.20 dS/m. It has organic carbon content (0.45 %), Available phosphorus (40.3 kg/ha) and potassium (230.59 kg/ha). The experiment was laid out in a Factorial Randomized Block Design (FRBD) with three replications, comprising twelve treatment combinations comprising four sowing times (S_1: 2nd week of February; S_2: 3rd week of February; S_3: 4th week of February and S_4: 1st week of March) and three varieties (V_1: GNN 8; V_2: CFMV 2 (Gira) and V_3: CFMV 3), The Recommended dose of nitrogen, phosphorus and potassium (N: P_2O_5 : K_2O @ 40:20:00 kg/ha) was applied through urea and DAP as a basal dose. The seeds of finger millet varieties were sown manually in previously opened furrows at the distance of 30 cm between the rows @ 10 kg/ha. Fertilizers were placed below the seeds before sowing. After sowing seeds were covered with a thin layer of soil to avoid damage by birds in all the treatments. Weed management was carried out through one timely hand weeding and with the help of wheel hoe which effectively removed broad-leaf and grassy weeds from the crop rows. The first irrigation was given just before sowing and remaining irrigations were given as and when required by the crop and harvesting of crop was done at physiological maturity stage. Plant population at 20 DAS from each plot one meter row length selected and counted. Growth attributes (Periodical plant height at 30, 60 DAS and at harvest, number of days to 50 per cent flowering, number of tillers per plant and number of days to maturity) and yield attributing characters (Number of fingers per plant, fingers length and test weight).

Table 1: Treatment Details:

Treatment combinations	Treatment details
S_1V_1	2nd Week of February + GNN 8
S_1V_2	2nd Week of February + CFMV 2
S_1V_3	2nd Week of February + CFMV 3
S_2V_1	3rd Week of February + GNN 8
S_2V_2	3rd Week of February + CFMV 2
S_2V_3	3rd Week of February + CFMV 3
S_3V_1	4th Week of February + GNN 8
S_3V_2	4th Week of February + CFMV 2
S_3V_3	4th Week of February + CFMV 3
S_4V_1	1st Week of March + GNN 8
S_4V_2	1st Week of March + CFMV 2
S_4V_3	1st Week of March + CFMV 3

Results and Discussion

Various factors related to crop production played a crucial role in increasing finger millet production per unit area. Among these factors, the sowing time and the selection of suitable varieties were particularly important in maximizing production. The objective of the experiment was to find out the effect of sowing time and suitable varieties on growth and yield attributes of summer finger millet. To achieve the aforementioned objectives, the results and discussion of various parameters are presented below:

Effect of sowing time

Plant population

Data presented in Table 2 revealed that the effect of sowing time on plant population was not statistically significant, indicating that sowing time had no significant impact on plant emergence or early establishment under the study conditions. The highest plant population was observed with sowing in the S_3 (4th week of February) had 42.3, while the lowest plant population was recorded in the S_4 (1st week of March). Different sowing times reflects the influence of physiological and environmental compatibility.

Growth attributes

Data presented in Table 2, revealed that different time of sowing significantly affected the periodical plant height at 30, 60 DAS and at harvest. Treatment

S_1 (2nd week of February) was recorded significantly higher plant height at 30, 60 DAS and at harvest 35.8 cm, 79.9 cm and 102.7 cm respectively; which was at par with S_2 (3rd week of February) and S_3 (4th week of February) at 30 DAS. While data presented in Table 3, significantly more number of days to 50 per cent flowering (82.1 days) was observed in treatment S_1 (2nd week of February) followed by treatments S_2 (3rd week of February) and S_3 (4th week of February) (81.0 and 79.2 days). While sowing time S_4 (1st week of March) recorded significantly the lowest number of days to 50 per cent flowering (70.8 days). The data showed that the effect of different sowing time on number of tillers per plant and days to maturity of finger millet was found to be non-significant. It was reported that more number of days are required for maturity of crop in the treatment S_1 (2nd week of February with 117 days). Timely sowing of finger millet leads to increased plant height, likely because these plants were better able to use the existing weather conditions. This included more consistent temperatures, suitable humidity and less water evaporation. These factors improved soil moisture and nutrient access, encouraging stronger growth and taller plants. Conversely, finger millet planted late or very late grew shorter plants with restricted overall growth reported by Nagale *et al*. (2024). Days to 50 per cent flowering and maturity reduced significantly with every day delay in sowing in the trial. This decrease would be caused by delayed sown crop exposure to high temperatures, thereby hastening the crop into the reproductive phase without enough vegetative growth. Which is similar to the findings of Sarala *et al*. (2022) and Ungata *et al.* (2020).

Yield attributes

Different sowing time proved its significant effect on number of fingers per plant as per the data presented in Table 4. Significantly higher number of fingers per plant (9.3) recorded when finger millet sown on S_1 (2nd week of February) which was at par with S_2 (3rd week of February) with 8.8 fingers per plant. Delayed sowing produced lower number of fingers per plant which observed in treatment S_4 (1st week of March) that is 8.3, which was not significantly differ to S_2 (3rd week of February) and S_3 (4th week of February). However, sowing in the S_1 (2nd week of February) recorded the highest finger length (8.5 cm), followed by the S_2 (3rd week of February) and S_3 (4th week of February) with 8.3 and 8.0 cm, respectively. Sowing time significantly affected test weight in finger millet. The highest test weight (2.82 g) was obtained from S_1 (2nd week of February), This was closely followed by the S_2 (3rd week of February) with 2.72 g. The reduction in test weight with delayed sowing time might be due to reduction in growth period and the shriveling of the grains as a result of the high temperatures during the milking and grain filling stages. Due to longer days to maturity and a longer time for photosynthates to be transported to developing grains, earlier sowing had the highest test weight these findings are in line with those reported by Phom *et al.* (2022) and Nagale *et al*. (2024). By shortening the vegetative phase and exposing the crop to unfavorable climatic conditions (temperature, moisture, light) which collectively restrict the plant ability to produce the maximum number of fingers per plant which was indicated by Upadhyay *et al.* (2012), Ungata *et al.* (2020).

Effect of varieties

Plant population

Data showed in Table 2, indicating that varietal differences did not significantly influence plant population at 20 DAS. Among the varieties V_2 (CFMV 2) recorded the highest plant population (41.5), followed by V_1 (GNN 8) and V_3 (CFMV 3) having 40.4 and 40.2, respectively. Variety V_2 (CFMV 2) demonstrated better performance in terms of early plant population contributing to a stronger initial crop stand. It might be due to favourable weather conditions during the germination period and soil conditions were also favourable.

Growth attributes

Data presented in Table 2, showed that the Periodical plant height was not significantly affected at 30, 60 DAS and at harvest due to different finger millet varieties. The higher plant height (34.7 cm, 76.3 cm and 98.3 cm) was recorded with variety V_2 (CFMV 2) at 30, 60 DAS and at harvest, respectively. While the lower plant height at all the stages observed in variety V_3 (CFMV 3). However, Data mentioned in Table 3, indicated that number of days to 50 per cent flowering, number of tillers per plant and number of days to maturity affected due to different finger millet varieties is found to be non-significant. While variety V_2 (CFMV 2) has more number of days to 50 per cent flowering, number of tillers per plant and number of days to maturity as compared to variety V_1 (GNN 8) and V_3 (CFMV 3). It might be due to proper climatic conditions and genetic makeup of the varieties.

Yield attributes

Data indicated in Table 4, revealed that the different finger millet varieties produced significant effect on number of fingers per plant. Treatment V_2 (CFMV 2) exhibited significantly higher number of fingers per plant (9.1), which was statistically at par

with V_1 (GNN 8) variety. Variety V_3 (CFMV 3) showed significantly lower fingers per plant, which was not differ with variety V_1 (GNN 8). Moreover, the effect of variety on finger length was non-significant; while among the varieties, V_2 (CFMV 2) exhibited the numerically highest finger length (8.4 cm), while V_1 (GNN 8) and V_3 (CFMV 3) recorded slightly lower values. As like number of fingers per plant, varietal differences also significantly influenced test weight of finger millet. Variety V_2 (CFMV 2) reported significantly the higher test weight (2.78 g). While, variety V_1 (GNN 8) produced significantly lower test weight (2.54 g), which was also at par with variety V_3 (CFMV 3) during the study. Significantly higher test weight among different varieties might be due to varietal genetic makeup. The present findings are in close agreement with those reported Sarala *et al.* (2022), Phom *et al.* (2022) and Patil *et al.* (2022).

Table 2 : Plant population and periodical plant height as influenced by different sowing time and varieties of finger millet

Treatments			Plant population (Per meter row length) At 20 DAS	Plant height (cm)		
				30 DAS	60 DAS	At harvest
Factor (A): Sowing Time (S)						
S_1	:	2nd Week of February	40.0	35.8	79.9	102.7
S_2	:	3rd Week of February	40.8	34.7	74.0	96.5
S_3	:	4th Week of February	42.3	33.8	70.4	93.5
S_4	:	1st Week of March	39.7	31.9	66.4	90.1
S.Em.±			1.0	0.7	1.0	2.9
C.D. at 5%			NS	2.2	NS	8.5
Factor (B): Varieties (V)						
V_1	:	GNN 8	40.4	34.1	72.4	94.8
V_2	:	CFMV 2 (Gira)	41.5	34.7	76.3	98.3
V_3	:	CFMV 3	40.2	33.4	69.3	94.1
S.Em.±			0.9	0.6	0.9	2.5
C.D. at 5%			NS	NS	NS	NS
Interaction (S×V)						
S.Em.±			1.8	1.27	4.5	5.0
C.D. at 5%			NS	NS	NS	NS
C.V. (%)			7.5	6.46	10.8	9.1

Conclusion

An experimental result clearly demonstrated that both sowing time and variety significantly influenced plant stand, growth and yield attributes of finger millet. Early sowing particularly in the 2nd week of February (S_1) consistently resulted in superior vegetative plant growth. Among the different finger millet varieties, variety CFMV 2 (V_2) outperformed others in terms of growth and yield attributes. The treatment combination variety CFMV 2 sown in the 2nd week of February (S_1V_2) emerged as the most effective and profitable.

Table 3 : Number of days to 50 per cent flowering, number of tillers per plant & number of days to maturity as influenced by different sowing time and varieties of finger millet

Treatments			Number of days to 50 per cent flowering	Number of tillers per plant	Number of days to Maturity
Factor (A): Sowing Time (S)					
S_1	:	2nd Week of February	82.1	9.1	117
S_2	:	3rd Week of February	81.0	8.8	113
S_3	:	4th Week of February	79.2	8.4	111
S_4	:	1st Week of March	70.8	8.0	107
S.Em.±			1.8	0.3	2.6
C.D. at 5%			5.4	NS	NS
Factor (B): Varieties (V)					

V_1	:	GNN 8	78.4	8.6	112
V_2	:	CFMV 2 (Gira)	79.3	9.0	115
V_3	:	CFMV 3	77.1	8.1	109
S.Em.±			1.6	0.3	2.3
C.D. at 5%			NS	NS	NS
Interaction (S×V)					
S.Em.±			3.2	0.6	4.6
C.D. at 5%			NS	NS	NS
C.V. (%)			7.1	11.5	7.2

Table 4 : Number of fingers per plant, fingers length and test weight as influenced by different sowing time and varieties of finger millet

Treatments			Number of fingers per plant	Fingers length (cm)	Test Weight (g)
Factor (A): Sowing Time (S)					
S_1	:	2nd Week of February	9.3	8.5	2.82
S_2	:	3rd Week of February	8.8	8.3	2.72
S_3	:	4th Week of February	8.4	8.0	2.52
S_4	:	1st Week of March	8.3	7.4	2.48
S.Em.±			0.2	0.3	0.06
C.D. at 5%			0.6	0.7	0.19
Factor (B): Varieties (V)					
V_1	:	GNN 8	8.6	8.0	2.54
V_2	:	CFMV 2 (Gira)	9.1	8.4	2.78
V_3	:	CFMV 3	8.4	7.7	2.59
S.Em.±			0.2	0.2	0.05
C.D. at 5%			0.5	NS	0.16
Interaction (S×V)					
S.Em.±			0.4	0.4	0.11
C.D. at 5%			NS	NS	NS
C.V. (%)			7.4	9.5	7.22

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The authors declare that there is no conflict of interest related to this article.

Author's contributions

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Dr. Y. C. Lakum: Conceptualization, discussion, Review and editing, Supervision.

V. M. Parmar: Conceptualization, discussion, Review and editing, Supervision.

S. N. Chaudhary: Conceptualization, discussion, Review and editing, Supervision.

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