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EFFECT OF SOWING DATES AND NUTRIENT LEVELS ON GROWTH, YIELD AND QUALITY OF FINGER MILLET (*ELEUSINE CORACANA* L. GAERTN.) VARIETIES UNDER RAINFED CONDITIONS OF JAMMU

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ABSTRACT

A field investigation was carried out during the *kharif* seasons of 2023 and 2024 at Advanced Centre for Rainfed Agriculture (ACRA), Rakh Dhiansar, SKUAST-Jammu to assess the impact of sowing dates and nutrient levels on two finger millet varieties under rainfed conditions. The experiment followed a factorial randomized block design involving three sowing dates (20th June, 30th June, and 10th July), two varieties (VL Mandua 382 and VL Mandua 379), and four nutrient levels (0, 20:10:10, 40:20:20, and 60:30:30 kg NPK/ha). Results revealed that sowing on 30th June (D_2) facilitated early emergence, flowering, and maturity. VL Mandua 382 matured earlier, whereas VL Mandua 379 recorded higher grain yield and growth attributes. Nutrient application at 60:30:30 kg NPK/ha significantly improved protein, fiber, calcium, and iron content. The study emphasizes that appropriate sowing time, improved genotype, and balanced nutrition are key to optimizing yield and quality of finger millet under rainfed ecosystems.
***Keywords*:** Finger millet, sowing dates, nutrient levels, physiological traits, quality parameters.

Introduction

Finger millet (*Eleusine coracana* L. Gaertn.) is a climate-resilient cereal widely cultivated in the semi-arid and rainfed regions of India, particularly in hilly terrains and marginal soils Naresh *et al.* (2023). Its remarkable nutritional profile, enriched with calcium, iron, and dietary fiber, makes it a vital crop for food and nutritional security. In the sub-tropical rainfed regions of Jammu, low productivity of finger millet is often attributed to sub-optimal agronomic practices including sowing time and nutrient management.

Sowing time is a decisive factor in crop production as it determines the crop's exposure to favorable environmental conditions during critical growth stages. Similarly, appropriate nutrient application improves not only growth and yield but also the nutritional quality of the grain. However, studies on the combined effect of sowing dates and nutrient levels on finger millet varieties in the rainfed agro-ecosystem of Jammu are limited.

Hence, the present study was undertaken to evaluate the influence of different sowing dates and graded nutrient levels on phenological development and grain quality of two finger millet varieties under rainfed condition.

Materials and Methods

The field trial was conducted at ACRA, Rakh Dhiansar, SKUAST-Jammu during the *kharif* seasons of 2023 and 2024. The soil was sandy loam in texture with initial fertility of 165.68 kg/ha N, 14.22 kg/ha P, and 99.28 kg/ha K. The experiment was laid out in a factorial RBD with three replications. Treatments included three sowing dates (D_1: 20th June, D_2: 30th June, D_3: 10th July), two varieties (V_1: VL Mandua 382, V_2: VL Mandua 379), and four nutrient levels (N_1: 0, N_2: 20:10:10, N_3: 40:20:20, N_4: 60:30:30 kg NPK/ha). The net plot size was 3.6 m × 2.0 m and spacing was maintained at 30 × 10 cm. The crop was grown under purely rainfed conditions. Observations were recorded on days to emergence, flowering, maturity, crude protein, fiber, calcium, and iron contents.

Results and Discussion

Phenological Parameters

The number of days required for complete emergence, flowering, and maturity of finger millet varied significantly with sowing dates, varieties, and nutrient levels. Sowing on 30th June (D_2) recorded the earliest emergence (6.95 and 8.83 days in 2023 and 2024, respectively), while 20th June (D_1) took the longest time. Variety VL Mandua 379 (V_2) emerged faster compared to VL Mandua 382 (V_1), although V_2 took longer to reach 50% flowering and maturity. Nutrient levels did not significantly influence emergence, but increasing nutrient levels delayed flowering and maturity, with the longest durations recorded under N_4 (60:30:30 kg NPK/ha). Significant interactions (D × V and D × V × N) were recorded for flowering and maturity.

The prolonged emergence observed under early sowing (D_1) was likely due to high temperatures and low soil moisture caused by a prolonged dry spell. On the other hand, June 30th sowing (D_2) benefited from moderate temperatures and sufficient rainfall, resulting in faster emergence. These findings align with the observations of Nigade *et al*. (2020), Guo-jun *et al.* (2019), and Shiwu *et al*. (2015), who reported positive correlations between favorable environmental conditions and early crop development. The differential varietal response in physiological parameters could be attributed to genetic potential, with VL Mandua 382 maturing earlier due to its genotype, as also noted by Joshi *et al*. (2021).

Although emergence was not affected by nutrient application, increased doses of nutrients resulted in delayed flowering and maturity due to prolonged vegetative growth. Seemawat *et al*. (2013) similarly reported that enhanced nutrient availability delays reproductive transitions by extending vegetative stages. Interaction effects confirmed that combinations like VL Mandua 382 sown on June 30th matured earliest, especially under lower nutrient levels, likely due to faster phenological progression in less nutrient-rich conditions. The relevant data is presented in Table 1.

Quality Parameters

Quality attributes such as crude protein, crude fiber, calcium, and iron content were significantly influenced by sowing date, variety, and nutrient application levels. Among sowing dates, June 30th (D_2) resulted in the highest crude protein (9.69% in 2023 and 9.17% in 2024). This could be attributed to favorable growing conditions enhancing protein synthesis during the vegetative stage. However, sowing dates did not significantly influence crude fiber, calcium, or iron content.

Varietal differences were prominent, with VL Mandua 382 (V_1) showing higher protein and iron contents, whereas VL Mandua 379 (V_2) had higher crude fiber and calcium. These results highlight the importance of cultivar selection in achieving desired nutritional outcomes. Such variation may stem from differences in nutrient uptake efficiency and genetic characteristics, a conclusion supported by findings from Gavit *et al*. (2017) and Mubeena *et al*. (2019).

Nutrient application strongly influenced all quality parameters. N_4 (60:30:30 kg NPK/ha) consistently produced the highest protein, fiber, calcium, and iron values across both years, suggesting that adequate nutrient supply enhances metabolic efficiency and nutrient accumulation. The lowest values were observed in the control treatment (N_1). These results corroborate previous findings by Pallavi *et al*. (2015) and Radha *et al*. (2020), who emphasized the positive influence of higher nutrient doses on crop nutritional content.

No significant interactions were recorded for quality traits, indicating that each factor (sowing date, variety, nutrient level) independently influenced nutritional quality without synergistic effects. This finding is useful in practice, as it suggests that optimizing each agronomic factor individually can still result in improved crop quality without complex interaction management. The relevant data is presented in Table 2.

Conclusion

Sowing finger millet on 30th June, coupled with the application of 60:30:30 kg NPK/ha, significantly enhanced phenological development and grain nutritional quality under rainfed conditions in the kandi belt of Jammu. VL Mandua 382 emerged as the earlier maturing variety, while VL Mandua 379 exhibited superior grain yield and mineral accumulation. The findings underscore the importance of optimizing sowing time, variety, and nutrient management to achieve sustainable productivity and improved grain quality in finger millet cultivation under rainfed agro-ecosystems.

Table 1: Effect of sowing dates, varieties and nutrient levels on phonological parameters of finger millet.

Treatments	Days to Complete Emergence		Days to 50% Flowering		Days to Maturity	
	2023	2024	2023	2024	2023	2024
Dates of sowing (D)						
D_1: 20th June	9.49	13.37	75.72	79.92	106.82	114.01
D_2: 30th June	6.95	8.83	69.03	73.79	100.12	107.88
D_3: 10th July	8.39	10.46	72.83	77.74	103.92	111.84
SEm(±)	0.12	0.11	0.41	0.44	0.41	0.44
CD at (5%)	0.34	0.33	1.17	1.26	1.17	1.26
Varieties (V)						
V_1: VL Mandua 382	9.03	11.69	70.41	74.69	100.45	107.80
V_2: VL Mandua 379	7.53	10.08	74.64	79.61	106.79	114.69
SEm(±)	0.10	0.09	0.34	0.36	0.34	0.36
CD at (5%)	0.27	0.27	0.96	1.03	0.96	1.03
Nutrient levels (N)						
N_1: 0	8.21	11.00	68.35	72.65	99.45	106.75
N_2: 20:10:10	8.28	10.89	72.30	77.00	103.40	111.09
N_3: 40:20:20	8.33	10.92	74.16	78.82	105.26	112.92
N_4: 60:30:30	8.30	10.75	75.28	80.12	106.38	114.22
SEm(±)	0.14	0.13	0.48	0.51	0.48	0.51
CD at (5%)	NS	NS	1.36	1.45	1.36	1.46
Interaction						
D × V	0.48	0.47	1.66	1.78	1.66	1.78
D × N	NS	NS	NS	NS	NS	NS
V × N	NS	NS	NS	NS	NS	NS
D × V × N	NS	NS	3.23	3.56	3.32	3.56

Table 2: Effect of sowing dates, varieties and nutrient levels on quality parameters of finger millet

Treatments	Crude protein content (%)		Crude fiber content (%)		Calcium content (mg)		Iron content (ppm)	
	2023	2024	2023	2024	2023	2024	2023	2024
Dates of sowing (D)								
D_1: 20th June	8.67	8.25	3.58	3.55	351.01	348.65	36.01	35.77
D_2: 30th June	9.69	9.17	3.67	3.62	357.57	355.79	38.90	38.64
D_3: 10th July	9.30	8.74	3.63	3.62	354.92	352.43	37.70	37.40
SEm(±)	0.15	0.14	0.06	0.05	5.54	5.97	0.65	0.53
CD (P=0.05)	0.42	0.39	NS	NS	NS	NS	1.86	1.52
Varieties (V)								
V_1: VL Mandua 382	10.21	9.71	3.56	3.54	334.11	332.00	38.69	38.44
V_2: VL Mandua 379	8.23	7.73	3.69	3.66	374.89	372.58	36.38	36.10
SEm(±)	0.12	0.11	0.05	0.04	4.52	4.88	0.53	0.44
CD (P=0.05)	0.34	0.32	NS	NS	12.88	13.89	1.52	1.24
Nutrient levels (N)								
N_1: 0	8.01	7.53	3.54	3.51	350.69	347.75	31.09	30.87
N_2: 20:10:10	8.97	8.45	3.61	3.59	353.88	352.19	35.73	35.39
N_3: 40:20:20	9.58	9.08	3.67	3.63	356.30	354.14	39.92	39.60
N_4: 60:30:30	10.31	9.82	3.70	3.67	357.12	355.09	43.42	43.22
SEm(±)	0.17	0.16	0.07	0.06	6.4	6.90	0.75	0.61
CD (P=0.05)	0.48	0.45	NS	NS	NS	NS	2.14	1.75
Interaction								
D × V	NS	NS	NS	NS	NS	NS	NS	NS
D × N	NS	NS	NS	NS	NS	NS	NS	NS
V × N	NS	NS	NS	NS	NS	NS	NS	NS
D × V × N	NS	NS	NS	NS	NS	NS	NS	NS

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