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Effect of sowing dates on seed yield and seed quality of proso millet (*Panicum miliaceum* L.)

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Abstract

For the investigation of the effect of sowing dates on seed yield and seed quality of proso millet (*Panicum miliaceum* L.). The field experiment was undertaken during *summer* season of the year 2025 with two sowing dates S1: 1st MW (1st Jan. 2025) and S2: 4th MW (20th Jan. 2025) as the main plot treatment and 14 proso millet genotypes along with two checks as the sub plot treatment. First sowing date S1: 1st MW (1st Jan. 2025) recorded highest (115.97 cm) plant height than second sowing date S2: 4th MW (20th Jan. 2025) (108.53 cm). The genotype KOPPM-23-26 (V₂) had significantly higher plant height (123.03 cm). Significant varietal differences were found in characters viz. days to 50 per cent flowering in proso millet genotypes when sown on second sowing date S2-4th MW (20th Jan. 2025) required significantly less (43.19 days) number of days to 50 per cent flowering. Number of days required to maturity follows same trend. Number of tillers per plant was significantly influenced by date of sowing and genotypes. The highest number of tillers (11.52 plant⁻¹) was recorded in genotypes KOPPM-23-26 (V₂), followed by the genotype KOPPM-23-18 (V₄) (11.24 plant⁻¹), which is statistically at par with KOPPM-23-26 (V₂). The genotypes KOPPM-23-26 (V₂) recorded significantly highest grain yield in first sowing date S1-1st MW (1st Jan. 2025) (3944 kg ha⁻¹). The grain yield recorded by the genotype KOPPM-23-26 (V₂) for second sowing date S2-4th MW (20th Jan. 2025) was 3806.67 kg ha⁻¹. The genotypes KOPPM-23-26 (V₂) recorded significantly highest fodder yield in first sowing date S1-1st MW (1st Jan. 2025) (5625 kg ha⁻¹). The highest seed germination percentage (93.10%) was recorded in genotypes KOPPM-23-26 (V₂). Seedling vigour index-I is significantly influenced by date of sowing and genotypes. The highest seedling vigour index-I (1990.48) was recorded in genotype KOPPM-23-26 (V₂), which was followed by the genotypes KOPPM-23-33 (V₅) (1960.13) and KOPPM-23-43 (V₁) (1957.89). Seedling vigour index II is significantly influenced by date of sowing and genotypes. The higher (3.55) Seedling vigour index II was recorded in genotype KOPPM-23-26 (V₂).

Keywords: Proso millet, *Panicum miliaceum* L., sowing dates, seed yield, seed quality

Introduction

Proso millet (*Panicum miliaceum* L.) is an ancient, short-duration cereal members of the botanical family Poaceae and is widely cultivated for food, feed and forage, particularly in regions characterized by limited rainfall and poor soil fertility. It is a drought-tolerant C₄ crop with high water-use efficiency and the ability to withstand high temperature and moisture stress, making it well suited to arid and semi-arid environments (Baltensperger, 2002; Changmei and Dorothy, 2014) [6, 7]. Proso millet completes its growth cycle within a span of 60-100 days and primarily undergoes self-pollination. The species exhibits substantial genetic diversity, which can be harnessed for varietal improvement programs. In India, its cultivation is concentrated in states such as Karnataka, Maharashtra, Tamil Nadu, Andhra Pradesh, Bihar, Madhya Pradesh, and Uttar Pradesh, covering nearly 0.41 lakh hectares and yielding close to 0.22 lakh tonnes (Elangovan *et al.*, 2023) [10]. The grain is nutritionally rich, containing about 12-13 per cent protein, 68.9-72.9 per cent carbohydrates, dietary fibre, minerals and essential amino acids, and is naturally gluten-free (Kalinova and Moudry, 2006; Anonymous, 2010) [13, 4]. Its superior nutrient profile, reduced glycaemic response, and antioxidant potential further highlight the crop's relevance as a health-promoting nutri-cereal (Das *et al.*, 2019) [8].

Proso millet has considerable potential for sustainable and climate-resilient agriculture because of its short duration, efficient utilization of water and adaptability to diverse environmental conditions. However, its productivity is influenced by both genetic constitution and environmental

factors. “Determining the appropriate sowing window is crucial, as it ensures favorable temperature, moisture, and environmental conditions that support effective crop establishment, growth, and yield formation. Timely sowing allows the crop to synchronize its critical growth stages with favourable environmental conditions, thereby improving productivity (Aishwarya *et al.*, 2022) [12]. The selection of suitable genotypes along with an appropriate sowing time is therefore essential for exploiting the genetic potential of proso millet and achieving higher grain and fodder productivity. Therefore, this study was conducted to assess the performance of diverse proso millet genotypes across varying sowing dates, with the objective of identifying promising cultivars and determining the most suitable sowing time for maximizing productivity under existing agro-climatic conditions.

Materials and Methods

The field experiment was conducted during the summer season of 2025, following a split-plot design with three replications and two sowing dates S1: 1st MW (1st Jan. 2025) and S2: 4th MW (20th Jan. 2025) as the main plot treatment and 16 proso millet genotypes viz., V1: KOPPM-23-43, V2: KOPPM-23-26, V3: KOPPM-23-04, V4: KOPPM-23-18, V5: KOPPM-23-33, V6: KOPPM-23-48, V7: KOPPM-23-20, V8: KOPPM-23-45, V9: KOPPM-23-35, V10: KOPPM-23-39, V11: KOPPM-23-40, V12: KOPPM-23-23, V13: KOPPM-23-36, V14: KOPPM-23-31 along with two checks V15: TNAU-202 (C) and V16: TNAU-164 (C) as the sub plot treatment for the study of the effect of sowing dates on seed yield and seed quality of proso millet (*Panicum miliaceum* L). The recommended package of practice was undertaken for conduct of experiment. The growth and yield parameters viz., Days to 50% flowering and Maturity, Plant height (cm), Panicle length (cm), Number of tillers plant⁻¹, Grain and fodder yield, Harvest index (%) and Test weight (g) was recorded. The seed quality parameters viz., Germination (%) carried out in accordance with ISTA guidelines, Root and shoot length (cm), Vigour indices (I and II) The values were derived following the computational method outlined by Abdul Baki and Anderson (1973) [1], and qualitative parameters like seed colour and seed shape were also recorded. The dataset was analyzed using analysis of variance, and statistical significance was determined following the procedures outlined by Gomez and Gomez (1984) [12]. The critical difference (CD) was calculated at the 5% level of probability. For treatment comparisons, whenever the F-test indicated significance, the mean values of key traits were tabulated along with the corresponding standard error of mean and CD values.

Results and Discussion

1. Effect of sowing dates, genotypes and interaction on growth and yield attributes of proso millet

The analysis revealed that both sowing dates and genotypes exerted significant influence on vegetative growth and yield attributes of proso millet, as presented in Table 1. Marked varietal differences were observed in days to 50% flowering, with genotypes sown on the second sowing date (S2 - 4th MW, 20th January 2025) requiring fewer days (43.19) to reach 50% flowering. Similar findings were reported by Anilrao *et al.* (2024) [3]. Maturity duration also followed this trend, with genotypes under S2-4th MW (20th Jan. 2025) attaining maturity earlier (70.09 days), whereas delayed flowering and maturity were recorded under the first sowing date S1-1st MW (1st Jan. 2025). Plant height was significantly greater under S1-1st MW (1st Jan. 2025) (115.97 cm) compared to S2-4th MW (20th Jan. 2025) (108.53 cm). Among genotypes, KOPPM-23-26 (V₂) exhibited the tallest plants

(123.03 cm), followed closely by KOPPM-23-43 (V₁), KOPPM-23-18 (V₄), and KOPPM-23-45 (V₈), all statistically at par with KOPPM-23-26 (V₂). The enhanced height under S1-1st MW (1st Jan. 2025) likely reflects favorable weather conditions that promoted vegetative growth, corroborating the observations of Swathi *et al.* (2021) [22]. Productive tiller number per plant was also significantly affected by sowing date and genotype. The highest tiller count (8.73 plant⁻¹) was recorded under S1-1st MW (1st Jan. 2025), while the lowest (8.52 plant⁻¹) occurred under S2-4th MW (20th Jan. 2025). Genotype KOPPM-23-26 (V₂) produced the maximum number of productive tillers (11.52 plant⁻¹), followed by KOPPM-23-18 (V₄) (11.24 plant⁻¹), both statistically at par. Taller plants with stronger photosynthetic capacity likely contributed to higher tiller production and improved yield, consistent with Salini *et al.* (2010) [21]. Panicle length was similarly influenced, with S1-1st MW (1st Jan. 2025) recording the longest panicles (31.92 cm) compared to S2-4th MW (20th Jan. 2025) (30.84 cm). Genotype KOPPM-23-26 (V₂) again excelled (36.94 cm), followed by V₁ (36.30 cm) and KOPPM-23-18 (V₄) (35.83 cm), in agreement with Anilrao *et al.* (2024) [3]. Grain yield per plant was significantly higher under S1-1st MW (1st Jan. 2025) (19.85 g) than S2-4th MW (20th Jan. 2025) (18.97 g). Genotype KOPPM-23-26 (V₂) recorded the maximum grain yield (24.22 g), followed by KOPPM-23-43 (V₁) (23.16 g) and KOPPM-23-18 (V₄) (23.36 g), all statistically at par. Similar results were reported by Ghorbannezhad *et al.* (2023) [11]. And, KOPPM-23-26 (V₂) produced 3944 kg ha⁻¹ under S1-1st MW (1st Jan. 2025) and 3806.67 kg ha⁻¹ under S2-4th MW (20th Jan. 2025), reflecting a 6.55% reduction in yield under later sowing. The superior performance of KOPPM-23-26 (V₂) may be attributed to its genetic potential for efficient partitioning of photosynthates into grain and adaptability to environmental conditions. Fodder yield followed a similar trend, with KOPPM-23-26 (V₂) recording the highest under S1-1st MW (1st Jan. 2025) (5007.08 kg ha⁻¹). Elevated temperatures and longer photoperiods during later sowing likely contributed to reduced grain yield through sterility, fewer grains, and lower assimilate partitioning, as noted by Ghorbannezhad *et al.* (2023) [11] and Anilrao *et al.* (2024) [3]. The high fodder yield of KOPPM-23-26 (V₂) reflects its capacity to produce taller plants with more tillers, enhancing suitability to the sowing environment. Harvest index was not significantly influenced by sowing date or genotype, though KOPPM-23-26 (V₂) recorded the highest value (40.80%), followed by KOPPM-23-43 (V₁) (40.62%), consistent with Kumari and Reddy (2023) [16] and Pannase *et al.* (2024) [17]. Overall, most growth parameters (plant height, tiller number, panicle length) and yield attributes (grain yield, fodder yield) were maximized under the first sowing date S1-1st MW (1st Jan. 2025), likely due to optimum temperature and more congenial environmental conditions during the crop growth period.

2. Effect of sowing dates, genotypes and interaction on seed quality attributes of proso millet

Seed germination percentage was significantly affected by both sowing date and genotype. The maximum germination (93.10%) was observed in KOPPM-23-26 (V₂), followed by KOPPM-23-43 (V₁) (92.88%), KOPPM-23-18 (V₄) (92.54%), KOPPM-23-33 (V₅) (92.21%), and KOPPM-23-45 (V₈) (91.96%), all statistically comparable with KOPPM-23-26 (V₂). These findings are consistent with earlier reports by Krishnappa *et al.* (2001) [14] and Deshmukh *et al.* (2025) [9]. Seedling root length also varied significantly, with KOPPM-23-26 (V₂) recording the longest roots (8.06 cm), followed by KOPPM-23-33 (V₅) (8.00 cm), KOPPM-23-43 (V₁) (7.90 cm), and KOPPM-23-18 (V₄) (7.80

cm), all at par with KOPPM-23-26 (V₂). Similarly, shoot length was highest in KOPPM-23-26 (V₂) (13.32 cm), followed by KOPPM-23-33 (V₅) (13.26 cm), KOPPM-23-43 (V₁) (13.16 cm), and KOPPM-23-18 (V₄) (12.96 cm), corroborating the observations of Patil *et al.* (1999)^[18] and Kumar *et al.* (2011)^[15]. Seedling dry weight was likewise influenced, with KOPPM-23-26 (V₂) producing the highest (38.10 mg), followed by KOPPM-23-33 (V₅) (37.90 mg) and KOPPM-23-43 (V₁) (37.67 mg), all statistically comparable. Seedling vigour index-I was maximized in KOPPM-23-26 (V₂) (1990.48), followed by KOPPM-23-33 (V₅) (1960.13) and KOPPM-23-43 (V₁) (1957.89). Vigour index-II also showed significant variation, with KOPPM-23-26 (V₂) recording the highest (3.55), followed by KOPPM-23-33 (V₅) (3.50), KOPPM-23-43 (V₁) (3.50), KOPPM-23-18 (V₄) (3.47), and KOPPM-23-45 (V₈) (3.39), all at par with KOPPM-23-26 (V₂). These results align with the findings of Tripathi and Verma (2011)^[23] and Rawat *et al.* (2022)^[20]. Overall, genotypes played a crucial role in determining yield potential, while environmental conditions influenced the expression of genetic capacity. Yield performance is governed by physiological processes regulated jointly by genetic constitution and environmental factors. The interaction between sowing date and genotype was non-significant for most growth, yield, and seed quality traits, except for productive tillers, panicle length, grain yield, fodder yield, and test weight.

3. Effect of sowing dates on qualitative parameters of proso millet

Seed colour of all genotypes remained stable across both sowing

dates, namely S1-1st MW (1st Jan. 2025) and S2-4th MW (20th Jan. 2025), indicating that sowing time exerted no influence on this qualitative trait. Based on the Royal Horticultural Society (RHS) colour chart, seven genotypes — KOPPM-23-43 (V₁), KOPPM-23-04 (V₃), KOPPM-23-18 (V₄), KOPPM-23-48 (V₆), KOPPM-23-45 (V₈), TNAU-202 (C) (V₁₅), and TNAU-164 (C) (V₁₆) — exhibited Golden Yellow (RHS No. 13A) seed colour. Five genotypes — KOPPM-23-26 (V₂), KOPPM-23-33 (V₅), KOPPM-23-39 (V₁₀), KOPPM-23-40 (V₁₁), and KOPPM-23-23 (V₁₂) — were classified as Dark Grey (RHS No. N199C). Genotype KOPPM-23-36 (V₁₃) displayed Grey (RHS No. N199D), while KOPPM-23-20 (V₇) and KOPPM-23-31 (V₁₄) were characterized by Straw White/Cream (RHS No. 159C). Seed shape also remained unaffected by sowing date, with identical shapes observed under both S1-1st MW (1st Jan. 2025) and S2-4th MW (20th Jan. 2025). However, variation was evident among the sixteen proso millet genotypes. According to DUS descriptors, four genotypes — KOPPM-23-18 (V₄), KOPPM-23-20 (V₇), TNAU-202 (C) (V₁₅), and TNAU-164 (C) (V₁₆) — exhibited an oval seed shape. The remaining twelve genotypes — KOPPM-23-43 (V₁), KOPPM-23-26 (V₂), KOPPM-23-04 (V₃), KOPPM-23-33 (V₅), KOPPM-23-48 (V₆), KOPPM-23-45 (V₈), KOPPM-23-35 (V₉), KOPPM-23-39 (V₁₀), KOPPM-23-40 (V₁₁), KOPPM-23-23 (V₁₂), KOPPM-23-36 (V₁₃), and KOPPM-23-31 (V₁₄) — were characterized by an elliptical seed shape. The observed variation highlights distinct differences in this qualitative trait among the genotypes, consistent with the findings of Ragupathi *et al.* (2017)^[19].

No.	Treatment	Plant height (cm)	Days to 50% flowering	Days to maturity	Productive tillers plant ⁻¹	Panicle length (cm)	Grain yield plant ⁻¹ (g)	Grain yield (kg/ha)	Fodder yield plant ⁻¹ (g)	Fodder yield (kg/ha)	Harvest index (%)	Test weight (g)
A.	Main plot: Sowing Dates											
S1:	1 st MW (1 st Jan. 2025)	115.97	46.32	74.29	8.73	31.92	19.85	3305.00	30.20	5007.08	39.66	4.82
S2:	4 th MW (20 th Jan. 2025)	108.53	43.19	70.09	8.52	30.84	18.97	3088.54	30.03	4877.04	38.52	4.61
	SE (m)±	0.36	0.45	0.26	0.03	0.13	0.14	31.61	0.02	11.55	-	0.02
	CD at 5%	2.20	2.71	1.56	0.19	0.77	0.84	192.32	0.13	70.30	-	0.15
B.	Sub plot: Genotypes											
V1:	KOPPM-23-43	121.61	47.95	74.87	11.20	36.30	23.16	3780.83	33.81	5526.67	40.62	5.76
V2:	KOPPM-23-26	123.03	45.42	73.92	11.52	36.94	24.22	3875.33	35.11	5625.00	40.80	5.92
V3:	KOPPM-23-04	110.90	47.12	72.55	7.37	30.42	18.24	3018.17	29.19	4830.00	38.45	4.28
V4:	KOPPM-23-18	121.57	32.25	57.56	11.24	35.83	23.36	3760.00	34.29	5516.67	40.53	5.55
V5:	KOPPM-23-33	116.18	36.77	62.42	9.90	35.05	19.84	3152.50	30.83	4893.00	39.15	5.21
V6:	KOPPM-23-48	118.07	40.88	65.83	9.53	32.20	20.58	3237.50	31.18	4918.00	39.49	4.71
V7:	KOPPM-23-20	115.58	50.08	79.42	8.79	31.97	18.84	3150.00	29.20	4862.00	39.26	4.51
V8:	KOPPM-23-45	120.90	39.12	67.74	10.80	35.53	22.05	3522.50	31.80	5075.00	40.45	5.38
V9:	KOPPM-23-35	116.01	49.18	77.12	8.55	32.73	18.07	3120.00	28.77	4882.83	38.98	4.59
V10:	KOPPM-23-39	107.83	46.31	78.55	6.77	27.71	17.09	2900.00	27.76	4713.67	38.09	4.24
V11:	KOPPM-23-40	103.33	42.30	69.48	6.66	26.36	17.33	2906.17	28.05	4701.00	38.22	4.20
V12:	KOPPM-23-23	95.32	52.15	81.32	6.18	24.95	16.86	2835.33	27.90	4697.17	37.63	3.95
V13:	KOPPM-23-36	115.78	43.62	70.57	9.10	32.12	19.19	3206.67	29.82	4720.00	39.70	4.62
V14:	KOPPM-23-31	109.93	44.55	71.41	6.95	29.23	17.83	2987.50	28.20	4727.00	38.72	4.34
V15:	TNAU-202 (C)	87.82	49.72	76.42	5.68	23.15	15.54	2581.67	27.28	4535.00	36.28	3.70
V16:	TNAU-164 (C)	112.15	48.63	75.93	7.77	31.58	18.45	3114.17	28.65	4850.00	39.06	4.46
	SE (m)±	1.44	2.01	2.48	0.10	0.47	0.45	55.29	0.46	42.35	-	0.11
	CD at 5%	4.06	5.68	7.00	0.28	1.32	1.28	156.41	1.30	119.79	-	0.30
	Interaction (A x B)											
	SE (m)±	2.03	2.84	3.50	0.14	0.66	0.64	78.19	0.65	59.89	-	0.15
	CD at 5%	NS	NS	NS	0.39	1.86	1.81	221.19	1.84	169.41	-	0.43
	General mean	112.25	44.75	72.19	8.62	31.38	19.41	3196.77	30.11	4942.06	39.09	4.71

No.	Treatment	Seed germination* (%)	Seedling root length (cm)	Seedling shoot length (cm)	Seedling dry weight (mg)	Seedling vigour index-I	Seedling vigour index-II
A.	Main plot: Sowing Dates						
S ₁ :	1 st MW (1 st Jan. 2025)	92.19 (74.05)	7.47	12.27	36.03	1816.91	3.33
S ₂ :	4 th MW (20 th Jan. 2025)	88.62 (70.42)	7.26	12.00	35.25	1716.44	3.13
	SE (m)±	0.26	0.01	0.02	0.06	6.73	0.02
	CD at 5%	1.56	0.07	0.11	0.34	40.93	0.10
B.	Sub plot: Genotypes						
V ₁ :	KOPPM-23-43	92.88 (74.68)	7.90	13.16	37.67	1957.89	3.50
V ₂ :	KOPPM-23-26	93.10 (75.07)	8.06	13.32	38.10	1990.48	3.55
V ₃ :	KOPPM-23-04	89.78 (71.50)	7.30	11.97	35.10	1730.02	3.16
V ₄ :	KOPPM-23-18	92.54 (74.34)	7.80	12.96	37.33	1921.52	3.47
V ₅ :	KOPPM-23-33	92.21 (74.02)	8.00	13.26	37.90	1960.13	3.50
V ₆ :	KOPPM-23-48	91.63 (73.50)	7.72	12.55	36.60	1856.98	3.36
V ₇ :	KOPPM-23-20	90.94 (72.73)	7.42	12.00	35.98	1765.86	3.28
V ₈ :	KOPPM-23-45	91.96 (73.83)	7.34	12.00	36.83	1778.02	3.39
V ₉ :	KOPPM-23-35	90.21 (71.88)	7.01	11.90	35.45	1706.04	3.20
V ₁₀ :	KOPPM-23-39	89.09 (70.89)	7.20	11.83	34.55	1714.13	3.08
V ₁₁ :	KOPPM-23-40	88.42 (70.21)	6.82	11.12	34.73	1585.68	3.07
V ₁₂ :	KOPPM-23-23	87.96 (69.80)	6.70	10.95	33.85	1552.15	2.98
V ₁₃ :	KOPPM-23-36	90.95 (72.70)	7.34	12.15	36.30	1773.03	3.30
V ₁₄ :	KOPPM-23-31	89.35 (71.24)	7.25	12.05	34.83	1725.07	3.12
V ₁₅ :	TNAU-202 (C)	85.62 (67.80)	6.49	10.70	29.21	1472.36	2.50
V ₁₆ :	TNAU-164 (C)	89.84 (71.49)	7.52	12.26	35.87	1777.49	3.20
	SE (m)±	0.45	0.09	0.14	0.26	16.81	0.06
	CD at 5%	1.27	0.27	0.41	0.75	47.54	0.18
	Interaction (A x B)						
	SE (m)±	0.64	0.13	0.20	0.37	23.77	0.09
	CD at 5%	NS	NS	NS	NS	NS	NS
	General mean	90.40	7.37	12.13	35.64	1766.68	3.23

Conclusion

Based on one season of experimental research, and in alignment with the objectives of the present study, it can be concluded that all proso millet genotypes are suitable for cultivation during the summer season. The 1st MW (1st Jan.), was identified as the most appropriate sowing time for summer proso millet. Furthermore, the evaluated set of traits can serve as reliable criteria for large-scale screening of proso millet germplasm lines, facilitating the identification of suitable entries for summer cultivation. Among the tested genotypes, KOPPM-23-26 (V₂) consistently outperformed others in terms of growth and yield attributes, thereby emerging as the most promising genotype for summer season productivity.

References

- Abdul-Baki AA, Anderson JD. Vigour determination in soybean seed by multiple criteria. *Crop Science*. 1973;13:630-632.
- Aishwarya G, Rani PS, Umamahesh V, Sarala NV. Effect of weather parameters on proso millet (*Panicum miliaceum* L.) cultivars under different sowing windows. *Andhra Pradesh Journal of Agricultural Sciences*. 2022;8(2):94-99.
- Anilrao MA, Sukanya T, Thimmegowda M, Anand M, Krishnamurthy R, Manegar GA. Effect of sowing windows on growth and yield parameters of small millets and their varieties during late Kharif. *Mysore Journal of Agricultural Sciences*. 2024;58(4):245-250.
- Anonymous. International rules for seed testing. *Seed Science and Technology*. 2010;24:1-335.
- Anonymous. International rules for seed testing. *Seed Science and Technology*. 1999;13(2):299-513.
- Baltensperger DD. Progress with proso, pearl and other millets. In: *Trends in new crops and new uses*. 2002. p.100-103.
- Changmei S, Dorothy J. Millet-the frugal grain. *International Journal of Scientific Research and Reviews*. 2014;3(4):75-90.
- Das S, Khound R, Santra M, Santra DK. Beyond bird feed: Proso millet for human health and environment. *Agriculture*. 2019;9(3):64-73.
- Deshmukh SS, Gagare KC, Karjule AP, Ban YG, Gidadyamannavar BN, Mehare AR, *et al.* Effect of sowing dates on seed yield and seed quality of barnyard millet (*Echinochloa frumentacea* (Roxb.) Link). *International Journal of Research in Agronomy*. 2025;8(9):359-362.
- Elangovan M, Singode A, Venkatesh K, Amasiddha B, Karthik AS, Pandey S, *et al.* Agro-morphological characterization of proso millet germplasm for utilization. *International Journal of Plant and Soil Science*. 2023;35(16):381-392.
- Ghorbannezhad F, Zavareh M, Rahmani M. Optimizing proso millet production according to planting date and growth analysis. *Cereal Research*. 2023;13(1):77-97.
- Gomez KA, Gomez AA. *Statistical procedures for agricultural research*. 2nd ed. New York: John Wiley and Sons; 1984. p.357-427.
- Kalinova J, Moudry J. Content and quality of protein in proso millet (*Panicum miliaceum* L.) varieties. *Plant Foods for Human Nutrition*. 2006;61(1):43-47.
- Krishnappa N, Chandrakanthappa K, Lokesh K, Narayanaswamy S. Evaluation of finger millet varieties for seed quality characters. *Current Research*. 2001;39(5-6):93-94.
- Kumar BNM, Basavegowda, Vyakaranahal BS, Deshpande VK, Kenchanagowdar PV. Influence of sowing dates on production of seed yield in niger (*Guizotia abyssinica*). *Karnataka Journal of Agricultural Sciences*. 2011;24:289-293.
- Kumari CR, Reddy BS. Performance evaluation of foxtail millet varieties in rainfed Alfisols. *The Journal of Research*

- ANGRAU. 2023;51(1):28-37.
17. Pannase S, Bagade SV, Sonawane DA, Sondawale PA. Effect of foxtail millet cultivars on yield and yield attributes under different sowing windows. *Journal of Scientific Research and Reports*. 2024;30(6):277-288.
 18. Patil KN, Hiremath KA, Shanthakumar G. Study on seed yield and its quality parameters in different genotypes of finger millet (*Eleusine coracana* G.). *Advances in Agriculture Research in India*. 1999;12:51-55.
 19. Ragupathi KP, Sujatha K, Paramasivam V, Sabir Ahamed A. Seed development and maturation studies in proso millet (*Panicum miliaceum* L.). *American International Journal of Research in Formal, Applied and Natural Sciences*. 2017;20(1):24-27.
 20. Rawat A, Kumar A, Paliwal A, Kumar P, Rawat D. Evaluation of seed vigour tests to predict field emergence potential of finger millet [*Eleusine coracana* (L.) Gaertn.] and barnyard millet [*Echinochloa frumentacea* (Roxb.) Link.] varieties. *International Journal of Agriculture, Environment and Biotechnology*. 2023;16(1):13-20.
 21. Salini K, Nirmalakumari A, Muthiah AR, Senthil N. Evaluation of proso millet (*Panicum miliaceum* L.) germplasm collections. *Electronic Journal of Plant Breeding*. 2010;1(4):489-499.
 22. Swathi PB, Jyothi BN, Sambasiva R, Saida NV. Growth and yield of proso millet varieties as influenced by different dates of sowing. *Journal of Biodiversity and Ecological Sciences*. 2021:187-194.
 23. Tripathi N, Verma RS. Effects of sowing on vigour parameters in wheat (*Triticum aestivum*) varieties. *Seed Research*. 2011;39(1):58-62.