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Performance of little millet (*Panicum sumatrense* L.) under different spacings and seed rate

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Abstract
A field trial was conducted at AICRP on Weed Management, Department of Agronomy farm, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, during *kharif* season 2024-25 with the objective to study the effect of spacing and seed rate on performance of little millet. The experiment was laid out in Randomized Block Design with four replication and six treatments. Result of the study revealed that plant height (cm) at harvest and leaf area (cm^2 plant^{-1}) at 75 DAS was recorded highest in close spacing of 30 cm × 5 cm with 3 kg ha^{-1} seed rate and dry matter accumulation (g plant^{-1}) at harvest was significantly higher in wider spacing 45 cm × 15 cm with 0.7 kg ha^{-1} seed rate.

Keywords: Little millet, Growth, Spacing, Seed rate, *Panicum sumatrense* L.

Introduction
Little millet (*Panicum sumatrense* L.) one of the most ancient cereal crops, holds significant value in traditional Indian agriculture. It belongs to the family *Poaceae* and is widely recognized for its resilience to harsh agro-climatic conditions, including drought and poor soils. Believed to have originated in the Indian subcontinent, the crop has been cultivated since prehistoric times, with evidence of its domestication dating back over 3,000 years. It is often referred to by local names such as Kutki, Sama, Samai, or Gajro, and is predominantly grown in India, with limited cultivation reported in Nepal, Sri Lanka, and Myanmar. In India, its cultivation is concentrated in tribal and rainfed regions, particularly in Madhya Pradesh, Chhattisgarh, Maharashtra, Odisha, Andhra Pradesh, Tamil Nadu, and Karnataka. These areas benefit from its adaptability to low-input farming systems and minimal irrigation requirements, making it an essential crop for food and livelihood security in marginal environments.

Botanically, little millet is a short-day annual crop that typically reaches a height of 30 to 100 cm. It exhibits a robust fibrous root system and is well suited to shallow, red, sandy loam soils with low fertility. It is a C4 plant, capable of efficient photosynthesis under high temperatures and limited moisture, allowing it to perform well in semi-arid climates. The crop matures within 80 to 120 days and is usually sown during the kharif season under rainfed conditions. Its resilience to abiotic stress, coupled with its short growth duration, enables it to be cultivated even in degraded or marginal lands where major cereals fail. Due to these characteristics, little millet is considered a climate-resilient crop with potential to contribute to sustainable farming systems in the face of increasing climate variability (Singh *et al.*, 2018).

Optimum spacing and seed rate are crucial for achieving better growth parameters in little millet, as they directly influence plant population, resource utilization, and crop performance. Appropriate spacing ensures adequate availability of sunlight, nutrients, moisture, and aeration to each plant, thereby promoting higher photosynthetic efficiency, balanced tiller production, and robust root development. Similarly, an optimum seed rate maintains the desired plant density, avoiding excessive competition under higher seed rates or poor canopy coverage under lower seed rates. Together, these factors regulate plant height, leaf area, biomass accumulation, and overall vigor, ultimately enhancing yield potential and resource-use efficiency in little millet cultivation. Therefore, this study was designed to determine the optimal plant spacing and seed rate of little millet (*Panicum sumatrense* L.).

Materials and Methods

An agronomic investigation was carried out at AICRP on Weed Management, Department of Agronomy farm, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, during *kharif* season 2024-25 with the objective to study the effect of spacing and seed rate on performance of little millet.

The experiment was laid out in Randomized Block Design with four replication and six treatments *viz*., T1 (Spacing 30 cm × 5 cm with 3 kg ha^{-1} seed rate), T2 (Spacing 30 cm × 10 cm with 1.5 kg ha^{-1} seed rate), T3 (Spacing 30 cm × 15 cm with 1 kg ha^{-1} seed rate), T4 (Spacing 45 cm × 5 cm with 2 kg ha^{-1} seed rate), T5 (Spacing 45 cm × 10 cm with 1 kg ha^{-1} seed rate) and T6 (Spacing 45 cm × 15 cm with 0.7 kg ha^{-1} seed rate). Little millet variety PDKV Tejashree was sown with recommended dose of fertilizer was 40:20:20 kg NPK ha^{-1}.

Result and Discussion

Plant height is an important component which helps in the determination of growth. Spacing of 30 cm × 5 cm with 3 kg ha^{-1} seed rate recorded maximum height (111 cm) at harvest. The increased plant height observed under higher plant density can be attributed to inter-plant competition for light, resulting in mutual shading particularly of the lower foliage. This reduced light interception stimulates vertical elongation as an adaptive response, provided nutrient availability remains adequate. Conversely, the relatively shorter stature of little millet under wider spacing may be due to improved access to solar radiation and spatial resources, which diminishes the need for compensatory stem elongation. Similar results were recorded by Roy *et al*. (2001) [4], Siddiqui *et al*. (2020) [6] and Minz *et al*. (2021) [1].

At 75 DAS, the maximum leaf area (563.97 cm^2 $plant^{-1}$) was observed under the closer spacing of 30 cm × 5 cm with 3 kg ha^{-1} seed rate. Under closer spacing, intense competition for sunlight induces plants to produce larger leaves in order to enhance their photosynthetic surface area. Such dense planting patterns force plants to utilize the available space more efficiently, thereby increasing the total leaf area per unit ground area. These observations are in agreement with the findings of Reddy *et al.* (2021) [3].

The different planting geometries had no significant effect on days to 50% flowering and days to physiological maturity. Higher dry matter accumulation at harvest was recorded at spacing 45 cm × 15 cm with 0.7 kg ha^{-1} seed rate (31.60 g $plant^{-1}$). In wider spacing, reduced inter-plant competition and better resource availability favored overall plant growth, resulting in higher dry matter accumulation per plant through improved development of leaves, stems, and roots. These results are in close agreement with the findings of Rana *et al.* (2009) [2] and Sarala *et al.* (2020) [5].

Table 1: Effect of spacing and seed rate on growth parameters of little millet

Treatments	Plant height (cm) at harvest	Leaf area (cm^2 $plant^{-1}$) at 75 DAS	Day to 50% flowering	Day to maturity	Dry matter (g $plant^{-1}$) at harvest
T1- 30 cm ×5 cm with 3 kg ha^{-1}seed rate	111.00	563.97	77	102.50	16.14
T2- 30 cm ×10 cm with 1.5 kg ha^{-1}seed rate	105.50	556.69	77	102.50	20.16
T3- 30 cm ×15 cm with 1 kg ha^{-1}seed rate	99.75	551.30	78	103.00	23.03
T4- 45 cm ×5 cm with 2 kg ha^{-1}seed rate	96.25	554.63	79	103.00	24.52
T5- 45 cm ×10 cm with 1 kg ha^{-1}seed rate	96.25	548.76	79	102.25	28.05
T6- 45 cm ×15 cm with 0.7 kg ha^{-1}seed rate	94.50	542.98	80	103.06	31.60
SE(m) ±	1.23	2.98	1.02	1.49	0.14
CD at 5%	3.72	8.99	NS	NS	0.41
GM	100.54	533.05	78	102.00	23.91

Conclusion

The study revealed that growth parameters were significantly influenced due to different spacings and seed rate in little millet. Highest plant height and leaf area was observed in close spacing 30 cm × 5 cm with 3 kg ha^{-1} seed rate (111 cm and 563.97 cm^2 respectively), however maximum dry matter accumulation (31.60 g $plant^{-1}$) was recorded in wider Spacing 45 cm × 15 cm with 0.7 kg ha^{-1} seed rate.

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