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Growth and yield performance of pigeonpea (*Cajanus cajan* L) as influenced by different land configuration and plant spacings

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ABSTRACT

A field trial was conducted during kharif season, 2025 at Experimental Farm of Agronomy Section, College of Agriculture, Latur (Maharashtra), to study the effect of land configuration and spacings on growth and yield of pigeonpea (*Cajanus cajan* L). The soil was clayey in texture, moderately alkaline, low in available phosphorus, moderate in nitrogen and high in potassium. The experimental field was laid out in a Factorial Randomized Block Design (FRBD) with two factors and replicated thrice. The main factor comprises three land configurations viz. Flat bed (L_1), BBF (L_2), Ridges & furrow (L_3) and sub factor comprises three spacings viz. 90 cm x 10 cm (S_1), 90 cm x 20 cm (S_2) and 90 cm x 30 cm (S_3). Results revealed that among land configuration BBF (L_2) recorded significantly highest growth attributes and yield viz. plant height (168.00 cm), number of functional leaves plant-1 (51.80), leaf area plant-1 (3.49 dm²), primary branches plant-1 (10.32), secondary branches plant-1 (15.86), dry matter accumulation (146.78 g), pods plant-1 (213.78), seed yield (1677 kg ha⁻¹), straw yield (4397 kg ha⁻¹) and biological yield (6074 kg ha⁻¹) which was at par with Ridges & furrow (L_3) and found significantly superior over flat bed (L_1). Among different spacings, the wider spacing of 90 cm x 30 cm (S_3) recorded significantly highest growth attributes and yield viz. plant height (168 cm), number of functional leaves plant-1 (51.84), leaf area plant-1 (3.51 dm²), primary branches plant-1 (10.04), secondary branches plant-1 (14.99), dry matter accumulation (147.89 g), pods plant-1 (213.32), seed yield (1748 kg ha⁻¹), straw yield (4441 kg ha⁻¹) and biological yield (6189 kg ha⁻¹) which was at par with 90 cm x 20 cm (S_2) spacing and found superior over 90 cm x 10 cm (S_1).

Keywords: Pigeonpea, Land configuration, Spacings, Growth and yield

Introduction

In India, pulses play a significant role in the vegetarian diet. After chickpeas, pigeonpeas (*Cajanus cajan* L.) are the second most important pulse crop in India and the fifth most popular grain legume in the world. As a significant nitrogen-fixing crop, pigeon peas can fix up to 200 kg N ha⁻¹ of atmospheric nitrogen. For this reason, pigeon peas are sometimes referred to as "biological ploughs." The seed can be consumed dried in "dal," a staple of South Asia, or fresh as a vegetable. One of the most significant crops in the state of Maharashtra is the pigeonpea. Arhar, tur, or red gram are other names for pigeon pea (*Cajanus cajan* L.) Millsp.), a significant pulse crop cultivated throughout India. Pigeon pea, or *Cajanus cajan* (L.) Millsp., belongs to, family Fabaceae. With roughly 20.5% protein in the entire seed, 22.2% in the cotyledons, 49.5% in the embryo, and 4.9% in the seed coat, pigeon peas are an excellent source of protein. It contains vitamins, minerals, and vital amino acids. It is a dependable source of nutrition for underprivileged communities due to its capacity to flourish in marginal terrain and with little input. Approximately 21% protein, 8.2% crude fiber, 2.3% fat, and various important minerals are found in the green seeds, which are eaten as vegetables. (Faris *et al.*, 1990) [1]. The unpredictability and variability of rainfall in both space and time is one of the primary factors affecting agricultural output under rainfed farming. The crop is often impacted by the monsoon's unusual behavior during the same season, which lowers productivity through both water logging and a lack of soil moisture. It is crucial to preserve the moisture that plants need in the soil during crucial growth stages when there is a shortage of water. One of the key components of rainfed farming is moisture conservation, which is beneficial for effectively growing rainfed crops in dry and semiarid regions. Modified land configurations like ridges and furrows have been suggested as a solution to this issue (Desai *et al.*, 2000) [2]. Inadequate crop geometry (plant spacing), suboptimal plant population, insufficient irrigation, insufficient fertilizer application, and poor agronomic practices are some of the main problems impeding pigeon pea output. Particularly during the pod growth stage, pigeon peas need appropriate temperatures and a sufficient amount of moisture. Its productivity, however, frequently stays extremely low. Intensive cultivation with the right crop geometry, particularly the right inter- and intra-row spacing, is one efficient strategy to increase yield.

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Materials and Method

The experiment was conducted during *kharif* season, 2025-2026 at Experimental Farm of Agronomy Section, College of Agriculture, Latur (Maharashtra) to study the effect of land configuration and spacings on growth and yield of pigeonpea (*Cajanus cajan* L). The soil was clayey in texture, moderately alkaline, low in available phosphorus (17.56 kg ha^{-1}), moderate in nitrogen ($240.62 \text{ kg ha}^{-1}$) and high in potassium ($394.72 \text{ kg ha}^{-1}$). The experimental field was laid out in a Factorial Randomized Block Design (FRBD) with two factors and replicated thrice. The main factor comprises three land configurations viz. Flat bed (L_1), BBF (L_2), Ridges & furrow (L_3) and sub factor comprises three spacings viz. $90 \text{ cm} \times 10 \text{ cm}$ (S_1), $90 \text{ cm} \times 20 \text{ cm}$ (S_2) and $90 \text{ cm} \times 30 \text{ cm}$ (S_3). Sowing was done by dibbling. Gross plot was of size $5.4 \text{ m} \times 4.4 \text{ m}$ and net plot size was as per treatments. The recommended cultural practices and plant protection measures were taken. The data collected from various observations were organized into tables and analysed using analysis of variance (ANOVA) and significance of treatment was tested by *F* test (Panse *et al.*, 1967) [3].

Result and Discussion

Growth attributes

Growth attributing characters of pigeonpea viz., plant height (cm), number of leaves plant^{-1} , leaf area plant^{-1} (dm^2), number of primary branches plant^{-1} , secondary branches plant^{-1} , dry matter accumulation plant^{-1} (g) and pods plant^{-1} were influenced significantly due to different land configurations and spacings in (Table-1).

Effect of land configuration

Among the different land configuration, BBF (L_2) recorded maximum plant height (168.00 cm), number of functional leaves plant^{-1} (51.80), leaf area plant^{-1} (3.49 dm^2), primary branches plant^{-1} (10.32), secondary branches plant^{-1} (15.86), dry matter accumulation (146.78 g) and pod plant^{-1} (213.78) which was at par with Ridges & furrow (L_3) and found significantly superior over flat bed (L_1). BBF performed better because of better soil moisture conservation, enhanced aeration, and favorable root development, all of which increased vegetative growth. Similar findings were reported by Garud *et al.* (2019) [4], Kantwa *et al.* (2011) [5], Kirar *et al.* (2020) [6] and Jadhav *et al.* (2025) [7].

Effect of spacings

Among different spacings, the wider spacing of $90 \text{ cm} \times 30 \text{ cm}$ (S_3) produced significantly highest plant height (168 cm), number of functional leaves plant^{-1} (51.84), leaf area plant^{-1} (3.51 dm^2), primary branches plant^{-1} (10.04), secondary branches plant^{-1} (14.99), dry matter accumulation (147.89 g) and pods plant^{-1} (213.32), which was at par with spacing $90 \text{ cm} \times 20 \text{ cm}$ (S_2) and found significantly superior over $90 \text{ cm} \times 10 \text{ cm}$ (S_1). As there was less competition between plants for moisture, nutrients, light, and space, wider spacing might have improved vegetative growth. These results align with those of Sepat *et al.* (2021) [8], Pallavi *et al.* (2025) [9], Bansal *et al.*, (2024) [10], Jadhav *et al.*, (2025) [7], and Jadhav *et al.*, (2018) [11].

Yield

Data in Table 2 revealed that seed yield, straw yield and biological yield of pigeonpea were affected significantly due to land configuration and spacings.

Effect of land configuration

Among the land configuration, BBF (L_2) produced the highest seed yield (1677 kg ha^{-1}), straw yield (4397 kg ha^{-1}) and biological yield (6074 kg ha^{-1}) which was at par with Ridges & furrow (L_3) and found significantly superior over flat bed (L_1). Better moisture conservation, enhanced root growth, and favorable nutrient availability, which lead to better reproductive growth and pod formation, may be the cause of the increased in yield under BBF. Similar positive impacts of different land configurations on yield have been observed by Garud *et al.*, (2021), Kirar *et al.*, (2020) [6], Kantwa *et al.*, (2010) and Jadhav *et al.*, (2025) [7].

Effect of spacings

Among the spacing, $90 \text{ cm} \times 30 \text{ cm}$ (S_3) recorded the highest seed yield (1748 kg ha^{-1}), straw yield (4441 kg ha^{-1}) and biological yield (6189 kg ha^{-1}) which was at par with $90 \text{ cm} \times 20 \text{ cm}$ (S_2) spacing and found superior over $90 \text{ cm} \times 10 \text{ cm}$ (S_1). Wider spacing may have improved branching, pod formation, and seed production per plant by reducing interplant competition for light, moisture, nutrients, and space. These findings are in line with the observations reported by Tigga *et al.*, (2017) [12], Pallavi *et al.*, (2025) [9], Jadhav *et al.*, (2018) [11] and Nagaraj *et al.* (2018) [13].

Interaction effect

Interaction effect of land configuration and spacings were found to be non significant.

Table 1. Growth attributes of pigeonpea influenced by various treatments

Treatment	Mean plant height (cm)	Mean no. of functional leaves plant ⁻¹	Leaf area (dm ²) plant ⁻¹	Mean no. of primary branches plant ⁻¹	Mean no. of secondary branches plant ⁻¹	Total dry matter accumulation (g) plant ⁻¹	No. of pods plant ⁻¹
Main factor: Land configuration (L)							
L ₁ - Flatbed	151.89	42.03	3.10	8.09	12.67	129.44	195.33
L ₂ - BBF	168.00	51.80	3.49	10.32	15.86	146.78	213.78
L ₃ -Ridges & furrow	163.11	47.14	3.31	9.82	14.71	140.78	203.32
SE ±	3.78	1.64	0.09	0.33	0.40	3.45	4.79
C.D at 5%	11.35	4.93	0.27	0.99	1.20	10.35	14.36
Sub factor: Spacing (S)							
S ₁ – 90 cm x 10 cm	152.56	41.99	2.97	8.64	13.63	129.78	195
S ₂ – 90 cm x 20 cm	161.78	47.14	3.42	9.54	14.61	139.33	204.11
S ₃ – 90 cm x 30 cm	168.00	51.84	3.51	10.04	14.99	147.89	213.32
SE±	3.78	1.64	0.09	0.33	0.40	3.45	4.79
C.D at 5%	11.35	4.93	0.27	0.99	1.20	10.45	14.36
Interaction (Lx S)							
SE	6.56	2.85	0.16	0.57	0.70	5.98	8.29
C.D at 5%	NS	NS	NS	NS	NS	NS	NS

Table 2. Seed yield kg ha⁻¹, Straw yield kg ha⁻¹, and biological yield kg ha⁻¹ of pigeonpea influenced by various treatments

Treatment	Seed yield kg ha ⁻¹	Straw yield kg ha ⁻¹	Biological yield kg ha ⁻¹
Main factor: Land configuration (L)			
L ₁ - Flatbed	1400	3935	5334
L ₂ - BBF	1677	4397	6074
L ₃ -Ridges & furrow	1590	4260	5850
SE ±	46	123	168
C.D at 5%	138	369	504
Sub factor: Spacing (S)			
S ₁ – 90 cm x 10 cm	1344	3914	5258
S ₂ – 90 cm x 20 cm	1574	4238	5813
S ₃ – 90 cm x 30 cm	1748	4441	6189
SE ±	46	123	168
C.D at 5%	138	369	504
Interaction (Lx S)			
SE ±	6.56	33	5.16
C.D at 5%	NS	NS	NS

Conclusion

From above findings, it can be concluded that the among land configuration BBF (L₂) was found to be more remunerative for getting higher growth attributes and yield of pigeonpea followed by Ridges & furrow (L₃). However, the wider spacing of 90 cm x 30 cm (S₃) resulted in higher growth attributing characters and yield of pigeonpea followed by spacing 90 cm x 20 cm (S₂).

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