

Evaluating the Performance of Pigeon pea under raised bed technology for Climate Resilient Agriculture in *Vertisols* of Vikarabad district in Telangana.

Abstract

Vikarabad district of Telangana is major pulse-producing district. the district yields are lower on average than the state yields. Vikarabad district are mostly *Vertisols* having the higher clay content also creates deep cracks in case of drought spells and water logging under the heavy rains. There is a usual practice of flatbed sowing of pigeon pea in the district. These aggravate the situation and subsequently adversely affect to the crop productivity. To address the above issue, an assessment was conducted by sowing pigeon pea variety TDRG-59 on raised bed, during the year *kharif* - 2022 and 2023 in five different locations of Vikarabad district by the DAATT centre PJTAU, Tandur. Treatments included raised bed sowing (T₁) and flatbed sowing (T₂). Results revealed that raised bed sowing improved pigeon pea performance compared to flatbed sowing. Average plant height (195 cm), number of pods per plant (209), and yield (2094 kg/ha) were higher with raised bed sowing, the benefit-cost ratio was also higher 2.77 for raised beds, when compared to 2.33 for flatbed. These findings demonstrate that sowing pigeon pea under the raised bed method is more effective for improving yield and profitability, particularly in the *Vertisols* of Vikarabad district, Telangana. This system ensures effective water management, promoting sustainable agriculture and maximizing productivity under diversify farming conditions.

Keywords: Raised bed, Pigeon pea, Yield.

Introduction

Pigeon pea is an important protein-rich food supplement for many Indians, recognized for its resilience to many soil types, temperatures, and rainfall. India is the world's leading producer of pigeon pea, followed by Myanmar, Malawi, Tanzania, and Mozambique. India's pigeon pea production in 2022-23 is projected at 3.42 million tonnes. Major producing states include Maharashtra (8.76 lakh tonnes), Karnataka (8.77 lakh tonnes), Uttar Pradesh (3.89 lakh tonnes), Madhya Pradesh (3.62 lakh tonnes), Gujarat (2.46 lakh tonnes) and Telangana (1.53 lakh tonnes) [1]. In 2022-23, Telangana produced 2.06 lakh tonnes of pigeon pea from 2.28 lakh hectares, with a productivity of 903 kg/ha [2]. Telangana major red gram growing districts are Vikarabad 71606 ha (176943 acres), Narayanpet 45072 ha (111374 acres), Sangareddy 36439 ha (90043 acres), Adilabad 24477 ha (60483 acres) Mahabubnagar 10917

ha (26976 acres), Yadadri 9258 ha (22877 acres) and Kamareddy 7611 lakh ha (18806 acres) [3].

In Vikarabad district, flatbed sowing of pigeon pea is a common practice, which worsens soil conditions and negatively impacts crop productivity. There have been instances when the rain fell excess for five days creating a problem of water logging in the *Vertisols* area. In the view of above issues, DAATT Centre, PJTAU, Vikarabad has taken the study to assess the performance of raised bed sowing of pigeon pea.

Raised beds modify the geometry of pigeon pea crops and land configuration, effectively managing water and ion balance, minimizing abiotic stress impacts, and enhancing crop resilience and productivity under challenging conditions. Raised beds conserve soil moisture, ensuring efficient nutrient transport and regulation for optimal plant growth. Enhanced nutrient application and fertigation boost pigeon pea yield potential, supporting crop diversification, reducing soil erosion, and improving crop establishment (Ankit Sharma. 2022). Therefore, pulse based cropping systems can also improve soil fertility and increase farmers income (Chowhan *et al.*, 2022; Chowhan *et al.*, 2021) which plays a vital role in the overall agricultural economic growth of a country (Chowhan *et al.*, 2023).

Materials and Methods

Inaugurate to increase the yield of pigeon pea in the district. This research was undertaken by District Agricultural Advisory and Transfer of Technology Centre (DAATTC), Professor Jayashankar Telangana Agricultural University (PJTAU), in five different locations of Vikarabad district in Telangana. To explore the impact of raised bed pigeon pea cultivation during the *Kharif* - 2022 and 2023 with two treatments (T₁: Farmers Practice (flatbed method of sowing) and T₂: Raised bed method. The average annual rainfall of Vikarabad districts is 874.22mm. sowing of pigeon pea was done on raised beds using a tractor-drawn raised bed planter, with a seed rate of 10 kg/ha. The Raised Bed method involves sowing by dibbling seeds at 2 inches depth with the bed should be row-to-row spacing 2ft, width 2ft and height 1.5ft. Standard crop management practices were followed to ensure optimal growth. The actual yield per hectare was recorded, and cost of cultivation, gross, and net returns were calculated based on prevailing market rates. **The Benefit: Cost ratio was determined by dividing the average gross return by the average cost of cultivation.**

Results and Discussion

The study results revealed that during *Kharif* 2022 and 2023, highest average plant in raised bed (195 cm), when compared to the flat bed (180 cm) (Table 1). Similarly, the average number of pods per plant was 209 for raised bed sowing and 162 for flatbed sowing.

The average crop yield for pigeon pea was 2094 kg/ha with raised bed, when compared to 1600 kg/ha under flat-bed. This represents an increase of 494 kg/ha with raised beds. Sadvadiya *et al.* (2017) demonstrated that raised bed sowing of pigeon pea in *Vertisols* significantly outperformed flat-bed sowing in yield. The average cost of cultivation was Rs. 47,125/- per hectare for raised bed, when compared to flat-bed Rs. 40,875/- per hectare. Despite the higher cultivation cost, the gross returns were substantially better under raised bed sowing, averaging Rs. 1,77,990/- per hectare, when compared to flat beds Rs. 1,36,000/- per hectare. The net return for raised bed was Rs. 1,30,865/- per hectare, exceeding flat-bed by Rs. 95,125/- per hectare. The raised bed system not only delivered higher yields but also proved more profitable. The benefit-cost ratio further demonstrated the advantage, with 2.77 for raised bed sowing against 2.33 for flat beds. Singh *et al.*, (2014) and Shrivastava *et al.* (2018) in their study on pigeon pea cultivation on raised beds observed significant improvements in crop yield. These findings underscore the raised bed sowing method's efficiency in enhancing pigeon pea productivity and profitability, making it a sustainable alternative for improved agricultural outcomes.

Table 1: Performance of Pigeon pea under flat bed and raised bed conditions during *Kharif* 2022 and 2023

S. No	Observations	1 st year		2 nd year		Average	
		T1	T2	T1	T2	T1	T2
1.	Plant Height (cm)	181	198	178	192	180	195
2.	No of pods per plant	166	208	158	210	162	209
3.	Yield (kg ha ⁻¹)	1620	2083	1580	2105	1600	2094
4.	Cost of cultivation (Rs. ha ⁻¹)	41,250	47,500	40,500	46,750	40,875	47,125
5.	Gross returns (Rs. ha ⁻¹) Rs. 85 / kg	1,37,700	1,77,055	1,34,300	1,78,925	1,36,000	1,77,990
6.	Net returns (Rs. ha ⁻¹)	96,450	1,29,555	93,800	1,32,175	95,125	1,30,865
7.	B:C ratio	2.34	2.72	2.32	2.82	2.33	2.77

Treatments: -T₁: Farmers Practice (Under flatbed method of sowing), T₂: Red gram under raised bed method

Conclusion:

The raised bed sowing system offers a superior solution for pigeon pea cultivation in *Vertisols*, addressing challenges of moisture stress and waterlogging. Raised beds improve aeration and nodulation, essential for better crop growth, compared to flatbed sowing. This enhanced soil environment leads to significantly higher yields. In the current assessment, raised bed sowing demonstrated a clear advantage over the flat-bed method, delivering improved productivity. These findings highlight that the raised bed system is an effective approach for pigeon pea cultivation in the *Vertisols* of Vikarabad district of Telangana, in southern India. It ensures better adaptability, sustainability and productivity in these challenging soil conditions.

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