

Evaluating the Performance of High Density Planting System of Cotton in Alfisols of Vikarabad district in Telangana

Abstract:

A demonstrations were conducted in farmers field during the *Kharif* 2023 and 2024 in the Vikarabad district of Telangana to evaluate the performance of High-Density Planting System (HDPS) against traditional farmer's practices in cotton cultivation under ICAR-CICR special project on cotton by DAATT Centre Vikarabad . The results indicated that the HDPS treatment (T1) recorded a lower average plant height (101.35 cm) and a reduced average number of bolls per plant (23.5) when compared to the farmer's practice, which achieved an average plant height of 126.3 cm and an average of 36.5 bolls per plant. Despite of this, the HDPS system recorded 24.51 q/ha over farmers practice 18.03 q/ha, which is 36% higher than the farmer's practice. Economic analysis revealed that the HDPS system generated substantially higher net profits of ₹77,999 with a benefit-cost (B:C) ratio of 1.79, compared to ₹43,489.50 and a B:C ratio of 1.49 under the farmer's practice. This system of HDPS cotton ensures a viable and profitable alternative to traditional cotton farming practices, offering a pathway to enhanced productivity and sustainability for cotton growers in the region.

Keywords: High density planting system (HDPS), cotton yield, plant geometry

Introduction:

Cotton is a globally significant commercial commodity and a cornerstone of India as agro-industrial economy. Revered as "The King of Fibers" or "White Gold," cotton remains the primary raw material for the highest-quality textiles. It is cultivated in over 100 countries across diverse agroclimatic conditions (Anon, 2012). In India, cotton directly supports the livelihoods of approximately 60 million people through agriculture, processing, and the textile industry, contributing 29% to the nation GDP. Globally, in 2021–22, cotton was grown on 32.94 million hectares, producing 120.2 million bales with a productivity of 778 kg per hectare. In India, cotton production during the same period reached 362.18 lakh bales from an area of 120.69 lakh hectares, with an average yield of 510 kg per hectare (Annual report 2022-23 of ICAR - CICR) .

Within India, Maharashtra leads in cotton acreage (42.29 lakh hectares), while Gujarat is the top producer (87.12 lakh bales). Telangana ranks as the third-largest cotton producer (54.41 lak bales) and third in acreage, with an productivity of 457 kgs/ha (Annual report 202-23 of ICAR – CICR). According to <https://www.agri.telangana.gov.in>, the area covered by cotton in Telangana state on September 29, 2021–22, was 46,42,695 acres, compared to 60,17,992 acres in 2020–21. With 6,54,667 acres, Nalgonda was the largest district followed by Warangal (5,56,228 acres), Adilabad (3,87,311 acres), Sangareddy (3,61,213 acres), Nagarkurnool (3,52,619 acres) and Asifabad (2,97,280 acres) and Vikarabad, which accounted for 2,61,966 acres.

The adoption of a high-density planting system (HDPS) offers a transformative approach to enhancing cotton productivity, especially in challenging soil types like alfisols. HDPS involves planting early-maturing, semi-compact cotton varieties at closer spacing to maximize the number of bolls per unit area, even as the number of bolls per plant is limited (Khan et al., 2019). The HDPS is now being conceived as an alternative production system that can improve productivity, profitability, input use efficiency and reducing input costs as well as minimizing the risks associated with the current cotton production system in India and enable mechanical picking (Venugopalan et al., 2014). By focusing on improved cultivation practices, this research seeks to highlight the potential of HDPS as a sustainable solution to enhance cotton yields and support farmers in the region.

Material and methods:

The field demonstrations were conducted in different farmer fields in the Vikarabad district of Telangana state during kharif 2023 and 2024 with 2 treatments T1 : HDPS (High density planting system) cotton T2: Farmers practice as ICAR-CICR's special project on cotton entitled "Targeting technologies to agro-ecological zones – large scale demonstrations of best practices to enhance the cotton productivity " under NFSM. Large scale demonstrations were done in the farmer fields in the different location of the Vikarabad district.

Idea of high density planting method (T1) in cotton is a brand new technique for growing cotton. Instead of using regular farmers practice, this method involves sowing of cotton with spacing of 90 X 15 cm with 29,629 plants per acre and 4,938 plants per acre in farmer practice (T2) with spacing of 90 X 60 cm. Seed rate of 2.5 kgs per acre is used in high density planting system 1 kg per acre of seed is used in farmers practice. Cultivation package of practices are common in the both the systems with recommended dose of fertilizers 120 kg nitrogen (N), 60 kg phosphorus (P), and 60 kg potassium (K) per hectare. Mepiquat chloride,

a growth regulator, was applied twice during the crop cycle: first during the flowering stage (45 days after sowing) at a dosage of 1.2 ml per liter of water, and then during the boll formation stage (60 days after sowing) at a dosage of 1.5 ml per liter of water. This application regulated plant growth and size, promoting uniform boll bursting and simplifying the cotton-picking process. The effectiveness of pink bollworm control and peasant surveillance also diminished in subsequent *kharif* crops. Harvesting cotton before the last week of November allows for alternate rabi crop cultivation, such as maize, sesamum and groundnut (Prasad et al., 2023). Data was collected in farmers field and average plant height, number of bolls per plant, yield per hectare was recorded, and the cost of cultivation, gross returns, and net returns were calculated based on prevailing market rates. The benefit-cost ratio (B:C) was determined by dividing the average gross return by the average gross cost.

RESULTS AND DISCUSSIONS:

The findings revealed that the average plant height 101.35 cm and number of bolls per plant 23.5 were lower under HDPS cotton when compared plant height 126.3 cm and 36.5 bolls per plant under farmers practice. The higher seed cotton yield of 24.51 q/ha was in HDPS cotton when compared to traditional farmer practice, which achieved 18.025 q/ha. This 36% increase in yield under HDPS is attributable to the optimized plant population density, which enhances resource use efficiency, particularly for sunlight, nutrients, and water. This indicates that while individual plants in HDPS produced fewer bolls, the higher plant density effectively compensated for this reduction, resulting in significantly higher total productivity per hectare. These above are in accordance with those obtained by Giri and Gore (2006); Buttar and Singh (2007); Narayana and Aparna (2011)

Economic Analysis

The average cost of cultivation was higher for HDPS at ₹101,875 per hectare compared to ₹89,895.5 per hectare for the farmer practice. Despite the increased costs, HDPS demonstrated superior economic performance with gross returns of ₹181,374 per hectare compared to ₹133,385 per hectare under the farmer practice. The net returns under HDPS were markedly higher at ₹77,999 per hectare, compared to ₹43,489.5 per hectare for the farmer practice. The benefit-cost ratio further underscored the economic advantage of HDPS, standing at 1.77 compared to 1.49 for the farmer practice. This indicates that for every rupee invested, HDPS delivered 77% higher returns, making it a more profitable and efficient

system. These results are in conformity with the work done by Hemalatha *et al.*, 2024, Kavya *et al.*, 2022, Basha *et al.*, 2017 and Venugopalan *et al.*, 2014.

Table.1 performance of cotton under high density planting system over farmer practice during *Kharif*: 2023 and 2024

Sl. No.	Yield parameters	2023		2024		Pooled Mean	
		T1	T2	T1	T2	T1	T2
1	Plant Height (cm)	94	125	108.7	127.6	101.35	126.3
2	No of bolls/plant	23	38	24	35	23.5	36.5
3	Yield (Qtl/ha)	25.27	18.25	23.75	17.80	24.51	18.025
7	Cost of cultivation (in rupees)	99,250	86,875	1,04,500	92,916	101875	89895.5
8	Gross returns	1,86,998	1,35,050	1,75,750	1,31,720	181374	133385
9	Net returns	84748	48,175	71,250	38,804	77999	43489.5
10	B:C Ratio	1.85	1.55	1.69	1.42	1.77	1.49

Conclusion:

Cotton is the major commercial crop being grown in our country. Productivity of the cotton is not up to the mark despite the major efforts made by farmer as well as scientists. Productivity could be improved with the High-Density Planting System (HDPS) and it has proven to be a transformative approach in cotton cultivation, particularly in alfisols conditions. The system demonstrated clear advantages over traditional practices, with higher yields, net profits of ₹77,999 per hectare, with benefit-cost ratio of 1.77. The increased profitability is attributed to the higher plant population and greater number of bolls per unit area. Harvesting cotton before the last week of November allows for alternate rabi crop cultivation with double remunerative to the farmers.

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2. its regular technical programme data and Front line demonstration conducted in the farmers field
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