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Constraints in Adoption of High-Density Cotton Growing System in Telangana

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ABSTRACT: Cotton has now become well-known and grown all throughout the world and all the states of India. India's seed cotton production per unit area is still significantly lower than that of several other cotton-growing countries throughout the world. Two of the most prominent factors leading to the country's low cotton crop productivity are a lack of plant population and the use of low-potential cultivars. Several researches are conducted, including maintaining a sufficient plant density, employing the right number of fertilizers, applying growth regulators and so on and released some varieties which are suitable for high density planting system.

The study "constraints in adoption of High-density cotton growing system" was conducted in Telangana state, which consists of three agro climatic zones. From each zone one district was selected purposively for the study. From each district 30 HDPS cotton cultivating farmers were selected. A total sample of 90 farmers were selected. The research was conducted to know the farmers opinion, extent of adoption and constraints in the adoption of HDPS cotton. Among all the farmers, most of the farmers strongly agreed for High density planting cultivation is better and yield also more compared to normal cotton cultivation and disagreed for Gap filling and thinning was not followed in HDPS Cotton. The extent of adoption for HDPS cotton among the farmers are up to 50%. Based on the MSP (mean score position) among all the constraints, uneven rain falls (74.13), lodging effect (72.36), difficulty in weeding (67.46), unable to harvest at one time (62.46) and lack of sufficient irrigation (62.17) are the major constraints and high pest attack (29.96) and low education (30.93) are found to be the minor constraints in adoption of HDPS cotton.

Keywords: HDPS cotton, constraints, farmers opinion, adoption, MSP (Mean Score Position), Telangana.

INTRODUCTION

Cotton, sometimes known as "white gold," is one of India's most significant fibre crops, farmed all over the world. It has a significant impact on the national and international economies. It is mostly cultivated for its fibre, which is used to make textile for humans. Cotton continues to have a prominent position in the textile industry, due to competition from synthetic fibres (Jaffar *et al.*, 2017).

In 2021-22, India produced 362.18 lakh bales of cotton on 120.69 lakh hectares, yielding 510 kg per hectare (Cotton Corporation of India, 2022). Maharashtra ranks first in acreage (42.86 lakh ha) and stands second in production (84.00 lakh bales). Hence, there is a lot of scope to maximise its production potential.

Seed cotton yield per unit area in India is still much lower than in many other cotton growing countries across the world. Poor plant population and the usage of low potential varieties are two of the most important reasons contributing to the country's low cotton crop production (Bankar, 2008). To address these limits in cotton production, several approaches such as maintaining a sufficient plant density, using the optimum number of fertilisers, growth regulators, and so on are applied.

Previously, in India, Bt cotton was a technique that was well adopted by Indian farmers and had the ability to control in boll warming. Due to greater production costs farmers eventually resort to regular cultivars that provide normal yields (Navya and Venkataranganaika 2021). Cotton's optimal amount would, be determined by the plant variety. Generally, Cotton genotypes have a long maturation period of up to 200 days, are late maturing, tall growing, and spreading varieties, and have a bushy look. They also necessitate a wide spacing, leading in the formation of a netted canopy,

which causes issues with plant protection, machine picking, poor solar energy trapping, physiological efficiency, and harvest index (Gomez *et al.*, 1984). These types of varieties require more pickings because to their prolonged lifespan, resulting in a significant rise in the expense of cotton cultivation, particularly manual picking and a poor profit margin that fluctuates erratically. Furthermore, clean picking labour availability is a significant barrier.

Under these circumstances, high density planting system is ideally suited. They have a lot of potential for lowering row width as well as spacing between plants in a row. High density planting system is also known as Ultranarrow row (UNR). Cotton cultivation at high density is being examined as a possible technique for lowering production costs by shortening the growing season. Mostly High-density planting system is suited for early matured genotype. By using early matured genotype, reduces the cotton growing period and provides yield in a smaller number of days (Leena *et al.*, 2018). That has the chance to go for another crop. Because of their small stature, these compacts also allow for an increase in plant density per unit space. It allows for double cropping as well as mechanical harvesting. These compact varieties have the additional benefit of just requiring a few pickings. As a result, labour and seed costs are reduced because formers will use varietal seeds in the next planting season. In UNR cotton, proper main nutrient rates are also critical for optimal lint yield while lowering input costs (Gadade *et al.*, 2015).

This experiment was conducted to know about opinion, extent of adoption and constraints in High Density Planting System. Has most of the Indian farmers are interested in HDPS cotton, this experiment is used for further improvements.

MATERIALS AND METHODS

Present study was conducted in Telangana state. In Telangana state there are three agro climatic zones. Based on the proportion of adoption, from each zone one district was selected. From each district two mandals and from each mandala two villages are selected purposively. From each district 30 HDPS farmers are selected. A total sample of 90 HDPS farmers are selected from three districts of three zones. HDPS farmers are selected based on the HDPS farmers list provided by the KVKs and DAATTCs of PJTSAU in the respective districts. The data was obtained by a personal contact approach using a scheduled interview schedule and the data was coded, categorised, tabulated, and analysed in light of the objectives and to make the findings practical for making relevant conclusions.

Application of the Garret's Ranking Technique

An attempt is made to recognize the constraints faced by the growers in the cultivation of HDPS Cotton. The identified problems of growers in the cultivation of HDPS cotton are ranked by making use of Garrett's Ranking Technique. The technique was used to rank the preference mentioned by the respondents on different factors and aspects of the HDPS Cotton cultivation process. It is used to figure out what the most influential factor was in the respondent's decision. Respondents were asked to rank various limitations and outcomes based on their influence using the Garret's Ranking technique, which was then converted into a score value and rank using the following formula:

Percent position = R_{ij}-0.5/N_j × 100

Where,

R_{ij} = Rank given for the i^{th} variable by j^{th} respondents

N_j = Number of variables ranked by j^{th} respondents

The percent position estimated is transformed into scores using Garrett's Table by referring to the table provided by Garret and Woodworth (1969). The scores of each individual are then combined for each factor, and the total value of scores and mean values of scores are determined. The most important factor is determined by the variables with the highest mean value. Below is the tabular representation of the constraints faced by the HDPS Cotton farmers in Telangana. The table is a random categorization of the constraints discovered through personal interviews and questionnaires. The table represents cultivators' interests and rankings of the constraints they experience when growing HDPS Cotton.

RESULTS AND DISCUSSIONS

The results are mainly obtained from the data which was collected from the respondents to know the opinion on HDPS cotton, extent of HDPS adoption and constraints faced by the farmers during the HDPS cotton cultivation.

Farmer's opinions about Cotton cultivation in HDP System. The results of farmers opinion about cotton cultivation in HDPS system were depicted in table-1. Based on the mean score, most of the farmers are strongly agreed that high density planting cultivation is better and yield also more compared to normal cotton cultivation and most of the farmers disagreed that single pickings is better compared to more number of pickings (Singh and Waris 2002).

Extent of HDPS adoption by sample farmers. In extent of HDPS adoption, based on the percentage of farmers followed the recommended practices they are divided into three non adopters, partially adopters, complete adopters. A critical look at the data present in Table 2 revealed that the non adoption level of individual respondent in adoption of recommended practices showed in gap filling on the 10th day of sowing, partially adopted for summer ploughing to avoid perennial weeds and completely adopted for Land preparation by deep ploughing. Most of the farmers are motivated in adoption of technologies through training and demonstration so as they achieved maximum adoption level. The similar findings were reported by (Singh *et al.*, 2017).

Table 1: Farmer's opinions about Cotton cultivation in HDP System.

Sr. No.	Opinion	Mean	Rank
1.	High density planting cultivation is better and yield also more compared to normal cotton cultivation	103*	1
2.	More awareness programs have to be conducted regarding high density planting system	95	2
3.	Gap filling and thinning was not followed in HDPS Cotton	88	3
4.	More labours required for HDPS Cotton	84	4
5.	Compared to normal cotton cultivation labour charges are less in picking operation	78	5
6.	Seed rate is more in HDPS Cotton	77	6
7.	HDPS cotton possible in black & red soils	76	7
8.	Inter cropping is possible for HDPS Cotton	76	8
9.	Growth regulator is the one factors for increasing yields in HDP Cotton	76	9
10.	Drip irrigation is possible in HDPS Cotton	74	10
11.	Due to the adoption of soil conservation practises, irrigation to the HDPS plants is less	73	11
12.	Harvesting with machines is possible in HDPS Cotton	72	12
13.	Insufficient irrigation may decrease the yield of HDPS Cotton	72	13
14.	Ridges and furrows are mandatory in HDPS Cotton	68	14
15.	Top dressing is mandatory in HDPS cotton	67	15
16.	Fertilizer usage is more in HDPS compared to normal system	59	16
17.	Pest and disease attack was more for HDPS Cotton	58	17
18.	Intercultural operations are difficult in HDPS Cotton	55	18
19.	Production cost is more for HDPS Cotton	48	19
20.	Single picking is better compared to multiple pickings in HDPS cotton	45	20

(* Multiple respondents)

Table 2: Extent of HDPS adoption by sample farmers.

Sr. No.	Recommended practices	0	1	2
1.	Land preparation by deep ploughing	0.00	33.33	66.67
2.	Seeds are sown in the month of June	30.00	16.67	53.33
3.	Sowing the seeds at a depth of 3-5 cm on the side of the ridge 2/3 height from the top and above the band	36.67	10.00	53.33
4.	Seed treatment with 3 packets of Azospirillum (600 g/ha) and 3 packets (600 g/ha) of Phosphobacteria or 6 packets of Azophos (1200 g/ha)	66.67	33.33	0.00
5.	Gap filling on the 10th day of sowing	83.33	6.67	10.00
6.	Formation of Ridges and Furrows at 10 meter long with appropriate spacing	30.00	26.67	43.33
7.	Seed rate of 5kg/ acre	13.33	23.33	63.33
8.	Irrigation is given with broad based furrow to maintain the moisture level	16.67	26.67	56.67
9.	Spreading of 12.5 tonnes of FYM or Compost or 2.5 tonnes of vermicompost per ha. if available, uniformly on the unploughed soil	33.33	30.00	36.67
10.	Summer ploughing to avoid perennial weeds	33.33	36.67	30.00
11.	Application of 50 per cent of N, K and full dose of P_2O_5 as basal dosage and remaining 50 per cent N and K during 40 to 45 DAS	46.67	20.00	33.33
12.	$ZnSO_4$ @ 50 kg/ha as basal dosage or $ZnSO_4$ 0.5% spray thrice at 45, 60 and 75 DAS (If Zn is deficient in soil)	76.67	0.00	23.33
13.	Application of Pendimethalin @ 3.3 l/ha three days after sowing, for weed management using a hand operated sprayer fitted with deflecting or fan type nozzle.	43.33	30.00	26.67
14.	Single picking	60.00	0.00	40.00
15.	Harvesting at frequent intervals, at less than 15 days interval.	16.67	26.67	56.67

(0-Non adopters, 1- partial adopters, 2- complete adopters)

Constraints in adoption of High-density planting system. The constraints in adoption of high-density planting system were ranked based on the mean score (Shinde *et al.*, 2003). The data in Table 3 reveals that uneven rainfall (74.13), lodging effect (72.36), difficulty in weeding (67.46), unable to harvest at one time (62.64) and lack of sufficient irrigation water (62.17) is the major constraint in adoption and High rate of pest and disease attack in HDPS (29.96) low education levels (30.93), lack of awareness of the HDP System (31.32) are the minor constraints.

Table 3: Constraints in adoption of High-density planting system.

Sr. No.	Constraints	Mean score	Rank
1.	Uneven rainfall	74.13	1
2.	Lodging effect	72.36	2
3.	Difficulty in weeding	67.46	3
4.	Unable to harvest at one time	62.64	4
5.	Lack of sufficient irrigation water	62.17	5
6.	High labour charges	58.70	6
7.	Inadequate and untimely supply of inputs	57.89	7
8.	Unavailability of required machinery and equipment (For weeding, sowing, harvesting etc.)	56.31	8
9.	Unavailability of skilled labour	55.82	9
10.	High cost of seed and lack of certified seeds with good seed viability	47.40	10
11.	Lack of sufficient credit facility	47.13	11
12.	Unavailability of High yielding varieties	45.19	12
13.	Lack of storage facilities	44.62	13
14.	Lack of required training on HDPS	44.30	14
15.	Soil related problems	43.91	15
16.	Poor research extension farm linkages	35.10	16
17.	Small size holding / Farm size	33.34	17
18.	Lack of awareness of the HDP System	31.32	18
19.	Low education levels	30.93	19
20.	High rate of pest and disease attack in HDPS	29.96	20

CONCLUSION

From the results of opinion and extent of adoption of HDPS cotton, it can be concluded that, the HDPS growers in majority knew improved cultivation practices of HDPS Cotton but adopted to a moderate extent and most of the farmers opinion are, HDPS cotton cultivation was better compared to the traditional and pest attack also less. Furthermore, it was clear that as knowledge and adoption increased, there is a decrease in level of constraints faced by the HDPS Cotton producers (Manjula and Shashidhara 2017).

It can be further concluded that the constraints which were perceived most by the farmers in adoption of recommended production technology of HDPS cotton cultivation i.e., uneven rainfall, followed by lodging effect, difficulty in weeding, unable to harvest at one time and lack of sufficient irrigation water are the major constraint in adoption and High rate of pest and disease attack in HDPS, low education levels, lack of awareness of the HDPS cotton are the minor constraints. This suggests that extension agencies should make greater educational efforts, such as conducting training and demonstrations, to improve understanding and promote acceptance of High-density planting system in cotton. Training programs and demonstrations will make the farmers to get complete awareness on the technology and make them to overcome the problems which were occurred during the cultivation of HDPS cotton.

FUTURE SCOPE

The HDPS technology piqued people's interest all around the country. Farmers were convinced of the technology's viability, particularly in rain-fed shallow soil conditions (Sherene *et al.*, 2019). Short (90-100 cm) compact, zero monopodial plant varieties with early maturity, sucking insect tolerance, 6-7 bolls/plant under high planting density with big boll size that would perfectly fit into the system are also being bred. Bt genes have been inserted into semi compact cultivars that have already been established as acceptable for HDPS and it will remove the fear of American bollworm, which has been expressed by a number of farmers.

Strippers to harvest the cotton seeded under HDPS are also being developed, which would lower production costs and make the system more lucrative.

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Conflict of Interest. None.

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