Studies on Performance of Bt Cotton Hybrids against Jassids (*Amrasca bigutulla bigutulla* Ishida) During Summer Season

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Cotton (*Gossypium hirsutum*. L) is indeed a significant cash crop grown in three agro-climatic zones of India. The Indian subcontinent is considered the birthplace of cotton, and it has been a crucial part of human civilization for centuries. It is renowned as the most important natural fibre or vegetable wool and has been cultivated for both domestic consumption and export purpose for proximately 111 countries worldwide. Cotton is a vital crop that plays a significant role in the global economy. It provides livelihoods for over 250 million people worldwide and accounts for nearly 7%

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of the labour force in developing countries. The field experiment was carried out at Agricultural Research Station (ARS), Adilabad, Telangana during summer 2022-23. A Total of 8 Bt cotton hybrids were evaluated against jassids of cotton under unprotected conditions. Lowest population of jassids were recorded in hybrid NCS-2778 (3.76 jassids per 3 leaves), followed by RCH-659 (5.41 jassids), PRADEEP (6.27 jassids), MOKSHA (6.45jassids per 3 leaves). The highest population of jassids were recorded in JADHU (9.91 jassids) and MONEY MAKER (7.70 jassids).

1. INTRODUCTION

Cotton remains the dominant fiber in the textile industry and is commonly referred to as the "king" of fibers. It is widely used in apparel production, accounting for approximately half of all textiles. Cotton's profitability and extensive cultivation make it the most prevalent non-food crop globally. The top cotton-producing countries in the 2022-23 period were China (59.80 lakh tonnes), India (52.00 lakh tonnes), the USA (31.96 lakh tonnes), and Brazil (29.46 lakh tonnes). These four countries contribute around 71% of the world's cotton production from approximately 64% of the global cotton-growing area [1].

During the 2022-23 period, cotton production in India is estimated to reach 337.23 lakh bales weighing 170 kg each. This production comes from an area of 130.49 lakh hectares with a productivity of 439 kg lint/ha. The current year saw a 5.5% increase in cotton cultivation area compared to the previous year, resulting in an 8.4% increase in production. Productivity also experienced a slight marginal increase from 428 to 439 kg per hectare. Gujarat, Maharashtra, and Telangana have been the major cotton-growing and producing states in India in recent years (2018-19 to 2022-23). On average, Maharashtra cultivated 43.78 lakh hectares, producing 79.54 lakh bales, while Gujarat cultivated 24.84 lakh hectares, producing 76.67 lakh bales. Telangana cultivated 20.47 lakh hectares, producing 53.59 lakh bales. These states accounted for approximately 33.79%, 19.16%, and 15.80% of the total cotton cultivation area, respectively, and contributed 24.22%, 23.75%, and 16.32% of the national output, respectively [2].

Telangana is a southern state of India in which Nalgonda (Dist.) stood first rank and Adilabad (Dist.) stood second rank in cotton production. In Adilabad, cotton is cultivated in an area of 3.27 lakh ha with a production and productivity of 32.7 quintals and 1012 kg/-1, respectively [3]. In India more than 90% of farmers are cultivating BT cotton hybrids. Presently due to promotion of crop diversification by Government of Telangana and High market price for cotton, cotton crop area is increasing in summer season. Many progressive farmers under assured irrigation situation have voluntarily practiced cotton cultivation during summer 2021-22 in Northern Telangana Zone and recorded good yields [4].

One among the major constraints in cotton production is higher incidence of insect pests at different stages of crop growth period. Cotton production remained stagnant over years due to many biotic and abiotic constraints. Among the biotic problems, insect pests cause major damage to the crop and as many as 1326 species of insect pests were reported on this crop throughout the world. However, about 130 different species of insects and mites are found devouring cotton at different stages of crop growth in India [5].

Though much work has been done on the incidence of cotton pests during kharif season, no work was done on the insect pest attacking cotton during summer season. The incidence and development of insect pests is very much dependent on the prevailing physical environmental factors. Changes in cropping pattern may alter the incidence of insect pests. It was feared that the altered climate in summer season would aggravate insect pests. Among the management practices used for insect pest of cotton, chemical control is the most used method among farmers. Highest share of pesticide consumption, amongst the crops grown in our country is being cotton, consuming 36%–50% of the total pesticides in the country. Hence, the present study was taken up to find out the promising cotton hybrids suitable for cultivation in summer season against insect pests.

2. MATERIALS AND METHODS

The experiment was conducted at Agricultural Research Station (ARS), Adilabad Telangana during summer season, 2022. Adilabad is

situated in Northern zone of Telangana state at a latitude of 19º 40 12.00" North and longitude of 78º 31 48.00" East with an altitude of 264 m from Mean Sea Level (MSL). The experimental field represented medium black soil with good drainage and possessed low to medium organic matter range as well as potash contents. The experiment was conducted with eight treatments and three replications. The performance of eight Bt cotton hybrids viz., RCH-659, NCS-2778, PRADEEP, JADHU, SADANANDH, MOKSHA, MAGNA, and MONEYMAKER were worked out during summer season against insect pests. The crop was sown during December 15, 2022. Each hybrid was grown in 7 rows in one replication in a plot size of 5.6 m x 5 m with 90 x 60 cm spacing by adopting standard agronomic practices. Observations were taken on 10 randomly selected plants/replication. Observations on jassids were recorded on cotton at 15 days interval from 30 days after sowing 3 leaves/plant on top, middle and bottom of 10 randomly selected plants per replication. After data collection the data subjected to analyse using OP stat statistical software and ANOVA table, and treatment means were compared using Duncans Multiple Range Test (DMRT) [6].

3. RESULTS AND DISCUSSION

Average population of jassids (Amrasca bigutulla bigutulla Ishida) per 3 leaves on Bt cotton hybrids.

The recorded data on average jassid population during 2022 on Bt cotton hybrids at 30 DAS, 45 DAS, 60 DAS, 75 DAS, and 90 DAS Indicated in Table 1 and Fig. 1.

At 30 DAS, the results are showed that the least number of jassids per 3 leaves were significantly less in hybrid NCS-2778 (2.64 jassids) when compared to the other hybrids. RCH-659 (4.5 jassids) exhibited on-par results with PRADEEP (4.98 jassids). SADHANANDH (6.61 jassids), MONEY MAKER (6.69 jassids) and MAGNA (7.09 jassids) also having on-par each other. Among other hybrids SADHANANDH (6.61 jassids), MONEY MAKER (6.69 jassids) and MAGNA (7.09 jassids) having highest jassids than MOKSHA (5.2 jassids) but not higher when compared to JADHU (8.15 jassids pe) @ 30 DAS.

At 45 DAS, the hybrid NCS-2778 showed the least number of jassids, with 4.65 jassids. It had significantly fewer jassids compared to the other

hybrids. RCH-659 had 6.35 jassids, which was on par with PRADEEP at 6.84 jassids. SADHANANDH, and MONEY MAKER exhibited similar infestation levels, with 8.41and 8.55 jassids, respectively. MOKSHA with 7.65 jassids. Among all the hybrids, JADHU had the highest jassid population and followed by MAGNA with 9.62 jassids at 45 DAS, with 11.24 jassids, surpassing the other treatments.

At 60 DAS, the hybrid NCS-2778 continued to have the least number of jassids, with 7.74 jassids. It showed a significant reduction in jassid infestation compared to the other hybrids. RCH-659 had 8.94 jassids, which was on par with MOKSHA at 9.24 jassids. PRADDEP with 9.78 jassids. MAGNA and MONEY MAKER exhibited a similar infestation level, with 10.64 and 11 jassids, respectively. SADHANANDH recorded a higher jassid population of 11.21 jassids compared to other treatments. However, JADHU had the highest jassid population at 14.65 jassids at 60 DAS, surpassing all other treatments in terms of jassid infestation.

At 75 DAS, the results are showed that the least number of jassids were significantly less in hybrid NCS-2778 (3.05 jassids) when compared to the other hybrids followed by RCH-659 (6.06 jassids per 3 leaves). PRADEEP (7.54 jassids) exhibited on-par with the MOKSHA (7.22 jassids). MAGNA with 8.87 jassids per 3 leaves. SADHANANDH (9.1 jassids) and MONEY MAKER (9.05 jassids) recorded highest population of jassids than other treatments but not highest jassids when compared to the JADHU (11.02 jassids) @ 75 DAS.

At 90 DAS, the hybrid NCS-2778 continued to exhibit the least number of jassids per 3 leaves, with 0.72 jassids. It showed a significant reduction in jassid infestation compared to the other hybrids. RCH-659 had 1.38 jassids, followed by PRADEEP at 2.21 jassids. MAGNA exhibited a similar infestation level with 2.23 jassids. SADHANANDH and MOKSHA had a comparable infestation level, with 3.03 and 2.92 jassids per 3 leaves, respectively. MONEY MAKER recorded the highest jassid population with 3.31 jassids among all the treatments, but it was still lower than JADHU, which had 4.51 jassids at 90 DAS.

As we compare to the kharif jaassid infestation was very high in summer sue to jassids grow in hot, dry weather, which is common during the summer. The combination of high temperatures

and low humidity creates an optimal environment for reproduction and population expansion. During the crop period the average maximum temperature is 40oc and relative humidity is 54 per cent. The weather parameters also can affect the incidence of the jassid population.

The current findings agree with Patel and Radadia [7] reported that the jassid population were peak in GSB-21 (17.88 jassids). The variety Cocker-310 (11.82 jassids) showed the maximum jassid population followed by G.Cot - 100 (9.37 jassids). Among all varieties, the jassid population were significantly less in the cotton variety G. Cot-12 (1.94 jassids). The varieties GSHV- 01/1338(2.53 jassids per) and GISV-267 (3.19 jassids) exhibited on par with each other. Patil et al. [8] findings showed that Bio HY.

Table 1. Population of jassids per 3 leaves on Bt cotton hybrids in summer cotton

S.No	HYBRIDS	30 DAS	45DAS	60DS	75DAS	90 DAS	MEAN
1	RCH-659	4.50[d]	6.35[e]	8.94[e]	6.06[e]	1.38[e]	5.41[d]
		(2.23)	(2.71)	(3.14)	(2.64)	(1.54)	(2.52)
2	NCS-2778	2.64[e]	4.65[f]	7.74[f]	3.05[f]	0.72[f]	3.76[e]
		(1.88)	(2.36)	(2.95)	(2.01)	(1.31)	(2.18)
3	PRADEEP	4.98[c]	6.84[e]	9.78[d]	7.54[d]	2.21[d]	6.27[c]
		(2.42)	(2.78)	(3.27)	(2.90)	(1.78)	(2.69)
4	JADHU	8.15[a]	11.24[a]	14.65[a]	11.0[a]	4.51[a]	9.91[a]
		(3.01)	(3.49)	(3.95)	(3.45)	(2.33)	(3.30)
5	SADHANANDH	6.61[b]	8.41[c]	11.21[b]	9.10[b]	3.03[bc]	7.66[b]
		(2.74)	(3.06)	(3.48)	(3.17)	(1.99)	(2.94)
6	MOKSHA	5.20[c]	7.65[d]	9.24[e]	7.22[d]	2.92[c]	6.43[c]
		(2.47)	(2.90)	(3.19)	(2.85)	(1.96)	(2.72)
7	MAGNA	7.09[b]	9.62[b]	10.64[c]	8.87[c]	2.23[d]	7.57[b]
		(2.83)	(3.25)	(3.40)	(3.03)	(1.78)	(2.92)
8	MONEY MAKER	6.61[b]	8.55[c]	11.0b	9.05[b]	3.31[b]	7.70[b]
		(2.75)	(3.08)	(3.46)	(3.15)	(2.06)	(2.94)
9	SE(d)	0.301	0.246	0.199	0.256	0.164	0.105
10	SE(m)	0.213	0.174	0.140	0.181	0.116	0.074
11	CD at 5%	0.652	0.532	0.430	0.554	0.355	0.228
12	CV%	14.49	10.176	7.245	10.785	10.854	5.631

*Values expressed are mean of three replications; *Figures in the parenthesis are square root transformed values*
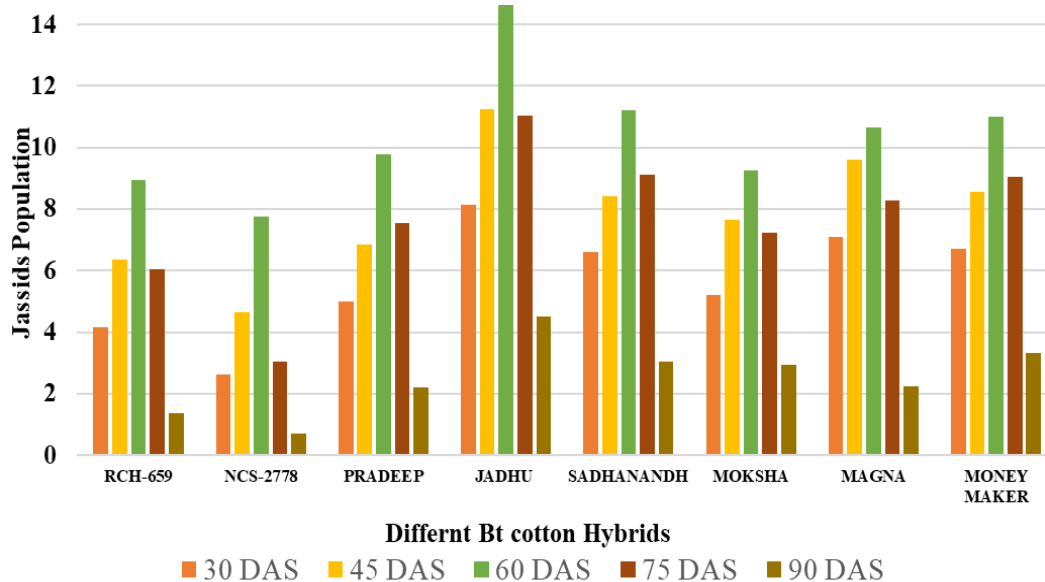
Fig. 1. Incidence of jassid population in summer cottonat different days after sowing
Mean values in graph; DAS: Days After Sowing

15-2 BGII had the lowest incidence of jassids (2.96 jassids), followed by Ankur Yesh BGII (3.40 jassids), 72SS 66 BGII (3.46 jassids), and BIO HY. 1101-2 BGII (3.49 jassids), all of which were comparable. VBCH 1545 BGII had the highest incidence (7.61 jassids). Abro et al. [9] noticed that the transgenic Bt cotton against jassid infestation. The results of field study revealed that the highest mean population (1.66 jassids) was recorded on KMG- 3 (1.66 jassids) followed by 1.95 jassids and 1.52 jassids on KMG-2 and KMG-1, respectively.

4. CONCLUSION

From the above study we would like to conclude that among the eight popular hybrids NCS-2778 shows least jassid infestation from 30 DAS to 90 DAS of crop. meanwhile highest jassid population were recorded in JADHU. Cotton hybrids NCS-2278 and RCH- 659 were found to be highly suitable for cultivation during summer season. PRADEEP and MAGNA were moderately suitable. SADHANANDH and JADHU has shown high susceptibility to jassid infestation during summer.

5. FUTURE SCOPE

IPM is an approach that combines multiple pest management strategies to minimize reliance on chemical pesticides. The future of cotton cultivation may see an increased emphasis on IPM techniques, including biological control (using natural enemies), cultural practices (crop rotation, trap cropping), and monitoring systems (pheromone traps, remote sensing) to optimize pest control while reducing pesticide use. Development of Resistant varieties response to insect pests, breeding programs may focus on developing cotton varieties with enhanced resistance or tolerance to major pests. This can involve traditional breeding methods or genetic engineering techniques to incorporate genes from naturally resistant species or to enhance cottons innate defence mechanisms.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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