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Pink Bollworm in North Cotton Growing Zone of India

– It Is Time For Coordinated Corrective Measures

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Bt-cotton hybrids (BG II) are cultivated in over 1.6 million ha area in the North Zone comprising of three North Western states of Punjab, Haryana and Rajasthan. Irrigated cotton is planted in April- and harvested by November and wheat is grown in rotation during the winter season.

Pink bollworm, *Pectinophora gossypiella* (Saunders), a late season insect pest, reappeared

in the North Zone especially in Punjab, causing considerable crop loss in the districts of Bathinda and Mansa. A report by the state government in November 2021, pegged yield loss of raw cotton at 34% in the state with over 54% of the 3.0 lakh ha cotton area infested by pink bollworm (news item, Hindustan times, 31Oct 2021).

Introduction of Bt cotton in 2006 effectively kept this pest at bay in the North Zone until 2017.

The reports of resistance breakdown to pink bollworm in Bt cotton in Central and South Zone was noticed in 2010. Several studies thereafter confirmed the field evolved resistance in pink bollworm populations of Central and South Zone to both cry1Ac and cry2Ab genes present in BG II. However, the first field report of pink bollworm damage to BG II hybrids in the North Zone was during the 2018 season from Jind district of Haryana and two other field locations in Punjab; all from fields adjoining to cotton ginning-cum-oil extraction mills. This article provides an objective analysis of the extent and severity of the problem and suggests measures to curtail this pest during the ensuing cotton season.

Survey and Surveillance of Pink Bollworm on BG II Cotton in North Zone Confirm Rise in Incidence

Under the All India Coordinated Research Project on Cotton, surveillance of pink bollworm on cotton is regularly carried out in the cotton growing regions of Punjab, Haryana and Rajasthan at weekly intervals from mid-August to first week of November (Table 1). In 2019, the incidence of pink bollworm crossed the Economic Threshold Level (ETL >10% green boll damage) at only one out of 2125 field locations. During 2020, this incidence crossed ETL in 69 out of 1622 locations surveyed in the North Zone (4.3%). Pink bollworm incidence was restricted only to Punjab and Haryana during both these years. However in 2021-22, field surveys at 763 locations indicated a sharp rise in pink bollworm

incidence, above ETL in Punjab (25.2%), Haryana and (27.9%). For the first time the incidence was also noticed in Rajasthan to the extent of 11.2%.

Random Field Surveys Confirm Increasing Threat Due to Pink Bollworm-

During the 2021 season, random survey were conducted to assess pink bollworm infestation on BG II cotton hybrids at 94 locations in four districts of Haryana, 24 locations in three districts of Punjab and 22 locations in two districts of Rajasthan between 20 August to 20 October (Table 2). The infestation was above ETL in 107 locations (76.4%) out of the 140 locations surveyed. State-wise survey data indicated incidence in green bolls was above ETL at 77.6% locations in Haryana, 90.9% locations in Punjab and 54.5% locations in Rajasthan. The severity of infestation recorded at above ETL locations was in the range of 10-100% green boll damage in Haryana and Punjab and 10-30% in Rajasthan.

At all the locations, the incidence of pink bollworm started increasing in mid-August, when majority of the fields were at boll development stage. Two districts in Punjab, Bathinda and Mansa were the worst affected. By the end of the season, the pest also spread to adjoining Muktsar and Fazilka districts of Punjab that were free from pink bollworm till August. However, economic loss was not serious in these districts as two pickings had already

Table 1. Extent of Spread of Pink Bollworm Infestation in Recent Years in the North Zone

States	# survey locations and number above ETL (>10% green boll damage)					
	2019-20		2020-21		2021-22	
	# locations	> ETL	# locations	> ETL	# locations	> ETL
Punjab	1474	1	1082	20	360	91
Haryana	388	0	288	49	136	38
Rajasthan	263	0	252	0	267	30
Total	2125	1	1622	69	763	159

Table 2. Random Surveys and Severity of Green Boll Damage During 2021-22

State/District	# Villages surveyed	# locations reporting PINK BOLLWORM green boll infestation (%) in the range of				
		0-10%	10-30%	31-50%	51-80%	81-100%
Haryana						
Sirsa	36	10	12	8	5	1
Fatehabad	6	2	4	0	0	0
Jind	20	8	7	4	1	0
Hisar	32	1	23	8	0	0
Total	94	21	46	20	6	1
Punjab						
Muktsar	2	2	0	0	0	0
Bathinda	12	0	0	3	2	7
Mansa	10	0	0	2	5	3
Total	24	2	-	5	7	10
Rajasthan						
Sri Ganganagar	10	6	4	0	0	0
Hanumangarh	12	4	5	3	0	0
Total	22	10	9	3	0	0
Grand total	140	33	55	28	13	11

been completed before this spread. In Haryana, the incidence was recorded in 14 cotton growing districts with variable intensity of green boll damage. In Sirsa and Fatehabad districts, higher incidence was noticed in villages adjoining Mansa and Bathinda districts of Punjab which suffered heavy crop loss. Incidence of pink bollworm on BG II hybrids was relatively lower in North Rajasthan. Among the districts, it

was higher in Hanumangarh compared to Sri Ganganagar.

Associated Contributing Factors for Higher Incidence in 2021

Farmers' practice of stacking cotton stalks of previous season along the field borders served as a source of pink bollworm build up, leading to higher incidence in neighbouring fields.



Previous season's infested stalks stacked on field border

Unusual rainfall in September in Punjab and Haryana hampered efforts of close monitoring and management of pink bollworm. Insecticide use against sucking pests during July-August was lower due to low incidence. Low adoption rate of pheromone-based monitoring of pink bollworm, improper choices of insecticides and untimely spray decisions also appear to have contributed to poor management, especially in newer areas compared to better management by farmers in villages which experienced pink bollworm infestation in the previous season. Continuous education and experiential learning thus appear to be a crucial factor.

Thus, it is now amply clear that the pink bollworm has made a comeback in North India and is likely to continue causing damage unless dedicated efforts are put in to combat it. The zone needs to redraw its IPM strategy to manage this pest.

Dissemination and Implementation of Pink Bollworm Management Strategy

Dissemination of Insecticide (Bt) Resistance Management (IRM) strategy for pink bollworm to BG II cotton growers was initiated in 2019 in five villages each at Sirsa and Jind (Haryana) from where the first field report of pink bollworm infestation came in 2018. Pink bollworm management strategy encompassed interventions spanning from pre-planting to post harvest management-including timely planting, pest and crop monitoring at regular intervals through installation of pheromone traps (5 traps/ha), rational ETL based spray decisions

for sucking pests and bollworms. Additionally, awareness programs were conducted; weekly voice messages and pest alerts were delivered to mobiles of registered farmers. Crop window-based management strategy was disseminated for timely pest management decisions. The benefit of this program in managing the pest is evident (Table 3). Peak incidence level of pink bollworm infestation in green bolls was lower in IRM fields by 20.2% in 2019, by 59.8% in 2020 and by 47.4% in 2021 compared to levels of infestation in non-IRM locations (Table 3).

Way Forward for 2022 Season

Better success in pink bollworm management in the cotton growing districts of North Zone may be achieved by implementing a three-pronged strategy- (1) reduction of pest carryover (2) practice close monitoring for timely action (3) plan for mass trapping and mating disruption technologies for area-wide management and community action in the most affected villages.

1. Reduction of Pest Carryover

Segregation of clean and infested cotton should be taken up and clean cotton may be stored or marketed separately. Cotton stalks should not be stacked on field bunds. If inevitable, they should be stacked vertically and used as fuel. Inter-state movement of cotton seed, especially infested seed, transport from the Central and South Zone states into the North Zone must to be monitored and regulated by the state departments. Storing of infested cotton in houses/ godowns till next May should be avoided. During the off-season, pheromone

Table: 3. Incidence of Pink Bollworm on BG II Cotton Hybrids in IRM Villages in Jind, Haryana

Pink bollworm Infestation	Peak incidence (%) recorded					
	2019		2020		2021	
	IRM	Non-IRM	IRM	Non-IRM	IRM	Non-IRM
Flower	8.3	NR*	1.6	8.3	7.1	16.0
Green boll	46.7	58.5	15.5	38.5	27.5	52.3
Open boll**	23.3	NR*	22.0	44.6	10.8	23.6
Locule damage	12.2	NR*	7.6	12.3	3.4	8.0

*Not recorded **open boll damage data recorded at the time of last picking



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• **Madhya Pradesh :** Khargone • **Karnataka :** Hubli • **Punjab :** Bathinda • **Telangana:** Warangal, Adilabad



COTTON ASSOCIATION OF INDIA

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traps must be installed near ginneries and market yards for mass trapping and destruction of moth catches. Cotton seed utilisation in the ginneries by the end of March must be regulated and the seed left uncrushed in the mills before end of April must be fumigated. Crop rotation must be encouraged to break the life cycle of pink bollworm and its carry over.

2. Pest Monitoring for Timely Action

Pink bollworm moth arrivals in cotton fields to be monitored by installing pheromone traps



Monitoring of pink bollworm moth arrivals and damage at flowering and green boll crop stages

@ 5/ha from 45 days after planting onwards. Close monitoring of the crop is to be practiced at square and flowering stages for presence of pink bollworm larvae within flowers and destroy rosette flowers. At boll formation stage, farmers are advised to scout for pink bollworm larvae and damage in green bolls for timely ETL based spray decisions.

3. Mass trapping and Mating Disruption for Pink Bollworm Management

Two mating disruption formulations have received approval from the Central Insecticide Board Registration Committee (CIBRC) for commercial use for management of pink bollworm. Effective management of pink bollworm through mating disruption for reduced egg laying and infestation in the treated crop is best practiced in clusters for area-wide management. One constraint for adoption of mating disruption technique is the cost of application for season long effect (2-3 applications). Deployment requirement across contiguous field clusters in view of the smaller land holdings is another challenge.

Establishment of resistant populations of pink bollworm in Punjab, Haryana and two districts of Rajasthan is a matter of great concern for the next cotton season. Stringent measures are needed to tackle the influx of resistant populations from infested areas in the Central and Southern states through seed transported for oil extraction, especially during the planting time of cotton (April to May). Mating disruption could be one of the currently available prophylactic options for reducing BG II resistant populations of pink bollworm in Punjab and Haryana. Concerted and integrated efforts by all stakeholders in the cotton value chain - State Department, industry, researchers and farmers are needed to manage this pest.

(The views expressed in this column are of the authors and not that of Cotton Association of India)

COTTON ASSOCIATION OF INDIA



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UPCOUNTRY SPOT RATES													
Standard Descriptions with Basic Grade & Staple in Millimetres based on Upper Half Mean Length [By law 66 (A) (a) (4)]								Spot Rate (Upcountry) 2021-22 Crop April 2022					
Sr. No.	Growth	Grade Standard	Grade	Staple	Micronaire	Gravimetric Trash	Strength /GPT	11th	12th	13th	14th	15th	16th
1	P/H/R	ICS-101	Fine	Below 22mm	5.0 – 7.0	4%	15	16085 (57200)	16169 (57500)	16253 (57800)	16394 (58300)	16450 (58500)	16591 (59000)
2	P/H/R (SG)	ICS-201	Fine	Below 22mm	5.0 – 7.0	4.5%	15	16281 (57900)	16366 (58200)	16450 (58500)	16591 (59000)	16647 (59200)	16788 (59700)
3	GUJ	ICS-102	Fine	22mm	4.0 – 6.0	13%	20	13216 (47000)	13076 (46500)	13076 (46500)	13076 (46500)	13216 (47000)	13357 (47500)
4	KAR	ICS-103	Fine	23mm	4.0 – 5.5	4.5%	21	14679 (52200)	14763 (52500)	14763 (52500)	14763 (52500)	14819 (52700)	14960 (53200)
5	M/M (P)	ICS-104	Fine	23mm	4.5 – 7.0	4%	22	20809 (74000)	20809 (74000)	20809 (74000)	20809 (74000)	20809 (74000)	20949 (74500)
6	P/H/R (U) (SG)	ICS-202	Fine	27mm	3.5 – 4.9	4.5%	26	24436 (86900)	24521 (87200)	24746 (88000)	25027 (89000)	25167 (89500)	25308 (90000)
7	M/M(P)/SA/TL	ICS-105	Fine	26mm	3.0 – 3.4	4%	25	21231 (75500)	21231 (75500)	21455 (76300)	21737 (77300)	21793 (77500)	21877 (77800)
8	P/H/R(U)	ICS-105	Fine	27mm	3.5 – 4.9	4%	26	24689 (87800)	24774 (88100)	24999 (88900)	25280 (89900)	25420 (90400)	25561 (90900)
9	M/M(P)/SA/TL/G	ICS-105	Fine	27mm	3.0 – 3.4	4%	25	21652 (77000)	21737 (77300)	21962 (78100)	22243 (79100)	22299 (79300)	22383 (79600)
10	M/M(P)/SA/TL	ICS-105	Fine	27mm	3.5 – 4.9	3.5%	26	22383 (79600)	22468 (79900)	22693 (80700)	22974 (81700)	23030 (81900)	23115 (82200)
11	P/H/R(U)	ICS-105	Fine	28mm	3.5 – 4.9	4%	27	25252 (89800)	25336 (90100)	25561 (90900)	25842 (91900)	25983 (92400)	26123 (92900)
12	M/M(P)	ICS-105	Fine	28mm	3.7 – 4.5	3.5%	27	25111 (89300)	25195 (89600)	25420 (90400)	25702 (91400)	25758 (91600)	25842 (91900)
13	SA/TL/K	ICS-105	Fine	28mm	3.7 – 4.5	3.5%	27	25167 (89500)	25252 (89800)	25477 (90600)	25758 (91600)	25814 (91800)	25898 (92100)
14	GUJ	ICS-105	Fine	28mm	3.7 – 4.5	3%	27	25252 (89800)	25336 (90100)	25561 (90900)	25842 (91900)	25898 (92100)	25983 (92400)
15	R(L)	ICS-105	Fine	29mm	3.7 – 4.5	3.5%	28	24633 (87600)	24717 (87900)	24942 (88700)	25224 (89700)	25280 (89900)	25420 (90400)
16	M/M(P)	ICS-105	Fine	29mm	3.7 – 4.5	3.5%	28	26067 (92700)	26152 (93000)	26376 (93800)	26658 (94800)	26714 (95000)	26798 (95300)
17	SA/TL/K	ICS-105	Fine	29mm	3.7 – 4.5	3%	28	26123 (92900)	26208 (93200)	26433 (94000)	26714 (95000)	26770 (95200)	26855 (95500)
18	GUJ	ICS-105	Fine	29mm	3.7 – 4.5	3%	28	25730 (91500)	25814 (91800)	26039 (92600)	26320 (93600)	26320 (93600)	26405 (93900)
19	M/M(P)	ICS-105	Fine	30mm	3.7 – 4.5	3.5%	29	26911 (95700)	26995 (96000)	27220 (96800)	27501 (97800)	27558 (98000)	27642 (98300)
20	SA/TL/K/O	ICS-105	Fine	30mm	3.7 – 4.5	3%	29	27051 (96200)	27136 (96500)	27361 (97300)	27642 (98300)	27698 (98500)	27782 (98800)
21	M/M(P)	ICS-105	Fine	31mm	3.7 – 4.5	3%	30	27642 (98300)	27698 (98500)	27923 (99300)	28204 (100300)	28261 (100500)	28261 (100500)
22	SA/TL/K/TN/O	ICS-105	Fine	31mm	3.7 – 4.5	3%	30	27726 (98600)	27782 (98800)	28007 (99600)	28289 (100600)	28345 (100800)	28345 (100800)
23	SA/TL/K/TN/O	ICS-106	Fine	32mm	3.5 – 4.2	3%	31	N.A. (N.A.)	N.A. (N.A.)	N.A. (N.A.)	N.A. (N.A.)	N.A. (N.A.)	N.A. (N.A.)
24	M/M(P)	ICS-107	Fine	34mm	2.8 - 3.7	4%	33	30651 (109000)	30651 (109000)	30791 (109500)	30932 (110000)	30932 (110000)	30932 (110000)
25	K/TN	ICS-107	Fine	34mm	2.8 - 3.7	3.5%	34	31775 (113000)	31775 (113000)	31916 (113500)	32057 (114000)	32057 (114000)	32057 (114000)
26	M/M(P)	ICS-107	Fine	35mm	2.8 - 3.7	4%	35	32057 (114000)	32057 (114000)	32197 (114500)	32338 (115000)	32338 (115000)	32338 (115000)
27	K/TN	ICS-107	Fine	35mm	2.8 - 3.7	3.5%	35	33041 (117500)	33041 (117500)	33181 (118000)	33322 (118500)	33322 (118500)	33322 (118500)

(Note: Figures in bracket indicate prices in Rs./Candy)