Indian J. Plant Prot. 10: 1-6, 1982

BOLLWORM INCIDENCE AS AFFECTED BY SOWING DATE, NITROGEN APPLICATION AND PLANT POPULATION IN UPLAND COTTON

S. LAL TANEJA* AND A.S. DHINDWAL
Cotton Research Station, H.A.U. Sirsa.

ABSTRACT

Trials were conducted to know the effect of sowing date, nitrogen application and plant population levels on the incidence of bollworms (pink and spotted bollworms) at Cotton Research Station, Sirsa (Haryana) during the crop seasons 1979-80 and 1980-81. Incidence of pink bollworm on flowers and spotted bollworm on bolls was more in early sown crop than the normal and late sown crop. Late sown crop recorded highest level of pink bollworm incidence on bolls and number of diapausing larvae. Application of nitrogen resulted in higher incidence of bollworms whereas plant population levels did not influence the bollworm incidence.

INTRODUCTION

Bollworms are the key pests of cotton in India. Pink bollworm is the predominant species in Northern India whereas spotted bollworm and gram pod borer (*Heliothis* sp.) are more serious in central and western region. These bollworms attack mainly the fruiting bodies (flower buds, flowers and bolls), thus resulting in great losses in quantity besides adversely affecting the quality of lint and seed. In India, 6525 metric tons of seed cotton worth about Rs. 1216 million is lost annually due to pink bollworm attack only, besides shedding of floral parts and reduction in germination and oil content of seeds (Agarwal and Katiyar, 1979).

Agronomic practices such as sowing date, fertilizer application and plant population per unit area may also influence the bollworm attack in a particular region. Time of sowing of a particular crop has a significant role to play in crop establishment and yield as well as in the population build up of an insect pest. In India it is not possible to sow the crop at one time because of limited irrigation facilities and erratic rainfall. Fertilizer levels and plant population density per unit area also influence the insect pest population. The present study was therefore undertaken to know the effect of sowing date, level of nitrogen application and plant population density on the incidence of bollworms on upland cotton Variety H 777.

MATERIALS AND METHODS

The experiment was conducted at Cotton Research Station, Haryana Agricultural University, SIRSA Farm during the two crop seasons *i.e.*, 1979-80 and 1980-81. The experiment was laid out in split plot design keeping date of sowing as main treatment and nitrogen and plant population levels as sub treatments. The various treatments were :

Main treatments (Date of sowing) :

		1979-80	1980-81
D1	„	10 May	25 April
D2	„	20 May	22 May
D3	„	19 June	16 June

* Sorghum Entomologist, ICRISAT, Patancheru P.O. Andhra Pradesh - 502 324.

Sub treatments (Nitrogen and specing)

No	„	No nitrogen
N1	„	40 Kg N/ha
N2	„	80 Kg N/ha
S1	„	60 × 15 cm (1,10,000 plants/ha)
S2	„	60 × 30 cm (55,000 „ „)
S3	„	75 × 30 cm (45,000 „ „)
S4	„	75 × 22.5 cm (59,000 „ „)

The plot size was 9.0 × 4.5 metres and each treatment was replicated thrice. *G. hirsutum* variety H 777 was planted during both the seasons.

During 1979-80 incidence of bollworms (pink and spotted bollworm) was recorded in the opened bolls only whereas during 1980-81, infestation of flowers as well as pickingwise incidence on opened bolls was recorded. Five plants per plot were selected randomly and labelled. All the flowers and those infested by pink bollworm (rosetted) were counted at weekly intervals. All the opened bolls of these plants were picked separately for each picking and examined for the incidence of bollworms. The percent incidence was converted into angular transformations and subjected to statistical analysis for variance.

RESULTS AND DISCUSSION

Incidence of pink bollworm on flowers ranged between 14.5 and 25.4 percent on 5 August in various treatments of first sowing (D1), whereas there were no flowers in second and third date of sowing (Table 1). On 12 August early sown crop recorded higher incidence (18.6-32.5%) than second date of sowing (1.5-6.2%). In the observations recorded on 19 and 26 August, pink bollworm incidence was minimum on the crop sown during June. The higher incidence on flowers in early sown crop is attributed to the larval infestation from the overwintering population of pink bollworm. During first fortnight of August, early sown cropcarried large number of flowers and thus the larvae infested those flowers in the absence of green bolls. Since during this period, normal and late sown crop did not have flowers, they escaped the flower infestation. This behaviour of insect attacking flowers in the absence of green bolls is also supported by Shaabad and Radwan (1974) and Taneja (1980). Nitrogen and plant population levels seem to have no influence on the incidence of pink bollworm on flowers.

The incidence of pink bollworm and diapausing larvae in opened bolls was significantly higher in late sown crop (D3) as compared to early sown crop (D1) during both the years (Table 2 and 3). This may be due to the fact that pink bollworm increased with advncement of the crop season and peak activity was observed in October-November. During this period (*i.e.*, in October) most of the bolls of early sown crop had opened whereas those of normal and late sown possessed large number of green bolls as a result these were liable to be infested by pink bollworm larvae. Kittock and Pinkas (1971) also observed that pink bollworm damage was lowest on bolls picked in September and highest on bolls picked in November. Joginder Singh *et al.* (1974) reported that early maturing plant had less bollworm incidence and reduced the carryover of pink bollworm. Katiyar and Butani (1978) noticed that cotton bolls which were set early in the season had low pink bollworm damage and hosted less number of larvae.

The incidence of spotted bollworm was significantly higher on early sown (D1), as compared late sown crop (D3). This trend of incidence may be attributed to the seasonal behaviour of the pest. Spotted bollworm is found to be active in July-August and its

TABLE 1. Effect of Different Treatments on the Incidence of Pink Bollworm on Flowers (1980-81)

Treatment		Percent Rosetted Flowers on											
		5-8-80			12-8-80			19-8-80			26-8-80		
		D1	D2	D3	D1	D2	D3	D1	D2	D3	D1	D2	D3
No	S1 ..	15.5	—	—	20.8	1.5	—	15.6	2.3	1.5	8.4	1.2	0.0
	S2 ..	17.2	—	—	26.5	2.0	—	17.5	1.5	1.1	7.2	0.5	1.5
	S3 ..	14.5	—	—	32.5	3.1	—	10.2	4.5	0.0	4.5	0.1	0.0
	S4 ..	16.5	—	—	29.6	1.5	—	18.3	2.3	0.2	9.6	0.0	2.2
N1	S1 ..	19.2	—	—	31.8	3.5	—	11.5	4.1	0.5	5.8	0.0	1.4
	S2 ..	16.2	—	—	20.6	4.6	—	9.2	2.3	1.5	4.6	0.0	1.2
	S3 ..	25.4	—	—	19.8	5.2	—	15.6	1.0	0.0	3.4	0.5	1.1
	S4 ..	20.2	—	—	27.6	2.8	—	13.2	0.0	1.5	7.2	1.2	0.0
N2	S1 ..	23.2	—	—	18.5	3.4	—	12.8	2.0	0.5	5.8	1.3	0.2
	S2 ..	18.6	—	—	29.6	5.0	—	16.9	0.0	0.0	6.4	0.0	1.6
	S3 ..	17.5	—	—	32.3	4.8	—	15.8	1.5	0.0	5.9	1.4	2.0
	S4 ..	22.8	—	—	28.6	6.2	—	16.1	0.8	2.3	4.6	0.0	1.7

TABLE 2. Effect of different treatments on the incidence of bollworms on opened bolls (1979-80)

Treatment	Pink bollworm		Spotted bollworm (% incidence)
	% incidence	Diapausing larvae / 100 bolls	
D1 ..	7.5 (15.89)*	15.4 (4.03)**	16.1 (23.73)*
D2 ..	18.2 (25.33)	27.5 (5.22)	10.9 (19.28)
D3 ..	22.4 (28.32)	48.3 (7.08)	12.1 (20.44)
S.E.m (±) ..	(0.49)	(0.32)	(0.63)
C.D. at 5% ..	(2.01)	(0.91)	(2.12)
No ..	9.5 (18.05)	25.4 (5.11)	12.1 (20.09)
N1 ..	15.1 (22.87)	36.1 (6.20)	11.1 (19.46)
N2 ..	17.2 (24.58)	38.4 (6.38)	19.1 (25.99)
S.E.m (±) ..	(0.64)	(0.15)	(0.64)
C.D. at 5% ..	(1.83)	(0.39)	(1.95)
S1 ..	10.1 (18.63)	29.5 (5.41)	8.8 (17.36)
S2 ..	9.6 (18.05)	32.4 (5.68)	10.1 (18.53)
S3 ..	11.4 (19.82)	27.1 (5.29)	9.1 (17.66)
S4 ..	10.4 (18.8)	30.5 (5.52)	9.2 (17.76)
S.E.m (±) ..	(0.71)	(0.20)	(0.72)
C.D. at 5% ..	(NS)	(NS)	(NS)

* Figures in parentheses are angular transformed values

** Figures in parentheses are $\sqrt{n+1}$ transformed values

TABLE 3. Effect of Different Treatments on the Incidence of Bollworms on Opened Bolls (1980-81)

Treatment	Pink bollworm incidence (%)		No. of diapausing larvae of PBW / 100 bolls		Spotted bollworm incidence (%)	
	1st picking	2nd picking	1st picking	2nd picking	1st picking	2nd picking
D1 ..	3.4 (10.11)*	9.4 (17.38)*	8.0 (2.89)**	27.3 (5.22)**	8.5 (16.61)*	8.1 (16.05)*
D2 ..	7.5 ('5.51)	10.7 (19.05)	13.6 (3.74)	34.6 (5.86)	5.5 (13.20)	5.3 (12.91)
D3 ..	14.5 (22.19)	14.6 (22.15)	38.7 (6.12)	40.1 (6.32)	6.1 (13.95)	3.8 (11.11)
S.E.m (±) ..	(0.74)	(0.97)	(0.25)	(0.16)	(0.39)	(0.97)
C D. at 5% ..	(2.89)	(3.79)	(0.97)	(0.62)	(1.52)	(3.81)
No ..	6.7 (13.84)	10.3 (18.31)	14.1 (3.69)	31.7 (5.48)	4.7 (12.29)	4.9 (12.27)
N1 ..	8.3 (15.84)	12.0 (19.80)	20.8 (4.20)	35.2 (5.87)	6.5 (14.65)	5.9 (13.50)
N2 ..	10.3 (18.12)	12.4 (20.47)	25.4 (4.86)	35.2 (5.93)	8.8 (16.82)	6.5 (14.30)
S.E.m (±) ..	(0.48)	(0.67)	(0.15)	(0.23)	(0.60)	(0.56)
C.D. at 5% ..	(1.34)	(NS)	(0.43)	(NS)	(1.69)	(1.57)
S1 ..	7.7 (15.23)	12.2 (20.08)	18.9 (4.16)	33.6 (5.74)	6.2 (13.86)	6.2 (13.91)
S2 ..	9.2 (16.63)	10.6 (18.52)	23.3 (4.49)	33.2 (5.70)	6.6 (14.68)	6.0 (13.74)
S3 ..	8.2 (15.64)	11.9 (19.86)	19.6 (4.28)	33.9 (5.93)	7.1 (15.11)	5.5 (13.07)
S4 ..	8.7 (16.20)	11.4 (19.65)	18.6 (4.08)	35.2 (5.83)	6.8 (14.69)	5.1 (12.71)
S.E.m (±) ..	(0.56)	(0.78)	(0.18)	(0.26)	(0.69)	(0.64)
C.D. at 5% ..	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)

* Figures in parentheses are angular transformed values

** Figures in parentheses are $\sqrt{n+1}$ transformed values

activity is reduced after September. Since the late sown crop bore few green bolls upto August, hence escaped the attack. Nangpal (1948) reported that spotted bollworm begin to multiply during April-May in North India and was numerically most abundant during July-September. Katiyar (1977) also observed the peak activity of spotted bollworm upto mid September at Delhi.

The level of nitrogen application had significant influence on the bollworm incidence. Application of 80 kg N per hectare (N2) showed the highest incidence of pink as well as spotted bollworm during both the years (Table 1 and 2), whereas lowest incidence was recorded where no nitrogen was applied. The application of nitrogen resulted in more luxurient vegetative growth of the plants which provided the conducive environment for the bollworms survival and multiplication. Joginder Singh *et al.* (1974) and Kalsy *et al.* (1976) also observed that tall plants having bigger top leaves and more vegetative growth recorded significantly more pink bollworm attack.

Plant population density did not seem to have any influence on the incidence of bollworms. This may be attributed to the fairly high level of bollworm incidence and growth habit of cotton plant. The bollworms have several overlapping generations during the crop season which results in high level of incidence in successive generations irrespective of plant density. Secondly, the growth habit of cotton plant is such that it covers most of the space provided to it. In low population density, the plant bears more monopodial branches and thus covers the whole space, whereas in high population density, it bears less monopodial branches.

ACKNOWLEDGEMENTS

We are greatly thankful to Dr B.R. Mor, Senior Cotton Breeder and Dr B.P.S. Lather, Economie Botanist for providing necessary facilities and Mr. I. Krishna Murty for typing the manuscript.

REFERENCES

Agarwal, R.A. and Katiyar, K.N., 1979. An estimate of losses of seed kapas and seed due to bollworms in cotton in India. Indian J. Ent. **41** (2): 143-148.

Joginder Singh, Singh, T.H., Kaley, H.S. and Karnail Singh, 1974. Influence of cotton morphology on bollworms incidence. Cott. Dev. 4 (2): 15-19.

Kalsy, H.S., Joginder Singh and Gatoria, G.S., 1976. A note on the incidence of bollworms on *arboreum* and *hirsutum* cotton varieties. Crop Improv. **3** (1-2): 128-130.

Katiyar, K.N., 1977. Impact of sequence of flowering on the incidence of bollworms in some varieties of cotton. Indian J. Ent. **39** (4): 324-332.

Katiyar, K.N. and Butani, Dhamo K., 1978. Incidence of bollworms vis-a-vis development of cotton bolls. Indian J. Ent. **40** (3): 245-253.

Kittock, D.L. and Pinkas, L.L.H., 1971. Effect of pink bollworm on cotton seed and fibre. Cott. Grow. Rev. **48** (3): 210-217.

Nangpal, H.D., 1948. Insect-pests of cotton in India. Indian Central Cotton Committee Publication, pp. 1-51.

Shaaban, A.M. and Radwan, H.S., 1974. Population dynamics of pink bollworm, *Pectinophora gossypiella* (Saunders) in relation to blooming and fruiting curves of cotton plants. Z. Pflakrankh. Pflschutz, **81** (4): 206-211.

Taneja, Sham Lal, 1980. Studies on the incidence and management of pink bollworm, *Pectinophora gossypiella* (Saund.) on cotton. Ph.D. dissertation submitted to Haryana Agricultural University.