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Sucking pests and bollworm studies of late sown Bt Cotton (*Gossypium hirsutum* L.) as influenced by different plant spacings, fertilizer levels and NAA applications under irrigation

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ABSTRACT

A field experiment was conducted on vertisol to study the sucking pests and bollworm population of late sown Bt cotton as influenced by different plant spacings, fertilizer levels and NAA applications under irrigation during 2006-07 at College of Agriculture, Raichur farm, University of Agricultural Sciences, Dharwad. The results of the investigation indicate that at 45 DAS the aphids population was significantly higher with 90 x 30 cm spacing (9.29 leaf $^{-1}$ plant^{-1}), 150 per cent RDF (8.06 leaf $^{-1}$ plant^{-1}) and three sprays of NAA (8.03 leaf $^{-1}$ plant^{-1}). At 30 and 45 DAS, jassids population was significantly higher with 90 x 30 cm (1.88 and 2.88 leaf $^{-1}$ plant^{-1}, respectively) spacing, 150 per cent RDF (1.79 and 2.66 leaf $^{-1}$ plant^{-1}, respectively) and three sprays of NAA (1.84 and 2.73 leaf $^{-1}$ plant^{-1}, respectively). At 30 and 45 DAS, the thrips population was significantly higher with plant spacing of 90 x 30 cm (48.62 and 12.94 leaf $^{-1}$ plant^{-1}, respectively), 150 per cent RDF (46.0 and 12.90 leaf $^{-1}$ plant^{-1}, respectively) and three sprays of NAA (46.10 and 13.30 leaf $^{-1}$ plant^{-1}, respectively). At 75 and 90 DAS, significantly higher number of bollworms per plant was recorded with plant spacing of 90 x 30 cm (0.66 and 1.00, respectively), 150 per cent RDF (0.58 and 0.86, respectively) and three sprays of NAA (0.59 and 0.87, respectively). Interaction effects were found to be non significant.

Key words : Sucking pests, Bollworm, Bt cotton, Spacing, Fertilizer levels, NAA sprays

INTRODUCTION

Cotton (*Gossypium hirsutum* L.) is an important fibre crop of India contributing 85 per cent of raw materials to the textile industry. India ranks first in area and third in production after USA and China with an average productivity of 462 kg lint ha^{-1} which is very low compared to world's average productivity of 682 kg lint ha^{-1} (Khadi, 2007). Optimum time for sowing of hybrid cotton is upto July second fortnight. Delay in sowing beyond normal time becomes inevitable due to partial or total failure of rains and/or late release of canal water in *Kharif* season (Rao and Janawade, 2006). The research studies indicated a 28.9 per cent reduction in cotton yields when sowing was delayed by a month (Basavanneppa *et al.,* 2001). Under such conditions it is necessary to find out suitable agronomic practices for enhancing the cotton productivity. The present investigation was conducted to study the sucking pests and bollworm populations of late sown Bt Cotton (*Gossypium hirsutum* L.) as influenced by different plant spacings, fertilizer levels and NAA applications under irrigation.

MATERIALS AND METHODS

Field experiment was conducted during 2006-07 at College of Agriculture, Raichur, farm on black clay soil. The experiment was laid out in a split- split plot design. There were 18 treatment combinations replicated three times with plant spacings (population levels), 90 cm x 30 cm (37,036 plants/ha), 90 cm x 45 cm (24,691 plants/ha) and 90 cm x 60 cm (18,518 plants/ha) in main plots, fertilizer levels (100 % and 150 % RDF) in sub plots and growth regulator sprays control (water spray), NAA @ 10 ppm - two sprays at flower commencement and full blooming stage and NAA @ 10 ppm - three sprays at squaring, flower commencement and full blooming stage in sub-sub plots replicated three times. The recommended dose of fertilizer (RDF) for cotton comprised of 150:75:75 NPK kg ha^{-1}. Bt cotton (Bunny Bt) was sown on 25th September 2006, a delay of 45 days from optimum schedule.

RESULTS AND DISCUSSION

Population of thrips, aphids and Jassids differed significantly due to plant population levels at 30 and 45 DAS (Table 1 and 2). Significantly higher population of thrips, aphids and jassids was recorded with 90 x 30 cm spacing (37,036 plants ha^{-1}) where as lower population of these pests was recorded with 90 x 60 cm (18,518 plants ha^{-1}). Similar observations were also made on bollworm population at 75 and 90 DAS (Table 2). This might be due to change in microclimate with higher plant population. Effect of spacing levels was found significant with respect to incidence of aphids at 45 DAS, but it did not differ significantly at 30 DAS (Table 1). At 45 DAS, the aphid population was significantly higher with 90 x 30 cm spacing

(9.29 leaf $^{-1}$ plant^{-1}). Significantly lower aphid population was noticed in 90 x 60 cm (6.50 leaf $^{-1}$ plant^{-1}) spacing. Plant spacing exerted significant influence on jassid population at 30 and 45 DAS. At 30 DAS, lower jassid population was recorded with plant spacing of 90 x 60 cm (1.43 leaf $^{-1}$ plant^{-1}) compared to 90 x 45 (1.66 leaf $^{-1}$ plant^{-1}) and 90 x 30 cm (1.88 leaf^{-1} plant^{-1}) spacings. Similar trend was noticed at 45 DAS (Table 1). Plant spacing exerted significant influence on thrips population at 30 and 45 DAS. At 30 DAS, lower thrips population was recorded with plant spacing of 90 x 60 cm (29.49 leaf $^{-1}$ plant^{-1}) compared to 90 x 45 (36.80 leaf $^{-1}$ plant^{-1}) and 90 x 30 cm (48.62 leaf^{-1} plant^{-1}) spacings. Similar trend was also noticed at 45 DAS (Table 2). Effect of spacings had significant influence with respect to number of bollworms per plant at 75 and 90 DAS. At 75 and 90 DAS, significantly higher number of bollworms per plant was recorded with plant spacing of 90 x 30 cm (0.66 and 1.00, respectively) and plant spacing of 90 x 60 cm recorded significantly lower number of bollworms per plant (0.35 and 0.66, respectively) (Table 2).

Population of thrips, aphids and jassids differed significantly due to fertilizer levels at 30 and 45 DAS (Table 1 and 2). Application of 150 per cent RDF increased the population of these sucking pests significantly over RDF application (Table 1 and 2). This is mainly due to luxuriant growth and succulence of plant, which attracted the sucking pests. The similar observations were also made on bollworm population at 75 and 90 DAS (Table 2). In case of 150 per cent RDF application luxuriant growth of plant attracted the bollworms but did not cross ETL. These findings are in agreement with those of

Table 1 : Number of sucking pests per leaf per plant in Bt cotton as influenced by management practices under late sown conditions

Treatments	Aphids population		Jassids population	
	30 DAS	45 DAS	30 DAS	45 DAS
Plant spacings (S)				
S_1- 90 x 30 cm (37,036 plants ha^{-1})	3.07	9.29	1.88	2.88
S_2- 90 x 45 cm (24,691 plants ha^{-1})	3.35	7.74	1.66	2.66
S_3- 90 x 60 cm (18,518 plants ha^{-1})	3.03	6.50	1.43	2.09
S.E.±	0.12	0.14	0.051	0.046
C.D (P=0.05)	NS	0.55	0.20	0.18
Fertilizer levels (F)				
F_1- 100% RDF	3.08	7.63	1.52	2.41
F_2- 150% RDF	3.22	8.06	1.79	2.66
S.E.±	0.05	0.08	0.055	0.043
C.D (P=0.05)	NS	0.30	0.19	0.14
Growth regulator sprays (G)				
G_1- Control (water spray)	3.04	7.61	1.50	2.39
G_2- NAA @ 10 ppm (2 sprays)	3.17	7.89	1.62	2.51
G_3- NAA @ 10 ppm (3 sprays)	3.24	8.03	1.84	2.73
S.E.±	0.12	0.13	0.079	0.063
C.D (P=0.05)	NS	0.39	0.23	0.18
Interactions				
S x F				
S.E.±	0.09	0.15	0.095	0.074
C.D (P=0.05)	NS	NS	NS	NS
S x G				
S.E.±	0.22	0.23	0.13	0.10
C.D (P=0.05)	NS	NS	NS	NS
F x G				
S.E.±	0.18	0.19	0.11	0.089
C.D (P=0.05)	NS	NS	NS	NS
S x F x G				
S.E.±	0.31	0.33	0.19	0.15
C.D (P=0.05)	NS	NS	NS	NS

NS-Non significant DAS – Days after sowing

Krishnegowda (2004). Aphid population differed significantly due to different levels of fertilizer at 45 DAS. Aphid population significantly increased with increase in fertilizer levels from 100 per cent RDF (7.63 leaf^{-1} plant^{-1}) to 150 per cent RDF (8.06 leaf^{-1} plant^{-1}) application. Jassid population differed significantly due to application of different levels of fertilizer. At 30 and 45 DAS, jassid population significantly increased with increase in fertilizer levels from 100 to 150 per cent RDF (1.79 and 2.66 leaf $^{-1}$ plant^{-1}, respectively). Lowest jassid population was recorded in 100 per cent RDF (1.52 and 2.41 leaf $^{-1}$ plant^{-1}, respectively) (Table 1). Thrips population differed significantly due to application of different levels of fertilizer. At 30 and 45 DAS, thrips population significantly increased with increase in fertilizer levels from 100 (42.64 and 10.88 leaf^{-1} plant^{-1}, respectively) to 150 per cent RDF (46.0 and 12.90 leaf^{-1} plant^{-1}, respectively). Number of bollworms per plant increased significantly with increase in the levels of fertilizer application from 100 to 150 per cent RDF. At 75 and 90 DAS, significantly higher bollworm per plant (0.58 and 0.86, respectively) was recorded with 150 per cent RDF application compared to 100 per cent RDF (0.43 and 0.71 per plant, respectively) (Table 2).

The variation in aphid population due to NAA sprays was significant at 45 DAS. Significantly higher aphid population was recorded with three sprays of NAA (8.03 leaf^{-1} plant^{-1}) compared to two sprays of NAA (7.89 leaf^{-1} plant^{-1}) and control (7.61 leaf $^{-1}$ plant^{-1}) (Table 1). The variation in jassid population due to NAA sprays was significant at 30 and 45 DAS. Significantly higher jassid population was recorded with three sprays of NAA (1.84

Table 2 : Thrips population per leaf per plant and bollworm population per plant in Bt cotton as influenced by management practices under late sown conditions

Treatments	Thrips population		Bollworm population	
	30 DAS	45 DAS	75 DAS	90 DAS
Plant spacings (S)				
S_1- 90 x 30 cm (37,036 plants ha^{-1})	48.62	12.94	0.66	1.00
S_2- 90 x 45 cm (24,691 plants ha^{-1})	36.80	10.01	0.50	0.70
S_3- 90 x 60 cm (18,518 plants ha^{-1})	29.49	9.86	0.35	0.66
S.E.±	0.85	0.19	0.021	0.037
C.D. (P=0.05)	3.30	0.57	0.081	0.14
Fertilizer levels (F)				
F_1- 100% RDF	42.64	10.88	0.43	0.71
F_2- 150% RDF	46.00	12.90	0.58	0.86
S.E.±	0.92	0.09	0.010	0.018
C.D. (P=0.05)	2.76	0.31	0.035	0.061
Growth regulator sprays (G)				
G_1- Control (water spray)	41.76	10.00	0.41	0.69
G_2- NAA @ 10 ppm (2 sprays)	44.66	11.85	0.52	0.80
G_3- NAA @ 10 ppm (3 sprays)	46.10	13.30	0.59	0.87
S.E.±	0.77	0.16	0.027	0.019
C.D. (P=0.05)	1.07	0.48	0.079	0.055
Interactions				
S x F			0.017	0.030
S.E.±	0.82	0.33	NS	NS
C.D. (P=0.05)	NS	NS		
S x G			0.047	0.051
S.E.±	0.15	0.58	NS	NS
C.D. (P=0.05)	NS	NS		
F x G			0.038	0.041
S.E.±	1.00	0.42	NS	NS
C.D. (P=0.05)	NS	NS		
S x F x G			0.066	0.072
S.E.±	1.82	0.91	NS	NS
C.D. (P=0.05)	NS	NS		

NS-Non significant DAS – Days after sowing

and 2.73 leaf $^{-1}$ plant^{-1}, respectively) compared to two sprays of NAA (1.62 and 2.51 leaf $^{-1}$ plant^{-1}, respectively) than control (1.50 and 2.39 leaf $^{-1}$ plant^{-1}, respectively) (Table 1). The variation in thrips population due to NAA sprays was significant at 30 and 45 DAS. Significantly higher thrips population was recorded with three sprays of NAA (46.10 and 13.30 leaf $^{-1}$ plant^{-1}, respectively) compared to two sprays of NAA (44.66 and 11.85 leaf^{-1} plant^{-1}, respectively) and control (41.76 and 10.0 leaf^{-1} plant^{-1}, respectively) (Table 2). The variation in number of bollworm per plant due to NAA sprays was significant at 75 and 90 DAS. At 75 and 90 DAS, significantly higher bollworm population was recorded with three sprays of NAA (0.59 and 0.87 plant^{-1}, respectively) compared to two sprays of NAA (0.52 and 0.80 plant^{-1}, respectively) and control (0.41 and 0.69 plant^{-1}, respectively) (Table 2).

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