



E-ISSN: 2320-7078

P-ISSN: 2349-6800

JEZS 2018; 6(1): 1041-1044

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Received: 21-11-2017

Accepted: 22-12-2017

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Effect of dates of sowing on population of sucking insect pests in desi cotton (*Gossypium arboreum* L.)

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Abstract

The present study was conducted at Chaudhary Charan Singh Haryana University, Hisar, and experimental area of the Department of Entomology during the *Kharif* season of 2016 and 2017. The pooled data of both the years revealed that maximum population of leafhopper (*Amrasca biguttula biguttula*) nymphs (3.94 nymphs/leaf) was recorded in late sown while minimum population (2.91 nymphs/leaf) was recorded in early sown cotton. In case of thrips (*Thrips tabaci* Linderman), the population of thrips adults was highest (3.99 adults per leaf) in late sown crop while population was least (2.89 adults per leaf) in normal sown cotton. In case of whitefly (*Bemisia tabaci* Gennadius), the population of whitefly adults was highest (4.46 adults/leaf) in late sown while population of whitefly adults was least (2.88 adults/leaf) in early sown cotton.

Keywords: leafhopper nymphs, thrips adults, whitefly adults and different dates of sowing

1. Introduction

Cotton, *Gossypium* spp. is one of the commercially important fibre crops in the world grown as an annual crop in both tropical and warm temperate regions. Nearly 130 species and a few species of mites have been reported to cause considerable reduction in cotton yield in India. Among various important insect pests, sucking pests viz., thrips (*Thrips tabaci* Linderman), leafhopper (*Amrasca biguttula biguttula*) and whitefly (*Bemisia tabaci* Gennadius) cause yield reduction in almost all cotton growing areas of Haryana (Sunramurthy, 1985) ^[1]. Realizing and recognizing the associated adverse effects of chemical pesticides, IPM approach has been effective strategy for sustainable agriculture throughout the world (Diwakar, 1999) ^[2]. The manipulation of planting time helps to minimize pest damage by producing asynchrony between host plant and the pest. Luxurious and succulent growth of plant attracts more number of whitefly in late sown (30 May) in comparison to early sown (30 April) and normal sown (15 May) recorded by Acharya and Singh, 2002 ^[3]. Early planted cotton had lower aphids, jassids, whitefly and red bollworm population than later-planted cotton recorded by Karavina *et al.* 2012 ^[4]. There is increasing awareness about the ill effects of pesticide, particularly in terms of pest resurgence, environmental pollution and toxic residue in food; efforts are being made to encourage those pest management practices which are ecofriendly. The objective of the study was effect of dates of sowing on population of sucking insect pests in cotton.

2. Materials and Methods

Cotton variety HD-432 was sown in the experimental area of Department of Entomology, CCS Haryana Agricultural University, Hisar during 2016 and 2017. First date of sowing was on 27 April, second was on 15 May and third was on 2 June in both the years. Before sowing, the seeds of cotton was soaked in water for 2 hours. The plot size was of five rows of cotton of 4.8 m length, with a spacing of 67.5 cm between the rows and 30 cm between the plants (Plot size- 16.17 Square meter). There were three replications in each sowing and the experiment was laid out in randomized block design.

2.1 Methodology for recording observation

The population of leafhopper nymphs, adults of thrips and whitefly were recorded from three leaves, each one on top, middle and bottom canopies on five randomly selected plants per plot and observations were recorded at 10 days interval starting from 10 days after sowing. The observations recorded on sucking insect pests were later averaged to per leaf basis. Populations of these pests were counted with the help of magnifying glass where ever required on the lower surface of leaves.

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3. Results and Discussion

3.1 Population of leafhopper, *Amrasca biguttula biguttula*

The results of different dates of sowing on nymphal population of leafhopper revealed that leafhopper nymphs appeared at 20 DAS days after sown (DAS) and it was 0.80, 1.48 and 0.08 nymphs per leaf for early, normal and late sown, respectively in 2016 (Table 1). Peak population of leafhopper nymphs was recorded at 70 DAS in early sown (6.09 nymphs per leaf), at 70 DAS in normal sown (7.12

nymphs per leaf) and at 60 DAS in late sown (9.60 nymphs per leaf). The overall population of leafhopper nymphs was 3.25 nymphs per leaf for early sown, 3.79 nymphs per leaf for normal sown and 4.19 nymphs per leaf for late sown cotton. The population of leafhopper nymphs was highest (4.19 nymphs per leaf) in late sown which was significantly different from early sown and at par with normal sown (3.79 nymphs per leaf) and lowest population was found in early sown (1.98 nymphs per leaf).

Table 1: Effect of dates of sowing on nymphal population of leafhopper in cotton

Observations recorded (DAS)	Mean number of leafhopper nymphs per leaf								
	2016			2017			Pooled Mean		
	Early	Normal	Late	Early	Normal	Late	Early	Normal	Late
10	0(1.00)	0(1.00)	0(1.00)	0(1.00)	0.01(1.01)	0(1.00)	0(1.00)	0.01(1.01)	0(1.00)
20	0.80(1.29)	1.48(1.57)	0.08(1.04)	0.22(1.11)	1.63(1.62)	1.84(1.68)	0.51(1.23)	1.56(1.60)	0.96(1.40)
30	1.33(1.52)	2.53(1.88)	3.53(2.13)	0.31(1.15)	2.54(1.88)	2.95(1.99)	0.82(1.35)	2.54(1.88)	3.24(2.06)
40	3.40(2.10)	5.43(2.54)	7.47(2.91)	3.33(2.08)	3.23(2.06)	6.32(2.71)	3.37(2.09)	4.33(2.31)	6.90(2.83)
50	4.22(2.28)	6.12(2.67)	5.09(2.47)	4.98(2.45)	4.92(2.43)	7.32(2.89)	4.60(2.37)	5.52(2.55)	6.21(2.69)
60	5.11(2.47)	6.99(2.83)	9.60(3.26)	3.78(2.19)	5.87(2.62)	4.74(2.40)	4.45(2.33)	6.43(2.73)	7.17(2.86)
70	6.09(2.66)	7.12(2.85)	8.89(3.15)	5.66(2.57)	5.32(2.52)	6.76(2.79)	5.88(2.62)	6.22(2.69)	7.83(2.97)
80	6.01(2.65)	6.32(2.71)	5.23(2.50)	4.88(2.42)	4.11(2.26)	4.45(2.34)	5.45(2.54)	5.22(2.49)	4.84(2.42)
90	5.33(2.51)	5.61(2.57)	7.33(2.89)	4.22(2.29)	2.95(1.99)	6.34(2.71)	4.78(2.40)	4.28(2.30)	6.84(2.80)
100	4.43(2.33)	4.22(2.29)	5.43(2.54)	3.99(2.23)	4.16(2.27)	4.76(2.40)	4.21(2.28)	4.19(2.28)	5.10(2.47)
110	4.45(2.33)	4.17(2.28)	4.12(2.26)	3.21(2.25)	3.54(2.13)	3.98(2.23)	3.83(2.20)	3.86(2.21)	4.05(2.25)
120	4.20(2.27)	3.21(2.05)	3.21(2.05)	2.11(1.77)	2.05(1.75)	2.87(1.97)	3.16(2.04)	2.63(1.91)	3.04(2.01)
130	2.23(1.79)	2.43(1.85)	1.32(1.53)	1.01(1.42)	1.03(1.43)	1.88(1.70)	1.62(1.62)	1.73(1.65)	1.60(1.61)
140	1.13(1.45)	1.21(1.49)	1.54(1.60)	0.58(1.26)	0.04(1.02)	1.04(1.43)	0.86(1.36)	0.63(1.28)	1.29(1.51)
150	0.04(1.02)	0.06(1.03)	0.01(1.01)	0.05(1.03)	0.01(1.01)	0(1.00)	0.05(1.03)	0.04(1.02)	0.01(1.01)
Mean	3.25(1.98)	3.79(2.10)	4.19(2.15)	2.56(1.80)	2.76(1.86)	3.68(2.08)	2.91(1.89)	3.28(1.99)	3.94(2.12)
SE± (m)	(0.05)			(0.04)			(0.04)		
CD at 5%	(0.12)			(0.14)			(0.12)		

Figures in parentheses are square root transformed values.

DAS= Days After sown

The results of different dates of sowing on leafhopper nymphs population of revealed that leafhopper nymphs appeared at 20, 10 and 20 DAS and it was 0.22, 0.01 and 1.84 nymphs per leaf for early, normal and late sown in 2017, respectively. Peak population of leafhopper nymphs was recorded at 70 DAS in early (5.66 nymphs per leaf), at 60 DAS in normal sown (5.87 nymphs per leaf) and 70 DAS in late sown (7.32 nymphs per leaf). The overall mean population of leafhopper nymphs was 2.56 nymphs per leaf for early sown, 2.76 nymphs per leaf for normal sown and 3.68 nymphs per leaf for late sown cotton. The population of leafhopper nymphs was highest (3.68 leafhopper nymphs/leaf) in late sown which was significantly different from others while population was least (2.56 nymphs/leaf) in early sown cotton which was at par with normal sown (2.76 nymphs/leaf). Pooled mean of both the years showed that leafhopper nymphs appeared at 20, 10 and 20 DAS and it was 0.51, 0.01 and 0.96 nymphs per leaf for early, normal and late sown, respectively. Peak population of leafhopper nymphs was recorded at 70 DAS in early (5.88 nymphs per leaf), at 60 DAS in normal sown (6.43 nymphs per leaf) and 70 DAS in late sown (7.83 nymphs per leaf). The overall mean population of leafhopper nymphs was 2.91 nymphs per leaf for early sown, 3.28 nymphs per leaf for normal sown and 3.94 nymphs per leaf for late sown cotton. The population of leafhopper nymphs was highest (3.94 nymphs/leaf) in late sown which was significantly different from others while population was least (2.91 nymphs/leaf) in early sown cotton which was at par with normal sown (3.28 nymphs/leaf). The present findings are in agreement with the findings of Butter *et al.*, 1992^[5] who studied the effect of agronomic practices on the incidence of key pests of cotton under unsprayed condition

and found that leafhopper population was lower in early sown and normal sown and highest in late sown crop. Singh *et al.*, 1970^[6] studied effect of timing of sowing on incidence of pests and plant characters of cotton and recorded that highest population of leafhopper was on late sown crop and lowest was in early sown crop. The present findings are not in agreement with the findings of Dhawan *et al.*, 1985^[7] studied effect of sowing date on incidence of sucking pests and reported the effect of sowing dates (April 25, May 9 and May 23) on the incidence of jassid. The population of cotton jassid was higher on May 9 sown crop than on May 23 sown crop.

3.2 Population of Thrips, *Thrips tabaci* Linderman

The results of different dates of sowing on adult population of thrips revealed that thrips adults appeared at 20 DAS and 10 DAS and it was 1.53, 1.12 and 0.02 adults per leaf for early, normal and late sown, respectively in 2016 (Table 2). Peak population of adults was recorded at 80 DAS in early sown (5.65 adults per leaf), at 60 DAS in normal sown (6.12 adults per leaf) and 70 DAS in late sown (8.86 adults per leaf). The overall mean population of thrips adults was 3.18 adults per leaf for early sown, 2.74 adults per leaf for normal sown and 3.91 adults per leaf for late sown cotton. The population of thrips adults was highest (3.91 adults per leaf) in late sown which was significantly different from early and normal sown crop while incidence was least (2.74 adults per leaf) in normal sown cotton which was at par with early sown crop (3.18 adults per leaf).

In 2017, the results of different dates of sowing on adult population of thrips revealed that thrips adults appeared at 10, 20 and 10 DAS and was 1.60, 1.09 and 0.01 adults per leaf for early, normal and late sown, respectively. Peak population of

thrips adults was recorded at 70 DAS in early (6.09 adults per leaf), at 70 DAS in normal sown (7.12 adults per leaf) and 60 DAS in late sown (9.98 adults per leaf). The overall mean population of thrips adults was 3.76 adults per leaf for early

sown, 3.03 adults per leaf for normal sown and 4.07 adults per leaf for late sown cotton. The population of thrips adults was highest (4.07 adults per leaf) in late sown while population was least (3.03 thrips adults per leaf) in normal Sown cotton.

Table 2: Effect of dates of sowing on adults population of thrips in *desi* cotton

Observation recorded (DAS)	Mean number of Thrips adults per leaf								
	2016			2017			Pooled Mean		
	Early	Normal	Late	Early	Normal	Late	Early	Normal	Late
10	0(1.00)	0(1.00)	0.02(1.01)	0(1.00)	0(1.00)	0.01(1.01)	0(1.00)	0(1.00)	0.02(1.01)
20	1.53(1.59)	1.12(1.46)	2.22(1.80)	1.60(1.62)	1.09(1.45)	2.43(1.85)	1.57(1.60)	1.11(1.45)	2.33(1.83)
30	3.67(2.16)	2.67(1.92)	4.87(2.42)	3.27(2.07)	1.47(1.57)	3.95(2.23)	3.47(2.11)	2.07(1.75)	4.41(2.33)
40	3.98(2.23)	3.98(2.23)	5.33(2.52)	2.87(1.97)	1.73(1.65)	5.11(2.47)	3.43(2.11)	2.86(1.97)	5.22(2.49)
50	3.76(2.18)	3.61(2.15)	5.43(2.54)	3.11(2.03)	4.67(2.38)	9.84(3.29)	3.44(2.11)	4.14(2.72)	7.64(2.94)
60	4.52(2.35)	6.12(2.67)	4.89(2.43)	4.11(2.26)	6.63(2.76)	9.98(3.31)	4.32(2.31)	6.38(2.72)	7.44(2.91)
70	4.89(2.43)	3.73(2.18)	8.86(3.14)	6.09(2.66)	7.12(2.85)	5.47(2.54)	5.49(2.55)	5.43(2.54)	7.17(2.86)
80	5.65(2.58)	5.88(2.62)	7.53(2.92)	5.99(2.64)	6.08(2.66)	6.34(2.71)	5.82(2.61)	5.98(2.64)	6.94(2.82)
90	5.13(2.48)	3.27(2.07)	4.27(2.30)	5.77(2.60)	2.33(1.83)	8.45(3.07)	5.45(2.54)	2.80(1.95)	6.36(2.71)
100	5.07(2.46)	3.73(2.18)	6.87(2.81)	5.98(2.64)	5.78(2.60)	4.33(2.31)	5.53(2.56)	4.76(2.40)	5.60(2.57)
110	2.07(2.03)	2.93(1.98)	4.45(2.33)	4.81(2.41)	3.27(2.07)	3.25(2.06)	3.44(2.11)	3.10(2.03)	3.85(2.20)
120	3.12(2.03)	1.87(1.70)	2.23(1.80)	4.76(2.40)	2.67(1.91)	1.13(1.46)	3.94(2.22)	2.27(1.81)	1.68(1.64)
130	2.23(1.80)	1.53(1.59)	1.54(1.60)	3.67(2.16)	1.53(1.59)	0.54(1.24)	2.95(1.99)	1.53(1.59)	1.04(1.43)
140	1.67(1.63)	0.63(1.28)	0.08(1.04)	2.13(1.77)	0.73(1.32)	0.21(1.11)	1.90(1.70)	0.68(1.30)	0.15(1.07)
150	1.03(1.42)	0.05(1.03)	0(1.00)	1.53(1.58)	0.32(1.15)	0(1.00)	1.28(1.50)	0.19(1.09)	0(1.00)
Mean	3.18(2.01)	2.74(1.86)	3.91(2.10)	3.76(2.12)	3.03(1.91)	4.07(2.11)	3.47(2.06)	2.89(1.89)	3.99(2.12)
SE± (m)	(0.05)			(0.09)			(0.06)		
CD at 5%	(0.16)			(NS)			(0.13)		

Figures in parentheses are square root transformed values.

DAS= days after sowing

There were no significant differences in thrips population in all dates of sowing. Pooled mean of both the years showed that thrips adults appeared at 20, 20 and 10 DAS and it was 1.57, 1.11 and 0.02 adults per leaf for early, normal and late sown, respectively. Peak population of thrips adults was recorded at 80 DAS in early (5.82 adults per leaf), at 60 DAS in normal sown (6.38 adults per leaf) and 50 DAS in late sown (7.64 adults per leaf). The overall mean population of thrips adults population was 3.47 adults per leaf for early sown, 2.89 adults per leaf for normal sown and 3.99 adults per leaf for late sown cotton. The population of thrips adults was highest (3.99 adults per leaf) in late sown which was significantly different from normal sown (2.89 adults per leaf) and at par with early sown (3.47 adults per leaf) while population was least (2.89 thrips adults) in normal sown cotton and it was significantly different from others. These findings are in accordance with the findings of Dhawan *et al.* 1985^[7], Micinski *et al.* 1993^[8], Abhilasha and Shekharappa, 2017^[9] and Magunmder, 2013^[10] and they recorded that low population of thrips was found in early and normal sowing as compared to late sown crop.

3.3 Population of Whitefly, *Bemisia tabaci* Gennadius.

The results of different dates of sowing on adult population of whitefly revealed that whitefly adults appeared at 20, 10 and 10 DAS and it was 1.50, 1.60 and 1.60 adults per leaf in early, normal and late sown cotton crop, respectively in 2016 (Table 3). Peak population of whitefly adults was recorded at 60

DAS in early (5.10 adults per leaf), at 70 DAS in normal sown (6.00 adults per leaf) and 80 DAS in late sown (9.00 adults per leaf). The overall mean population of whitefly adults population was 2.46 adults per leaf in early sown, 3.10 adults per leaf for normal sown and 4.12 adults per leaf for late sown cotton. The population of whitefly adults was highest (4.12 adults per leaf) in late sown which was at par with normal sown cotton (3.10 adults per leaf) while population was least (2.46 adults per leaf) in early sown cotton which was at par with normal sown (3.10 adults per leaf). In 2017, whitefly adults was appeared at 20, 10 and 10 DAS and it was 0.87, 0.02 and 1.56 adults per leaf for early, normal and late sown, respectively. Peak population of whitefly adults was recorded at 80 DAS in early (6.12 adults per leaf), at 70 DAS in normal sown (6.89 adults per leaf) and 70 DAS in late sown (9.54 adults per leaf). The overall mean population of whitefly adults was 3.30, 3.66 and 4.79 adults per leaf in early, normal and late sown cotton. The present findings are agreement with the findings of Acharya and Singh, 2002^[3] and they reported that early sown (30 April) had lowest, normal sown (15 May) had lower, and late sown (30 May) had highest incidence of whitefly. Late sown was found maximum population of whitefly adult. Nagargoje *et al.* 2002^[11] and Karavina *et al.* 2012^[4] found that maximum population of whitefly found in delayed sowing and early sowing was not affected by slight development of population of whitefly.

Table: 3 Effect of dates of sowing on population of whitefly adults in *desi* cotton

Observation recorded (DAS)	Mean number of whitefly adults per leaf								
	2016			2017			Pooled mean		
	Early	Normal	Late	Early	Normal	Late	Early	Normal	Late
10	0(1.00)	1.60(1.61)	1.61(1.61)	0(1.00)	0.02(1.01)	1.56(1.60)	0(1.00)	0.81(1.35)	1.58(1.61)
20	1.50(1.58)	2.50(1.87)	3.40(2.10)	0.87(1.37)	2.21(1.79)	0.1(1.01)	1.19(1.48)	2.36(1.83)	1.75(1.66)
30	1.50(1.58)	4.40(2.32)	4.04(2.25)	3.73(2.17)	4.47(2.34)	1.54(1.59)	2.62(1.90)	4.44(2.33)	2.77(1.94)
40	4.10(2.26)	5.02(2.45)	2.40(1.84)	2.87(1.97)	1.98(1.73)	4.56(2.36)	3.49(2.12)	3.49(2.12)	3.48(2.12)

50	4.11(2.26)	3.50(2.12)	5.90(2.63)	6.01(2.65)	0.78(1.33)	3.43(2.11)	5.06(2.46)	2.14(1.77)	4.67(2.38)
60	5.10(2.47)	3.71(2.17)	4.90(2.43)	5.53(2.56)	6.65(2.77)	8.23(3.04)	5.32(2.51)	5.18(2.49)	6.57(2.75)
70	2.90(1.98)	6.00(2.65)	8.01(3.00)	5.13(2.48)	6.89(2.81)	9.54(3.25)	4.02(2.24)	6.45(2.73)	8.77(3.13)
80	2.32(1.82)	2.71(1.92)	9.00(3.16)	6.12(2.67)	4.22(2.29)	9.46(3.23)	4.21(2.28)	3.46(2.11)	9.23(3.20)
90	4.20(2.28)	2.32(1.82)	5.51(2.55)	4.53(2.35)	6.76(2.79)	6.43(2.73)	4.37(2.32)	4.65(2.38)	5.97(2.64)
100	3.00(2.01)	5.00(2.45)	4.20(2.28)	4.54(2.35)	6.65(2.77)	5.54(2.56)	3.77(2.19)	5.83(2.61)	4.87(2.42)
110	2.40(1.84)	1.90(1.70)	4.01(2.24)	5.13(2.48)	3.32(2.08)	6.83(2.80)	3.77(2.18)	2.61(1.90)	5.42(2.53)
120	2.10(1.76)	4.60(2.37)	3.52(2.12)	2.67(1.92)	5.21(2.49)	4.32(2.31)	2.39(1.84)	4.91(2.43)	3.91(2.22)
130	0.70(1.31)	1.90(1.70)	3.80(2.19)	1.27(1.51)	2.11(1.78)	4.44(2.33)	0.99(1.41)	2.01(1.74)	4.12(2.26)
140	2.00(1.73)	1.40(1.55)	1.70(1.64)	1.09(1.45)	2.09(1.76)	3.37(2.09)	1.55(1.60)	1.75(1.66)	2.54(1.88)
150	1.10(1.45)	0.00(1.00)	0.00(1.00)	0.07(1.03)	1.32(1.52)	2.15(1.77)	0.59(1.26)	0.66(1.29)	1.08(1.44)
Mean	2.46 (1.82)	3.10 (1.98)	4.12(2.20)	3.30(1.99)	3.66(2.08)	4.79(2.32)	2.88(1.91)	3.38(2.04)	4.46(2.26)
SE± (m)		(0.08)			(0.09)			(0.06)	
CD at 5%		(0.24)			(0.26)			(0.18)	

Figures in parentheses are square root transformed values.

DAS= Days after sowing

The population of whitefly adults was highest (4.79 adults per leaf) in late sown which was at par with normal sown crop (3.66 adults per leaf) while population was least (3.30 adults per leaf) in early sown cotton which was at par with normal sown (3.66 adults per leaf). Pooled mean of both the years showed that whitefly adults appeared at 20, 10 and 10 DAS and it was 1.19, 0.81 and 1.58 adults per leaf for early, normal and late sown cotton crop, respectively. Peak population of adults was recorded at 60 DAS in early (5.32 adults per leaf), at 70 DAS in normal sown (6.45 adults per leaf) and 80 DAS in late sown (9.23 adults per leaf). The overall mean population of whitefly population in both the years was 2.88, 2.38 and 4.46 whitefly adults per leaf for early, normal and late sown cotton crop. The population of whitefly adults was highest (4.46 adults/leaf) in late sown which was significantly different from others while population of whitefly adults was least (2.88 adults/leaf) in early sown cotton which was at par with normal sown (2.38 adults/leaf).

4. Conclusion

From the present study it is concluded that in all dates of sowing maximum sucking insect pests recorded in late sown cotton crop as compared to early and normal sown.

5. Acknowledgement

The authors are highly grateful to the Department of Entomology, Chaudhary Charan Singh Haryana University, Hisar, for providing the facilities required to conduct this experiment.

6. References

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