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The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(10): 1551-1555
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www.thepharmajournal.com
Received: 26-07-2022
Accepted: 29-08-2022

Shraddha S Dahivalkar
M.Sc. Student, Department of Agril. Entomology, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

VS Desai and
Professor (CAS), Regional Fruit Research Station, Vengurla, Sindhudurg, Maharashtra, India

GM Golvankar
Research Associate (HORTSAP-Mango), Regional Fruit Research Station, Vengurla, Sindhudurg, Maharashtra, India

Corresponding Author:
Shraddha S Dahivalkar
M.Sc. Student, Department of Agril. Entomology, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India

Influence of sowing dates and mulches on the incidence of jassid in okra ecosystem

Shraddha S Dahivalkar, VS Desai and GM Golvankar

Abstract
The present investigation was conducted to study on the influence of sowing date and mulches on the incidence of jassid in okra ecosystem during *rabi* hot weather season of 2016-2017 at Agronomy farm, College of Agriculture, Dapoli. The results indicated that the data on effect of different sowing dates on mean jassid population during 4th, 5th, 6th, 7th, 8th and 9th Week after sowing (WAS), was minimum (2.12, 3.44, 6.55, 4.22, 2.21 and 0.96, respectively) in treatment S_1 (46th SMW, 12th-18th Nov.) and was at par with S_2.
The data on effect of different mulches on mean jassid population during 4th, 5th, 6th, 7th and 8th WAS, was minimum (0.02, 4.58, 7.29, 4.76 and 3.04, respectively) in treatment M_2 (Silver polythene mulch) which was at par with M_3.
The data on combination effect of different sowing dates and mulches on mean jassid population during 4th, 5th, 6th, 7th, 8th and 9th WAS, was minimum (1.05) in treatment combinations S_1M_2 [S_1 (46th SMW, 12th-18th Nov.) + M_2 (Silver polythene mulch)] and S_2M_2 [S_2 (49th SMW, 3rd-9th Dec.) + M_2 (Silver polythene mulch)].

Keywords: Sowing date, jassid, *Amrasca biguttula biguttula* (Ishida), mulch

Introduction
Okra, *Abelmoschus esculentus* Linn (Moench) is an important vegetable crop of tropics and subtropics. It is the second most preferred vegetable (next to brinjal) in India. It is an important source of vitamin A, B and C and is also rich in protein, carbohydrates, fats and iron. It is also a rich source of dietary fibre, antioxidants, ascorbic acid and folate (Dilruba *et al.* 2009) [5].
It is mainly cultivated in states of Uttar Pradesh, Karnataka, Gujarat and Maharashtra. In Maharashtra area under this crop is 0.023 Mha with production of 241.50 MT and productivity of 10.50 MT/ ha (Anon., 2015) [2]. It is extensively grown in Ahmednagar, Amravati, Nagpur, Aurangabad, Dhule, Jalgaon, Nasik, Osmanabad, Parbhani and Pune districts in the state of Maharashtra.
The crop is attacked by a variety of pests throughout its growth stages (Rao *et al.* 2002) [7]. The most important are shoot and fruit borer, *Earias vitella* (Fab.) *and E. insulana* (Boisduval), jassids [*Amrasca biguttula biguttula* (Ishida)], aphids [*Aphis gossypii* (Glover)], whiteflies [*Bemicia tabaci* (Gen.)] and red spider mite [*Tetranychus cinnabarinus* (Boisduval) and *Tetranychus telarius* (L.)]. Aphids, jassids, whiteflies and mites are the major sucking pests of okra. The nymphs and adults suck the cell sap from the foliage and devitalized the plants.
For the management of insect pests and diseases many options such as chemical, cultural, mechanical, biological etc. are available. Among available control methods, cultural method is considered to be the safest and environment friendly. Many cultural practices can be usually employed in an IPM scheme such as sanitation or destruction of debris, destruction of alternate hosts and volunteer plants, changing dates of planting and harvesting to avoid pest attack, crop rotation to avoid built of pests, tillage practices, habitat diversification, cropping systems or intercropping, plant density, trap crops, water management, *etc*. The mulches are used to control pest, diseases, weeds and maintaining soil moisture. The benefits and importance of mulching in modern agriculture respective to the type of material used have been stressed by many authors (Agropages, 2009) [1]. The information on effect of sowing dates and mulching practices on okra shoot and fruit borer in Konkan region of Maharashtra is very scanty. Hence, the present investigation carried out to study the influence of sowing date and mulches on the incidence of jassid in okra ecosystem.

Materials and Methods

A statistically designed field experiment using Split Plot Design having replications and treatments was laid out at Department of Agronomy farm, College of Agriculture, Dapoli to evaluate effect of sowing dates and mulches against pests of okra. The details of the experiment are given below;

The details of the experiment are given below

Location	:	Department of Agronomy farm, College of Agriculture, Dapoli
Name of crop	:	Okra
Variety	:	Varsha Upahar
Design of experiment	:	Split plot design
Replications	:	3 (Three)
Spacing	:	45 cm x 30 cm
Experimental Area	:	Gross area - 4.20m x 3.6m Net area - 3.60m x 2.70m
Method of Planting	:	Flat bed
Season and Year	:	*Rabi*-hot weather, 2016-17
Dose of fertilizers	:	100:50:25 NPK Kg/ha

Treatments

I. Main Plot Treatments (Sowing dates)

S_1 : 46th MW (12-18th November)
S_2 : 49th MW (03-09th December)
S_3 : 52nd MW (24-31st December)
S_4 : 03rd MW (15-21st January)
S_5 : 06th MW (05-11th February)
S_6 : 09th MW (26th Feb.- 4th March)

II. Sub plot Treatment (Mulches)

M_1 : No mulch
M_2 : Silver polythene mulch
M_3 : Transparent polythene mulch
M_4 : Black polythene mulch

Method of recording observations

An observation on sucking pests like jassids was recorded at weekly interval. The five plants per plot were selected randomly from each treatment plot. The numbers of jassids were recorded from three leaves *i.e.* top, middle and bottom per plant. The data recorded was averaged as per three leaves per plant, converted to $\sqrt{n} + 0.5$ transformations and analyzed statistically.

Results and Discussion

1. Effect of sowing dates on jassids infesting okra

The numbers of jassids per three leaves in the different sowing date treatments were recorded at weekly interval and the results are presented in Table 1.

The data on effect of different sowing dates on mean jassid population was recorded from 4th WAS to 11th WAS. During 4th WAS, the minimum (2.12) jassid population was recorded in treatment S_1 (46th SMW, 12th-18th Nov.) which was found to be at par with the treatment S_2 (49th SMW, 3rd-9th Dec.) with 3.12 jassids per three leaves. The maximum (5.93) jassid population was recorded in the treatment S_6 (9th SMW, 26th-Feb.-4th Mar).

Data during 5th WAS revealed that the least (3.44) population of jassids was recorded in S_1 (46th SMW, 12th-18th Nov.) which was found to be significantly superior over rest of the treatments. The next best treatment was S_2 (49th SMW, 3rd-9th Dec.) which recorded 5.10 jassids per three leaves. The highest (9.98) jassid population was recorded in treatment S_6 (9th SMW, 26th-Feb.-4th Mar).

The data on jassid population during 6th WAS showed that the lowest population (6.55) was noticed in S_1 (46th SMW, 12th-18th Nov.) and was at par with the treatment S_2 (49th SMW, 3rd-9th Dec.) with 7.64 jassids per three leaves. The jassid population was maximum (11.34) in treatment S_6 (9th SMW, 26th-Feb.-4th Mar).

During 7th WAS, results revealed that the minimum (4.22) jassid population was observed in S_1 (46th SMW, 12th-18th Nov.) and was at par with the treatment S_2 (49th SMW, 3rd-9th Dec.) with 5.40 jassids per three leaves. The maximum (10.53) jassid population was recorded in treatment S_6 (9th SMW, 26th-Feb.-4th Mar).

Data regarding jassid population during 8th WAS indicated that the treatment S_1 (46th SMW, 12th-18th Nov.) recorded lowest (2.21) jassids and was at par with S_2 (49th SMW, 3rd-9th Dec.) which recorded 2.97 jassids per three leaves. The treatment S_6 (9th SMW, 26th-Feb.-4th Mar) was recorded maximum (8.94) jassids per three leaves.

During 9th WAS, the treatment S_1 (46th SMW, 12th-18th Nov.) recorded minimum (0.96) jassid population and was at par with rest of the treatments except S_6. The maximum (1.09) jassid population was recorded in treatment S_6 (9th SMW, 26th-Feb.-4th Mar).

The data on jassid population during 10th and 11th WAS were found to be non-significant. During 10th WAS, the jassid population was in the range of 0.16 to 0.35 whereas, in 11th WAS the population ranged from 0.08 to 0.15 jassids per three leaves.

The results of the present findings are in conformity with the results of earlier workers. Bairwa *et al.* (2005) [3] revealed that there was minimum jassid population on the early sown crop (7th July) which increased gradually with the delayed sowing dates.

Vanlaldiki *et al.* (2017) [8] studied the effect of staggered sowing on the incidence of sucking pests in okra. They reported that the early sown crop had significantly less incidence than the late sown one. Two years data revealed that the least incidence of jassids occurred in 20th January sown crop. The highest incidence of jassids was in the 8th April sown crops.

2. Effect of mulches on jassids infesting okra

The numbers of jassids per three leaves in the different mulches were recorded at weekly interval and the results are presented in Table 2.

The data on effect of different mulches on mean jassid population were recorded from 4th WAS to 11th WAS. During 4th WAS, the minimum (0.02) jassids were recorded in treatment M_2 (Silver polythene mulch) which was found to be at par with the treatment M_3 (White polythene mulch) with 3.12 jassids per three leaves. The maximum (7.13) jassid population was recorded in treatment M_1 (No mulch).

Data during 5th WAS revealed that the least (4.58) population of jassids was recorded in M_2 (Silver polythene mulch) which was found to be at par with the treatment M_3 (White polythene mulch) with 6.16 jassids per three leaves per plant. The treatment M_1 (No mulch) recorded maximum (9.22) jassid per three leaves.

The data on jassid population during 6th WAS showed that the lowest population (7.29) was noticed in M_2 (Silver polythene mulch) and was at par with the treatment M_3 (White polythene mulch) with 8.54 jassids per three leaves per plant. The jassid population was highest (12.90) in treatment M_1

(No mulch).

During 7th WAS, results revealed that the minimum (4.76) jassid population was observed in M_2 (Silver polythene mulch) and was at par with the treatment M_3 (White polythene mulch) with 6.13 jassids per three leaves per plant. The maximum (10.54) jassid population was recorded in treatment M_1 (No mulch).

Data on jassid population during 8th WAS indicated that the treatment M_2 (Silver polythene mulch) recorded lowest (3.04) jassids and was at par with M_3 (White polythene mulch) which recorded 4.19 jassids per three leaves per plant. The treatment M_1 (No mulch) recorded maximum (7.24) jassids per three leaves per plant.

During 9th WAS, the result was found to be non-significant. The jassid population during this period was ranged from 0.96 to 1.07 jassids per three leaves per plant.

The data on jassids population during 10th and 11th WAS were found to be non-significant. During 10th WAS, the jassid population was in the range of 0.17 to 0.34 whereas, in 11th WAS the population ranged from 0.07 to 0.13 jassids per three leaves per plant.

The results finding are more or less corroborate with Mu Mu Thein *et al*. (2011) +. They evaluated the colour to monitor insect vector whitefly during May to October in Thailand and found leafhoppers were attractive to yellow colour than orange, white, green, and colourless films. Cesar *et al.* (2012) [4] found that yellow colour was most attractive for leafhoppers during conducted experiment in Chatsworth, New Jersey on Cranberry.

3. Combination effect of sowing dates and mulches on jassids infesting okra

The numbers of jassids per three leaves per plant in the different sowing date treatments and mulches were recorded at weekly interval and the results are presented in Table 3.

The data on combination effect of different sowing dates and mulches on mean jassid population was recorded from 4th WAS to 11th WAS. During 4th WAS, the minimum (1.05) jassid population was recorded in treatment combinations S_1M_2 [S_1 (46th SMW, 12th-18th Nov.) + M_2 (Silver polythene mulch)] and S_2M_2 [S_2 (49th SMW, 3rd-9th Dec.) + M_2 (Silver polythene mulch)] which were at par with the treatment combinations S_1M_3 [S_1 (46th SMW, 12th-18th Nov.) + M_3 (White polythene mulch)], S_2M_3 [S_2 (49th SMW, 3rd-9th Dec.) + M_3 (White polythene mulch)] and S_3M_2 [S_3 (52nd SMW, 24th-31st Dec.) + M_2 (Silver polythene mulch)] which recorded 1.33 jassids per three leaves per plant. The maximum (7.02) jassid population was recorded in treatment combination S_6M_1 (S_6 (9th SMW, 26th-Feb.-4th Mar) + M_1 (No mulch)].

Data during 5th WAS, revealed that the least (2.09) population of aphids was recorded in treatment combinations S_1M_2 [S_1 (46th SMW, 12th-18th Nov.) + M_2 (Silver polythene mulch)] and S_2M_2 [S_2 (49th SMW, 3rd-9th Dec.) + M_2 (Silver polythene mulch)] which was found to be at par with the treatment combinations S_1M_3 [S_1 (46th SMW, 12th-18th Nov.) + M_3 (White polythene mulch)], S_2M_3 [S_2 (49th SMW, 3rd-9th Dec.) + M_3 (White polythene mulch)] and S_3M_2 [S_3 (52nd SMW, 24th-31st Dec.) + M_2 (Silver polythene mulch)] with 2.78 jassids per three leaves per plant. The highest (8.89) jassid population was recorded in treatment combination S_6M_1 (S_6 (9th SMW, 26th-Feb.-4th Mar) + M_1 (No mulch)].

The data on jassid population during 6th WAS showed that the lowest (4.26) population of jassids was recorded in treatment combinations S_1M_2 [S_1 (46th SMW, 12th-18th Nov.) + M_2 (Silver polythene mulch)] and S_2M_2 [S_2 (49th SMW, 3rd-9th Dec.) + M_2 (Silver polythene mulch)] which was found to be at par with the treatment combinations S_3M_2 [S_3 (52nd SMW, 24th-31st Dec.) + M_2 (Silver polythene mulch)], S_4M_2 [S_4 (3rd SMW, 15th- 31stJan.) + M_2 (Silver polythene mulch)], S_5M_2 [S_5 (6th SMW, 5th -11th Feb.) + M_2 (Silver polythene mulch)], S_6M_2 [S_6 (9th SMW, 26th-Feb.-4th Mar) + M_2 (Silver polythene mulch)], S_1M_3 [S_1 (46th SMW, 12th-18th Nov.) + M_3 (White polythene mulch)], S_2M_3 [S_2 (49th SMW, 3rd-9th Dec.) + M_3 (White polythene mulch)] and S_3M_3 [S_3 (52nd SMW, 24th-31st Dec.) + M_3 (White polythene mulch)] with 5.54, 5.54, 5.54, 5.54, 5.61, 5.61 and 5.61 jassids per three leaves per plant, respectively. The highest (12.99) jassid population was recorded in treatment combination S_6M_1 (S_6 (9th SMW, 26th-Feb.-4th Mar) + M_1 (No mulch)].

During 7th WAS, results revealed that the minimum (2.10) jassid population was observed in treatment combinations S_1M_2 [S_1 (46th SMW, 12th-18th Nov.) + M_2 (Silver polythene mulch)] and S_2M_2 [S_2 (49th SMW, 3rd-9th Dec.) + M_2 (Silver polythene mulch)] and was at par with the treatment combinations S_4M_2 [S_4 (3rd SMW, 15th- 31stJan.) + M_2 (Silver polythene mulch)], S_5M_2 [S_5 (6th SMW, 5th -11th Feb.) + M_2 (Silver polythene mulch)], S_6M_2 [S_6 (9th SMW, 26th-Feb.-4th Mar) + M_2 (Silver polythene mulch)], S_1M_3 [S_1 (46th SMW, 12th-18th Nov.) + M_3 (White polythene mulch)], S_2M_3 [S_2 (49th SMW, 3rd-9th Dec.) + M_3 (White polythene mulch)], S_3M_2 [S_3 (52nd SMW, 24th-31st Dec.) + M_2 (Silver polythene mulch)] and S_3M_3 [S_3 (52nd SMW, 24th-31st Dec.) + M_3 (White polythene mulch)] with 3.11, 3.11, 3.11, 3.30, 3.30, 3.30 and 3.30 jassids per three leaves per plant, respectively. The maximum (10.10) jassid population was recorded in treatment combination S_6M_1 (S_6 (9th SMW, 26th-Feb.-4th Mar) + M_1 (No mulch)].

Data regarding jassid population during 8th WAS indicated that the treatment combinations S_1M_2 [S_1 (46th SMW, 12th-18th Nov.) + M_2 (Silver polythene mulch)] and S_2M_2 [S_2 (49th SMW, 3rd-9th Dec.) + M_2 (Silver polythene mulch)] recorded minimum (0.85) jassids per three leaves per plant and both these treatment combinations were significantly superior over other treatments. The next best treatment combinations were S_3M_2 [S_3 (52nd SMW, 24th-31st Dec.) + M_2 (Silver polythene mulch)], S_4M_2 [S_4 (3rd SMW, 15th- 31stJan.) + M_2 (Silver polythene mulch)], S_5M_2 [S_5 (6th SMW, 5th -11th Feb.) + M_2 (Silver polythene mulch)] and S_6M_2 [S_6 (9th SMW, 26th-Feb.-4th Mar) + M_2 (Silver polythene mulch)] and all these treatment combinations recorded 1.44 jassids per three leaves per plant. The treatment combination S_6M_1 (S_6 (9th SMW, 26th-Feb.-4th Mar) + M_1 (No mulch)] recorded highest (6.62) jassid population per three leaves per plant.

The data on jassid population during 9th, 10th and 11th WAS were found to be non-significant. The population of jassids during 9th WAS was ranged from 0.74 to 1.10. During 10th WAS, the jassid population was in the range of 0.11 to 0.40 whereas, in 11th WAS the population ranged from 0.00 to 0.19 jassids per three leaves per plant.

No review of literature related to combination effect of sowing dates and mulches on infestation of jassid in okra aspect is available. Hence, no review has been included and the obtained data remains uncomparable.

Table 1: Effect of sowing dates on okra jassids

Treatments	No. of jassids/3 leaves/plant							
	4th WAS	5th WAS	6th WAS	7th WAS	8h WAS	9th WAS	10th WAS	11th WAS
Main plot: Sowing dates								
S_1: 46th SMW (12th-18th Nov.)	2.12 (1.62)	3.44 (1.98)	6.55 (2.65)	4.22 (2.17)	2.21 (1.65)	0.95 (1.20)	0.16 (0.81)	0.08 (0.76)
S_2: 49th SMW (3rd-9th Dec.)	3.12 (1.90)	5.10 (2.37)	7.64 (2.85)	5.40 (2.43)	2.97 (1.86)	0.95 (1.20)	0.22 (0.85)	0.14 (0.80)
S_3: 52nd SMW (24th-31st Dec.)	3.84 (2.08)	6.57 (2.66)	9.79 (3.21)	6.82 (2.71)	3.96 (2.11)	1.03 (1.24)	0.29 (0.89)	0.15 (0.81)
S_4: 3rd SMW (15th- 31stJan.)	4.42 (2.22)	7.72 (2.87)	10.63 (3.34)	8.06 (2.93)	5.42 (2.43)	1.03 (1.24)	0.22 (0.85)	0.09 (0.77)
S_5: 6th SMW (5th -11th Feb.)	5.19 (2.39)	8.72 (3.04)	9.34 (3.14)	9.06 (3.09)	7.01 (2.74)	1.01 (1.23)	0.28 (0.88)	0.04 (0.74)
S_6: 9th SMW (26th-Feb.-4th Mar)	5.93 (2.54)	9.58 (3.17)	11.34 (3.44)	10.53 (3.32)	8.94 (3.07)	1.12 (1.27)	0.35 (0.92)	0.10 (0.78)
F test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	NS	NS
S.E. ±	0.10	0.02	0.07	0.09	0.08	0.02	0.05	0.02
C.D. at 5%	0.0.29	0.05	0.21	0.26	0.22	0.05	-	-

*Figures in parentheses are $\sqrt{n}$ +0.5 transformed values. WAS- Weeks after sowing

Table 2: Effect of mulches on okra jassids

Treatments	No. of jassids/3 leaves/plant							
	4th WAS	5th WAS	6th WAS	7th WAS	8th WAS	9th WAS	10th WAS	11th WAS
Sub plot: Mulches								
M_1 : No mulch (control)	7.13 (2.76)	9.22 (3.12)	12.90 (3.66)	10.54 (3.32)	7.24 (2.78)	1.04 (1.24)	0.17 (0.82)	0.07 (0.76)
M_2 : Silver polythene mulch	2.02 (1.59)	4.58 (2.25)	7.29 (2.79)	4.76 (2.29)	3.04 (1.88)	0.96 (1.21)	0.34 (0.92)	0.13 (0.79)
M_3 : White polythene mulch	3.12 (1.90)	6.16 (2.58)	8.54 (3.01)	6.13 (2.58)	4.19 (2.17)	0.99 (1.22)	0.24 (0.86)	0.11 (0.78)
M_4 : Black polythene mulch	4.54 (2.24)	7.19 (2.77)	8.27 (2.96)	7.94 (2.91)	5.35 (2.42)	1.07 (1.25)	0.26 (0.87)	0.09 (0.77)
F test	Sig.	Sig.	Sig.	Sig.	Sig.	NS	NS	NS
S.E. ±	0.11	0.12	0.08	0.10	0.10	0.03	0.03	0.02
C.D. at 5%	0.31	0.34	0.23	0.30	0.30	-	-	-

*Figures in parentheses are $\sqrt{n}$ +0.5 transformed values. WAS- Weeks after sowing

Table 3: Combination effect of sowing dates and mulches on okra jassids

Treatment combinations: Main plot x Sub plot	No. of jassids/3 leaves/plant							
	4th WAS	5th WAS	6th WAS	7th WAS	8th WAS	9th WAS	10th WAS	11th WAS
S_1M_1	4.65 (2.27)	6.12 (2.57)	9.80 (3.21)	7.21 (2.78)	4.30 (2.19)	1.10 (1.26)	0.31 (0.90)	0.19 (0.83)
S_1M_2	1.05 (1.24)	2.09 (1.61)	4.26 (2.18)	2.10 (1.61)	0.85 (1.16)	0.74 (1.11)	0.11 (0.78)	0 (0.71)
S_1M_3	1.33 (1.35)	2.58 (1.76)	5.61 (2.47)	3.30 (1.95)	1.73 (1.49)	0.92 (1.19)	0.12 (0.78)	0.04 (0.73)
S_1M_4	2.08 (1.61)	3.50 (2.00)	7.08 (2.75)	5.05 (2.36)	2.55 (1.75)	1.08 (1.26)	0.13 (0.79)	0.11 (0.78)
S_2M_1	5.89 (2.53)	7.47 (2.82)	11.27 (3.43)	8.63 (3.02)	5.34 (2.42)	1.08 (1.26)	0.31 (0.90)	0.19 (0.83)
S_2M_2	1.05 (1.24)	2.09 (1.61)	4.26 (2.18)	2.10 (1.61)	0.85 (1.16)	0.74 (1.11)	0.11 (0.78)	0.04 (0.73)
S_2M_3	1.33 (1.35)	2.58 (1.76)	5.61 (2.47)	3.30 (1.95)	1.73 (1.49)	0.92 (1.19)	0.13 (0.79)	0.11 (0.78)
S_2M_4	2.08 (1.61)	3.50 (2.00)	7.08 (2.75)	5.05 (2.36)	2.55 (1.75)	0.94 (1.20)	0.17 (0.82)	0.17 (0.82)
S_3M_1	5.89 (2.53)	7.47 (2.82)	11.27 (3.43)	8.63 (3.02)	5.34 (2.42)	0.94 (1.20)	0.20 (0.84)	0.14 (0.80)
S_3M_2	1.33 (1.35)	2.58 (1.76)	5.54 (2.46)	3.30 (1.90)	1.44 (1.39)	0.74 (1.11)	0.11 (0.78)	0.04 (0.73)
S_3M_3	1.37 (1.37)	3.16 (1.91)	5.61 (2.47)	3.30 (1.95)	1.73 (1.49)	0.86 (1.17)	0.13 (0.79)	0.11 (0.78)
S_3M_4	2.08 (1.61)	3.50 (2.00)	7.08 (2.75)	5.05 (2.36)	2.55 (1.75)	0.92 (1.19)	0.17 (0.82)	0.17 (0.82)

S_4M_1	5.89 (2.53)	7.47 (2.82)	11.27 (3.43)	8.63 (3.02)	5.34 (2.42)	1.07 (1.19)	0.20 (0.84)	0.17 (0.82)
S_4M_2	1.37 (1.37)	3.16 (1.91)	5.54 (2.46)	3.11 (1.90)	1.44 (1.39)	0.86 (1.17)	0.12 (0.79)	0.04 (0.73)
S_4M_3	2.08 (1.61)	3.50 (2.00)	6.24 (2.60)	4.11 (2.15)	2.55 (1.75)	0.92 (1.19)	0.13 (0.79)	0.10 (0.77)
S_4M_4	2.43 (1.71)	4.67 (2.27)	7.08 (2.75)	5.05 (2.36)	2.59 (1.76)	0.94 (1.20)	0.17 (0.82)	0.14 (0.80)
S_5M_1	5.89 (2.53)	7.47 (2.82)	11.27 (3.43)	8.63 (3.02)	5.34 (2.42)	1.07 (1.19)	0.40 (0.95)	0.17 (0.82)
S_5M_2	1.37 (1.37)	3.16 (1.91)	5.54 (2.46)	3.11 (1.90)	1.44 (1.39)	0.86 (1.17)	0.12 (0.79)	0.10 (0.77)
S_5M_3	2.43 (1.71)	4.67 (2.27)	6.24 (2.60)	4.11 (2.15)	2.59 (1.76)	0.94 (1.20)	0.17 (0.82)	0.13 (0.80)
S_5M_4	3.54 (2.04)	5.54 (2.46)	8.08 (2.93)	6.50 (2.65)	3.07 (1.89)	1.03 (1.24)	0.20 (0.84)	0.14 (0.80)
S_6M_1	7.02 (2.74)	8.89 (3.06)	12.99 (3.67)	10.10 (3.26)	6.62 (2.67)	1.07 (1.19)	0.40 (0.95)	0.15 (0.81)
S_6M_2	1.37 (1.37)	3.16 (1.91)	5.54 (2.46)	3.11 (1.90)	1.44 (1.39)	0.86 (1.17)	0.12 (0.79)	0.10 (0.77)
S_6M_3	2.43 (1.71)	4.67 (2.27)	6.24 (2.60)	4.11 (2.15)	2.59 (1.76)	1.03 (1.24)	0.20 (0.84)	0.13 (0.80)
S_6M_4	3.54 (2.01)	5.54 (2.46)	8.08 (2.93)	6.50 (2.65)	3.07 (1.89)	1.07 (1.25)	0.31 (0.90)	0.14 (0.80)
F test	Sig.	Sig.	Sig.	Sig.	Sig.	NS	NS	NS
S.E. ±	0.04	0.06	0.10	0.12	0.03	0.06	0.08	0.04
C.D. at 5%	0.12	0.16	0.29	0.34	0.09	-	-	-

*Figures in parentheses are √n +0.5 transformed values. WAS- Weeks after sowing

Conclusion

Date of sowing is one of the best cultural practice use by farmers to escape, avoided the pest infestation on the crop and get appropriate yield as well as income. From the present investigation, it can be concluded as the okra crop was cultivated at early sowing date *i.e*. (12^{th}-18^{th} Nov. and 3^{rd}-9^{th} Dec.) was noticed minimum jassids population as compare to late sown. Similarly, in treatment M_2 (Silver polythene mulch) and M_3 (White polythene mulch) were reported less incidence of jassids as compare to No mulching treatment. The minimum jassids were recorded in treatment combinations S_1M_2 [S_1 (46^{th} SMW, 12^{th}-18^{th} Nov.) + M_2 (Silver polythene mulch)] and S_2M_2 [S_2 (49^{th} SMW, 3^{rd}-9^{th} Dec.) + M_2 (Silver polythene mulch)]. The results proved that the infestation of jassids increased due to without mulching practices and delay in sowing of the crop.

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