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Effect of different fertilizer levels and various mulches on sucking pests infesting okra

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Abstract
The present studies were undertaken at Agronomy farm, College of Agriculture, Dapoli during rabi 2018-19 to evaluate the effect of different fertilizer levels and various mulches on sucking pests infesting okra in the rabi- summer. Results on effect of different levels of fertigation on population of aphids during 4th, 6th, 7th and 8th WAS was minimum (4.06, 11.36, 22.27 and 10.61 respectively) in treatments F_2, F_3, F_1, F_4, respectively. During 5th WAS whitefly population was minimum (0.53) in the treatments F_3 and F_4. During 7th WAS whitefly population lowest (0.57) in the treatment F_2. Whereas, effect of different mulches on population of aphids infesting okra during 4th, 7th, 8th and 10th WAS was minimum (2.94, 17.77, 8.79 and 0.53 respectively) in the treatment M_3. During 5th and 9th WAS population of aphids was minimum (3.33 and 0.53 respectively) in the treatment M_4. The data on effect of different mulches on jassid revealed that during 3rd, 4th, 5th, 6th, 7th, 8th, 9th and 10th WAS the minimum (0.90, 0.87, 2.12, 3.33, 2.66, 3.58, 2.78 and 2.77 respectively) jassid population was recorded in treatment M_3. During 4th, 6th and 9th WAS the minimum number of whiteflies were recorded in the treatment M_3 (0.54, 0.50 and 0.52 respectively). While, the combination effect of fertigation and mulches on aphids during 3rd, 4th, 5th and 8th WAS was lowest (0.52, 2.54, 2.40, 14.82 and 6.15 respectively) in the treatment combinations F_1M_2, F_2M_3, F_2M_4, F_4M_3 and F_3M_3 respectively. Interaction effect of fertigation and mulching on jassids during 3rd, 4th, 5th, 6th, 7th, 8th, 9th, 10th WAS was minimum (0.84, 0.83, 1.89, 2.75, 2.33, 2.85, 0.98 and 2.14 respectively) in the treatment combinations F_3M_3, F_1M_3, F_2M_4, F_2M_3, F_1M_3, F_1M_3, F_4M_3 and F_3M_4 respectively. During 6th WAS the treatment combinations F_1M_3, F_2M_3, F_3M_3 and F_4M_3 recorded minimum whiteflies.

Keywords: Mulch, fertigation, fertilizer levels, aphid, jassid, whitefly

1. Introduction
Okra is widely cultivated as a summer season crop in North India and as a *kharif* and summer season crop in Gujarat, Andhra Pradesh, Karnataka and Tamil Nadu. In India, it is grown over an area of 0.528 M ha with a production of 61.46 MT having productivity 11.6 t ha^{-1}. It contributes 5.8 per cent of the total vegetable area and 3.9 per cent of total country's vegetable production. In Maharashtra, area under this crop is 0.011 M ha with a production of 0.84 lakh MT and productivity is 10.26 t ha^{-1} (Anon., 2017) [2]. Many of the pests occurring on cotton are found to damage okra crop. Okra crop is susceptible to many insect pests from early stage to maturity. There is record of 72 species of insects infesting okra. Among the wide array of insect pests infesting okra crop, **t**he sucking pests such as aphid, *Aphis gossypii* (Glover), leafhopper, *Amrasca biguttula biguttula* (Ishida), and whitefly, *Bemesia tabaci* (Gennadius), are reported to be quite serious during all stages of the crop growth (Kumar *et al.*, 2016) [8]. Aphids and leafhoppers are important sucking pests of the crop which desap the plants, make them weak and reduce the yield and cause about 54.04 per cent losses in okra. Another sucking pests, whitefly, *Bemisia tabaci* (Gennadius) causes economic damage to okra by sucking phloem sap**.** Besides causing direct damage, it also transmits an economically important viral disease caused by Okra yellow vein mosaic virus (OYVMV) resulting in significant yield losses especially when it occurs in the early stages of crop growth (Manju *et al.*, 2018) [10]. 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. 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]. Fertilizers in general are one of the major inputs for increased agricultural productivity.

The form of these inputs can influence pest populations in various agro-ecosystems, depending on the kind of fertilizers used, the crops grown, and the insect pests present. However, excessive nutrient application can also lead to pest problems by increasing the reproduction, longevity and overall fitness of certain pests (Jahn, 2004) [7]. The information on impact of mulching and fertigation on sucking pests infesting okra is scanty in Konkan region of Maharashtra. Therefore, keeping the background in view, the present investigation was undertaken to study effect of fertigation and mulching on sucking pests infesting okra.

2. Material and Methods

A statistically designed field experiment using Strip Plot Design having three replications and four main and four sub treatments was laid out at Department of Agronomy, College of Agriculture, Dapoli to evaluate the effect of fertigation and mulching on sucking pests infesting 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**
Crop	:	Okra
Variety	:	Hybrid Mahyco-10
Design	:	Strip Plot Design
Replications	:	Three
Spacing	:	45 cm x 30 cm
Experimental Area	:	Gross area - 4.20 m x 3.6 m and Net area - 3.60 m x 2.70 m

Treatment details

I. Main plots (fertilizers levels):
F_1: 120% RDF through fertigation in 14 splits
F_2: 100% RDF through fertigation in 14 splits
F_3: 80% RDF through fertigation in 14 splits
F_4: Soil application of 100%RDF at recommended time schedule
II. Sub plots (Mulches):
M_1:Black polythene mulch (25µ)
M_2:Silver polythene mulch (25µ)
M_3:Paddy straw mulch (5 tons ha -1)
M_4:No mulch (Control)

2.1 Method of recording observations

Observations on sucking pests *viz*., aphids, jassids and whiteflies were recorded at weekly interval. Five plants were selected randomly from each treatment plot. The sucking pests were counted from three leaves i.e. top, middle and bottom per plant at morning so as to count the pest. The data recorded from five plants was averaged as number of pests per three leaves per plant and converted in to square root transformation and analyzed statistically.

3. Results and Discussion

3.1 Effect of fertigation on sucking pests infesting Okra

3.1.1 Effect of fertigation on aphids infesting okra

The numbers of aphids per three leaves per plant in the different fertilizer treatments were recorded at weekly interval and the results are presented in Table 1. During 3rd, 5th, 9th, 10th weeks after sowing (WAS) data on aphid population found to be non-significant. During 4th WAS, results revealed that the treatment F_2 (100% RDF through fertigation in 14 splits) recorded minimum (4.06) aphids population which was at par with the treatments F_1 (120% RDF through fertigation in 14 splits) and F_4(Soil application of 100% RDF at recommended time schedule) that recorded 4.57 and 4.64, respectively. The highest aphid population (5.69) was recorded on the treatment F_3 (80% RDF through fertigation in 14 splits). Data during 6th WAS revealed that the mean aphid population was lowest (11.36) in the treatment F_3 (80% RDF through fertigation in 14 splits) which was at par with the treatments F_2 (100% RDF through fertigation in 14 splits) and F_4 (Soil application of 100% RDF at recommended time schedule) which recorded 12.19 and 13.57 aphids respectively. The highest (13.92) aphid population was recorded on the treatment F_1 (120% RDF through fertigation in 14 splits). During 7th WAS, results revealed that the treatment F_1 (120% RDF through fertigation in 14 splits) recorded minimum aphid population (22.27) which was at par with the treatments F_4 (Soil application of 100% RDF at recommended time schedule) and F_3 (80% RDF through fertigation in 14 splits) which recorded 22.45 and 25.91, respectively. The highest aphid population (27.32) was recorded on the treatment F_2 (100% RDF through fertigation in 14 splits). Data during 8th WAS revealed that the mean aphid population was lowest (10.61) in the treatment F_4 (Soil application of 100% RDF at recommended time schedule) which was at par with the treatments F_1 (120% RDF through fertigation in 14 splits) and F_3 (80% RDF through fertigation in 14 splits) which recorded 11.62 and 12.89 aphids respectively. The highest (13.50) aphid population was recorded on the treatment F_2 (100% RDF through fertigation in 14 splits). The mean aphid population per three leaves per plant was mild during the course of investigation and that might be a reason for non- significant data during most of the weeks. The results were more or less in conformity with (Scriber and Hauck, 1984) [13] who reported that increase in nutrition in plants increases its susceptibility to pests. These results are in accordance with (Simpson *et al*., 1990) [14] who revealed that excessive application of nitrogenous fertilizers increased the incidence of insect pests by altering morphological, biochemical and physiological characters of host plants through host selection and ecological fitness such as survival, growth, fecundity and significant reduction of host resistance against herbivores improving the nutritional conditions for herbivores.

Table 1: Effect of fertigation on aphids infesting okra

Treatments	**No. of aphids/three leaves/plant**							
	3rd WAS	**4th WAS**	**5th WAS**	**6th WAS**	**7th WAS**	**8th WAS**	**9th WAS**	**10th WAS**
Main plot: Fertilizer								
F1: 120% RDF through fertigation in 14 splits	0.70 (0.84)	4.57 (2.14)	5.53 (2.35)	13.92 (3.73)	22.27 (4.72)	11.62 (3.41)	0.58 (0.76)	0.55(0.74)
F2: 100% RDF through fertigation in 14 splits	0.73 (0.85)	4.06 (2.01)	4.72 (2.17)	12.19 (3.49)	27.32 (5.23)	13.50 (3.67)	0.58 (0.76)	0.54 (0.74)
F3: 80% RDF through fertigation in 14 splits	0.71 (0.84)	5.69 (2.39)	5.42 (2.33)	11.36 (3.37)	25.91 (5.09)	12.89 (3.59)	0.60 (0.77)	0.54 (0.73)
F4: Soil application of 100% RDF at recommended time schedule	0.84 (0.91)	4.64 (2.15)	4.70 (2.17)	13.57 (3.68)	22.45 (4.74)	10.61 (3.26)	0.57 (0.75)	0.53 (0.73)

S.E. ±	0.03	0.10	0.10	0.11	0.15	0.10	0.02	0.03
C.D. at 5%	NS	0.29	NS	0.32	0.44	0.32	NS	NS

*Figures in parentheses are $\sqrt{n+1}$ transformed values WAS: Week after Sowing

3.1.2 Effect of fertigation on jassids infesting okra.

The numbers of jassids per three leaves per plant under different fertilizer treatments were recorded at weekly interval and the results are presented in Table 2. During 3rd, 4th, 5th, 6th, 7th, 8th, 9th and 10th WAS results revealed that the there was no any significant difference between various treatments of fertigation and the mean jassids population. The mean jassid population per three leaves per plant was meager during the course of investigation and that might be a reason for non-significant data during all weeks. (Pathan *et al.*, 2017) [12] reported that increasing supply of N improved the growth of okra plants by enhancing the photosynthetic pigment and photosynthetic efficiency and also significantly increased the number of leafhoppers on okra crop.

Table 2: Effect of fertigation on jassids infesting okra

Treatments	No. of jassids/three leaves/plant							
	3rd WAS	4th WAS	5th WAS	6th WAS	7th WAS	8th WAS	9th WAS	10th WAS
Main plot: Fertilizer								
F_1: 120% RDF through fertigation in 14 splits	1.82 (1.35)	1.50 (1.22)	3.05 (1.75)	4.59 (2.14)	4.11 (2.03)	8.26 (2.87)	6.41 (2.53)	4.06 (2.02)
F_2: 100% RDF through fertigation in 14 splits	1.74 (1.32)	1.30 (1.14)	2.90 (1.70)	4.48 (2.12)	4.07 (2.02)	7.01 (2.65)	3.58 (1.89)	3.14 (1.77)
F_3: 80% RDF through fertigation in 14 splits	1.71 (1.31)	1.43 (1.24)	3.16 (1.78)	4.71 (2.17)	4.74 (2.18)	6.61 (2.57)	4.95 (2.22)	3.38 (1.84)
F_4: Soil application of 100% RDF at recommended time schedule	1.54 (1.24)	1.39 (1.18)	2.90 (1.70)	4.39 (2.09)	4.85 (2.20)	9.04 (3.01)	5.49 (2.34)	4.13 (2.03)
S.E. ±	0.06	0.05	0.04	0.06	0.17	0.20	0.22	0.26
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS

3.1.3 Effect of fertigation on whitefly infesting okra

The numbers of whiteflies per three leaves per plant under different fertilizer treatments were recorded at weekly interval and the results are presented in Table 3. During 3rd, 4th, 6th, 8th, 9th and 10th WAS data on whitefly population was found to be non-significant. Data on observation of whitefly recorded in 5th WAS showed that the mean whitefly population was found minimum (0.53) on the treatments F_3 (80% RDF through fertigation in 14 splits) and F_4(Soil application of 100% RDF at recommended time schedule) and these treatments were at par with the treatment F_1(120% RDF through fertigation in 14 splits) which recorded 0.55. The maximum whitefly population (0.57) was recorded on the treatment F_2 (100% RDF through fertigation in 14 splits). Data on observation of whiteflies recorded in the 7th WAS showed that the lowest whitefly population (0.57) was found on the treatment F_2 (100% RDF through fertigation in 14 splits) which was at par with the treatment F_3 (80% RDF through fertigation in 14 splits) that recorded 0.60. The highest whitefly population (0.64) was recorded on both the treatments F_1 (120% RDF through fertigation in 14 splits) and F_4 (Soil application of 100% RDF at recommended time schedule). The findings of the present study are similar to that of the results obtained by (Yadav *et al.*, 2014) [16] who concluded that application of higher than recommended dose of nitrogenous fertilizers significantly increased the whitefly population over its recommended dose. (El-zahi *et al.*, 2012) [4] reported that phosphorous fertilizer proved to be very effective in lowering the incidence of whitefly, *Bemesia tabaci*.

Table 3: Effect of fertigation on whiteflies infesting okra

Treatments	No. of whiteflies/three leaves/plant							
	3rd WAS	4th WAS	5th WAS	6th WAS	7th WAS	8th WAS	9th WAS	10th AS
Main plot: Fertilizer								
F_1: 120% RDF through fertigation in 14 splits	0.57 (0.76)	0.68(0.82)	0.55 (0.74)	1.44 (1.20)	0.64 (0.80)	0.60 (0.78)	0.58 (0.76)	0.54 (0.73)
F_2: 100% RDF through fertigation in 14 splits	0.55 (0.74)	0.65 (0.81)	0.57 (0.76)	1.36 (1.17)	0.57 (0.76)	0.69 (0.83)	0.67 (0.82)	0.54 (0.74)
F_3: 80% RDF through fertigation in 14 splits	0.58 (0.76)	0.68 (0.83)	0.53 (0.73)	1.41 (1.19)	0.60 (0.77)	0.64 (0.80)	0.72 (0.85)	0.64 (0.80)
F_4: Soil application of 100% RDF at recommended time schedule	0.57 (0.76)	0.72 (0.85)	0.53 (0.73)	1.28 (1.13)	0.64 (0.80)	0.67 (0.82)	0.66 (0.81)	0.51 (0.71)
S.E. ±	0.01	0.02	0.01	0.06	0.01	0.03	0.04	0.04
C.D. at 5%	NS	NS	0.03	NS	0.03	NS	NS	NS

*Figures in parentheses are $\sqrt{n+1}$ transformed values WAS: Week After Sowing

3.2 Effect of mulching on sucking pests infesting okra

3.2.1 Effect of mulching on aphids infesting okra

The numbers of aphids per three leaves per plant in the different mulching treatments were recorded at weekly interval and the results are presented in Table 4. During 3rd and 6th WAS data on aphid population was found to be non-significant. The observations recorded at 4th WAS indicated that the treatment M_3 (Paddy straw mulch) was found to be the effective treatment by recording 2.94 and was at par with the treatment M_4 (No mulch) which recorded 4.35. The maximum (7.15) aphids were observed on the treatment M_1 (Black polythene mulch). Data during 5th WAS revealed that the minimum aphid population (3.33) was recorded on the treatment M_4 (No mulch).The next best treatment was M_3 (paddy straw mulch) which recorded 5.34 aphids. The highest aphid population (6.36) was recorded in the treatment M_1 (Black polythene mulch). The observations recorded at7th WAS showed minimum (17.77) numbers of aphids in the treatment M_3 (Paddy straw mulch) and was at par with the treatmentM_2 (Silver polythene mulch) which recorded 20.21 aphids. The highest numbers of aphids (33.76) were observed in the treatmentM_4 (No mulch). Data during 8th WAS revealed

that the least (8.79) population of aphids were recorded in M_3 (Paddy Straw mulch) which was found be significantly superior over rest of the treatments. The highest (15.75) aphid population was recorded in treatment M_4 (No mulch). During 9th WAS data on aphid population showed that minimum aphid population (0.53) was recorded in the treatment M_4 which was at par with the treatment M_3 and M_1 that recorded 0.56 and 0.58, respectively. The highest aphid population (0.67) was recorded in the treatment M_2 (silver polythene mulch). Data on observation of aphids recorded in 10th WAS showed that the mean aphid population ranged between 0.50 to 0.59.The treatment M_3 (Paddy straw mulch) showed minimum number of aphids 0.50 and was at par with the treatment M_2 (Silver polythene mulch) and M_4(No mulch)which recorded 0.52 and 0.55, respectively. The maximum number of aphids (0.59) were recorded on the treatment M_1 (Black polythene mulch). The above results were more or less in accordance with (Harpez, 1982) [6] who reported that mulches reflect short wave UV light which confuse and repels incoming aphids, thus reducing their incidence on plants. The overall results of the effect of mulches on aphid infestation in okra revealed that the paddy straw mulch was found to be best for repelling aphids followed by silver polythene mulch whereas, black polythene mulch harboured more number of aphids. The results of the present finding are in accordance with the results of the earlier workers. (Liewehr and Cranshaw, 1991) [9] reported that rice and wheat straw mulches were effective i n repelling aphids and thus reducing the incidence of aphids in squash melon. (Summers, 1990) [15] Compared the efficacy of silver mulch and polythene mulch and concluded that silver-pigmented mulches were more effective in repelling aphids and delaying virus onset than white-pigmented mulches. (Farias and Orozco, 1997) [5] Studied the effect of polyethylene mulch on aphid populations on watermelon and concluded that use of mulches delays aphid population increase and reduced the need for insecticides targeted for aphid control.

Table 4: Effect of mulches on aphids infesting okra

Treatments	No. of aphids/three leaves/plant							
	3rd WAS	4th WAS	5th WAS	6th WAS	7th WAS	8th WAS	9th WAS	10th WAS
Sub plot: Mulches								
M_1: Black polythene mulch (25µ)	0.87 (0.93)	7.15 (2.67)	6.36 (2.52)	12.16 (3.49)	27.59 (5.25)	14.04 (3.75)	0.58 (0.76)	0.59 (0.77)
M_2: Silver polythene mulch (25µ)	0.61 (0.78)	4.92 (2.22)	5.58 (2.36)	12.78 (3.58)	20.21 (4.50)	10.55 (3.25)	0.67 (0.82)	0.52 (0.72)
M_3: Paddy straw mulch (5 tons ha -1)	0.81 (0.90)	2.94 (1.71)	5.34 (2.31)	14.00 (3.74)	17.77 (4.22)	8.79 (2.97)	0.56 (0.75)	0.50 (0.71)
M_4: No mulch (Control)	0.70 (0.84)	4.35 (2.09)	3.33 (1.82)	12.06 (3.47)	33.76 (5.81)	15.75 (3.97)	0.53 (0.73)	0.55 (0.74)
S.E. ±	0.06	0.14	0.14	0.10	0.09	0.07	0.02	0.01
C.D. at 5%	NS	0.46	0.45	NS	0.26	0.19	0.05	0.02

3.2.2 Effect of mulching on jassids infesting okra

The numbers of jassids per three leaves per plant in the different mulching treatments were recorded at weekly interval from 3rd week after sowing to 10th week after sowing and the results are presented in Table 5. The observations recorded at 3rd WAS indicated that the treatment paddy straw mulch (M_3) was found to be effective treatment by recording 0.90 jassids and was at par with the treatment (M_4) no mulch which recorded 1.34. The maximum (2.57) jassids were observed in the treatment (M_2) silver polythene mulch. The data on mean population of jassids noted during 4th WAS showed that the population was in the range of 0.87 to 1.96. The lowest population of jassid (0.87) was recorded in the treatment (M_3) paddy straw mulch and this was at par with the treatment (M_4) which recorded 1.20. The treatment Silver polythene mulch (M_2) and Black polythene mulch (M_1) recorded 1.73 and 1.96 jassids respectively. Data on observation of jassids recorded in 5th WAS the treatment (M_3) Paddy straw mulch showed the minimum (2.12) jassid population which was at par with the treatment (M_4) which recorded 2.29 jassids. Data regarding jassid population during 6th WAS indicated that the treatment M_3 (Paddy straw mulch) recorded lowest (3.33) jassids and was at par with M_4 (no mulch) which recorded 3.35. The observations recorded at 7thWAS indicated that the treatment paddy straw mulch (M_3) was found to be effective treatment by recording 2.66 jassids and was at par with the treatment (M_4) no mulch which recorded 3.46 jassids. The maximum (7.53) jassids were observed in the treatment (M_2) silver polythene mulch. Data on observation of jassids recorded in 8th WAS was in the range of 3.58 to 12.03. The treatment (M_3) Paddy straw mulch showed the minimum jassid population of 3.58. The next best treatment was (M_1) Black polythene mulch that recorded 8.17 jassids which was at par with the treatment (M_2) Silver polythene mulch which recorded 8.29 jassids. The maximum jassid population (12.03) was observed in the treatment M_4(no mulch). Data regarding jassid population during 9th WAS indicated that the treatment M_3 (Paddy straw mulch) recorded the lowest (2.78) jassid population and was at par with M_4 (no mulch) which recorded 3.52 jassids. The maximum population of jassids (7.45) was recorded in M_1 (Black polythene mulch). Data on observation of jassids recorded in 10th WAS showed that minimum jassid population (2.77) was found in the treatment M_3 (Paddy straw mulch) which was at par with the treatments M_4 (No mulch) and M_2 (Silver polythene mulch) which recorded 3.47 and 3.60 jassids. The highest jassids population (4.99) was found in the treatment M_1 (Black polythene mulch). The overall results of the present investigation revealed that the paddy straw mulch was found to be the best treatment which harboured less number of jassids resulting in to less incidence. The results obtained was in accordance with (Liewehr and Cranshaw, 1991) [9] who studied the effect of organic mulches and reported that rice and wheat straw mulches were effective in repelling sucking pests and thus reducing the incidence of sucking pests in squash melon. (Dahiwalkar, 2018) [3] Who studied the effect of different sowing dates and mulches on pests infesting okra and the results indicated that aphid and jassids population was minimum in silver polythene mulch.

Table 5: Effect of mulches on jassids infesting okra

Treatments	No. of jassid/three leaves/plant							
	3rd WAS	4th WAS	5th WAS	6th WAS	7th WAS	8th WAS	9th WAS	10th WAS
Sub plot: Mulches								
M_1: Black polythene mulch (25µ)	2.26 (1.50)	1.96 (1.40)	3.90 (1.97)	5.64 (2.37)	4.79 (2.19)	8.17 (2.86)	7.45 (2.73)	4.99 (2.23)
M_2: Silver polythene mulch (25µ)	2.57 (1.60)	1.73 (1.31)	3.97 (1.99)	6.21 (2.49)	7.53 (2.74)	8.29 (2.88)	7.40 (2.72)	3.60 (1.90)
M_3: Paddy straw mulch (5 tons ha -1)	0.90 (0.95)	0.87 (0.94)	2.12 (1.45)	3.33 (1.83)	2.66 (1.63)	3.58 (1.89)	2.78 (1.67)	2.77 (1.67)
M_4: No mulch (Control)	1.34 (1.16)	1.20 (1.09)	2.29 (1.51)	3.35 (1.83)	3.46 (1.86)	12.03 (3.47)	3.52 (1.88)	3.47(1.86)
S.E. ±	0.13	0.08	0.06	0.09	0.13	0.20	0.10	0.14
C.D. at 5%	0.38	0.23	0.17	0.26	0.38	0.59	0.29	0.41

3.2.3 Effect of mulching on Whitefly infesting okra

The numbers of whiteflies per three leaves per plant in the different treatments of mulching were recorded at weekly interval and the results are presented in Table 6. During 3rd 5th, 7th, 8th and 10th WAS, data on whitefly population was found to be non-significant. At 4th week after sowing, minimum (0.54) numbers of whiteflies were recorded in the treatment M_3 (Paddy straw mulch) and it was followed by treatment (M_4) no mulch (0.63). The highest numbers of white flies (0.89) were observed in the treatmentM_2 (Silver polythene mulch). During 6th WAS, the minimum numbers of whiteflies (0.50) were recorded in the treatment M_3 (Paddy straw mulch) followed by M_4(No mulch) which recorded 0.85 whiteflies. The highest numbers of whiteflies (3.12) were observed in the treatment M_2 (Silver polythene mulch). The data at 9th WAS revealed that the treatment M_3 (Paddy straw mulch) and treatment M_4 (No mulch) recorded 0.52 and 0.59 whiteflies, respectively and both these treatments were at par with each other. The maximum (0.83) whiteflies were observed in treatment M_1 (Black polythene mulch). The overall results of the present study revealed that the whitefly population was less in paddy straw mulch and it was found to be the best treatment for reducing whitefly incidence in *rabi*-summer okra. The results obtained were in accordance with (Liewehr and Cranshaw, 1991) [9] who studied the effect of organic mulches and reported that rice and wheat straw mulches were effective in repelling sucking pests and thus reducing the incidence of sucking pests in squash melon. Whereas, (Mario *et al*., 1992) [11] reported that the use of mulches reduced the incidence of silver leaf whitefly than bare soil in cantaloupe.

Table 6: Effect of mulches on whiteflies infesting okra

Treatments	No. of whitefly/three leaves/plant							
	3rd WAS	4th WAS	5th WAS	6th WAS	7th WAS	8th WAS	9th WAS	10th WAS
Sub plot: Mulches								
M_1: Black polythene mulch (25µ)	0.59 (0.77)	0.81 (0.90)	0.54 (0.73)	1.65 (1.28)	0.59 (0.77)	0.68 (0.83)	0.83 (0.91)	0.59 (0.77)
M_2: Silver polythene mulch (25µ)	0.62 (0.78)	0.89 (0.94)	0.54 (0.73)	3.12 (1.77)	0.62 (0.79)	0.65 (0.81)	0.70 (0.84)	0.50 (0.71)
M_3: Paddy straw mulch (5 tons ha -1)	0.54 (0.74)	0.54 (0.73)	0.54 (0.73)	0.50 (0.71)	0.62 (0.79)	0.61 (0.78)	0.52 (0.72)	0.58 (0.76)
M_4: No mulch (Control)	0.54(0.73)	0.63 (0.80)	0.57 (0.75)	0.85 (0.92)	0.61 (0.78)	0.66 (0.81)	0.59 (0.77)	0.51 (0.71)
S.E. ±	0.02	0.02	0.01	0.09	0.03	0.04	0.02	0.03
C.D. at 5%	NS	0.05	NS	0.26	NS	NS	0.05	NS

3.3 Interaction effect of fertigation and mulching on sucking pests infesting okra

3.3.1 Interaction effect of fertigation and mulching on aphids infesting okra

Data on interaction effect of fertigation and mulching on number of aphids per three leaves per plant were recorded at weekly intervals and presented in Table 7. Interaction effect of fertigation and mulching during 3rd WAS showed that the treatment combination F_1M_2 (120% RDF through fertigation + Silver polythene mulch)recorded lowest aphid population 0.52 aphids which was at par with the treatments F_1M_1(120% RDF through fertigation + Black polythene mulch), F_1M_4(120% RDF through fertigation + No mulch), F_2M_2(100% RDF through fertigation + Silver polythene mulch), F_2M_4 (100% RDF through fertigation + No mulch), F_3M_2(80% RDF through fertigation + Silver polythene mulch), F_3M_3(80% RDF through fertigation + Paddy straw mulch), F_3M_4 (80% RDF through fertigation + No mulch) and F_4M_2 (Soil application of RDF+ Silver polythene mulch) which recorded 0.68, 0.72, 0.56, 0.61, 0.67, 0.63, 0.67 and 0.69 aphids per three leaves per plant respectively. The data on interaction effect of fertigation and mulching during 4th WAS revealed that the treatment combination F_2M_3(100% RDF through fertigation + Paddy straw mulch) recorded minimum aphid population(2.54) which was at par with the treatments F_1M_3(120% RDF through fertigation + Paddy straw mulch), F_1M_4(120% RDF through fertigation + No mulch), F_2M_2(100% RDF through fertigation + Silver polythene mulch), F_3M_3(80% RDF through fertigation + Paddy straw mulch) and F_4M_3(Soil application of RDF+ Paddy straw mulch) which recorded 3.16,3.77,3.50,3.15 and 2.94 aphids per three leaves per plant. The next best treatment was F_4M_4 (Soil application of RDF+ No mulch) which recorded 4.12 aphids. The highest aphid (8.44) population was recorded in the treatment F_3M_1 (80% RDF through fertigation +Black polythene mulch). During 5th WAS, minimum aphid population (2.40) was recorded in the treatment F_2M_4 (100% RDF through fertigation + No mulch) which was at par with the treatments F_1M_4(120% RDF through fertigation + No mulch), F_2M_3(100% RDF through fertigation + Paddy straw mulch), F_3M_4 (80% RDF through fertigation + No mulch), F_4M_1 (Soil application of RDF+ Black polythene mulch) and F_4M_4(Soil application of RDF+ No mulch) which recorded 4.52, 4.14,3.41, 4.77 and 3.14 aphids/three leaves/plant. The highest aphid population (8.33 aphids/3 leaves/plant) was recorded in the treatment F_3M_1(80% RDF through fertigation +Black polythene mulch). Data on observation of aphids recorded in 6th WAS showed that the mean aphid population was non-significant on ranged between 10.56 and 14.59. The observation during7th WAS revealed that treatment combination F_4M_3(Soil application of RDF+ Paddy straw mulch) recorded the lowest number of

aphids (14.82) which was at par with the treatments F_1M_2 (120% RDF through fertigation + Silver polythene mulch), F_1M_3(120% RDF through fertigation + Paddy straw mulch), F_2M_2(100% RDF through fertigation + Silver polythene mulch), F_3M_3(80% RDF through fertigation + Paddy straw mulch) and F_4M_2 (Soil application of RDF+ Silver polythene mulch) which recorded 19.35, 16.15, 20.02, 17.33 and 19.38 aphids, respectively. The highest aphid population (39.78) was recorded in the treatment F_2M_4 (100% RDF through fertigation + No mulch). During 8th WAS, aphid population was in the range of 6.15 to 21.60.The lowest population(6.15) was observed on the treatment combination F_3M_3(80% RDF through fertigation + Paddy straw mulch) which was at par with F_4M_3(Soil application of RDF+ Paddy straw mulch), F_2M_2(100% RDF through fertigation + Silver polythene mulch), F_1M_2(120% RDF through fertigation + Silver polythene mulch), F_1M_3(120% RDF through fertigation + Paddy straw mulch), F_4M_2 (Soil application of RDF+ Silver polythene mulch), F_4M_4(Soil application of RDF+ No mulch), F_3M_2(80% RDF through fertigation + Silver polythene mulch), F_1M_4(120% RDF through fertigation + No mulch), F_2M_3(100% RDF through fertigation + Paddy straw mulch), F_1M_1(120% RDF through fertigation + Black polythene mulch), F_2M_1(100% RDF through fertigation + Black polythene mulch) which recorded 6.40, 9.80, 9.86, 10.41, 11.43, 11.64, 13.05, 13.14, 13.37 and 13.79 aphid population respectively. The highest number of aphids were recorded in the treatment combination F_3M_4 (80% RDF through fertigation + No mulch) that recorded21.60 aphids. During 9th and 10th WAS, data on aphid population was found to be non-significant. The overall results of the present investigation showed that the combination of higher doses of N, P and K in different splits along with paddy straw and silver polythene mulch resulted into reduced aphid population on *rabi*-summer okra. The literature pertaining to the same aspects was not available therefore could not quoted.

Table 7: Interaction effect of fertigation and mulching on aphids infesting okra

Treatment combinations: Main plot x sub plot	No. of aphids/3 leaves/per plant							
	3rd WAS	4th WAS	5th WAS	6th WAS	7th WAS	8th WAS	9th WAS	10thWAS
F_1M_1	0.68 (0.82)	6.86 (2.62)	5.80 (2.41)	12.78 (3.58)	27.71 (5.26)	13.37 (3.66)	0.63 (0.79)	0.58 (0.76)
F_1M_2	0.52 (0.72)	4.90 (2.21)	5.62 (2.37)	14.59 (3.82)	19.35 (4.40)	9.86 (3.14)	0.58 (0.76)	0.52 (0.72)
F_1M_3	0.93 (0.96)	3.16 (1.78)	6.25 (2.50)	13.10 (3.62)	16.15 (4.02)	10.41 (3.23)	0.56(0.75)	0.50 (0.71)
F_1M_4	0.72 (0.85)	3.77 (1.94)	4.52 (2.13)	13.30 (3.65)	26.97 (5.19)	13.05 (3.61)	0.56 (0.75)	0.58 (0.76)
F_2M_1	0.91 (0.96)	6.11 (2.47)	6.80 (2.61)	11.98 (3.46)	28.07 (5.30)	13.79 (3.71)	0.54 (0.74)	0.50 (0.71)
F_2M_2	0.56 (0.75)	3.50 (1.87)	6.23 (2.50)	12.50 (3.54)	20.02 (4.47)	9.80 (3.13)	0.61 (0.78)	0.56 (0.75)
F_2M_3	0.85 (0.92)	2.54 (1.59)	4.14 (2.03)	13.00 (3.61)	23.31 (4.83)	13.14 (3.62)	0.54 (0.74)	0.50 (0.71)
F_2M_4	0.61 (0.78)	4.51 (2.12)	2.40 (1.55)	11.31 (3.36)	39.78 (6.31)	17.91 (4.23)	0.50 (0.71)	0.61 (0.78)
F_3M_1	0.87 (0.93)	8.44 (2.91)	8.33 (2.89)	11.10 (3.33)	28.91 (5.38)	14.59 (3.82)	0.63 (0.79)	0.67 (0.82)
F_3M_2	0.67 (0.82)	6.84 (2.62)	5.28 (2.30)	10.56 (3.25)	22.17 (4.71)	11.64 (3.41)	0.58 (0.76)	0.50 (0.71)
F_3M_3	0.63 (0.79)	3.15 (1.78)	5.21 (2.28)	12.44 (3.53)	17.33 (4.16)	6.15 (2.48)	0.50 (0.71)	0.50 (0.71)
F_3M_4	0.67 (0.82)	5.05 (2.25)	3.41 (1.85)	11.39 (3.38)	37.37 (6.11)	21.60 (4.65)	0.54 (0.74)	0.50 (0.71)
F_4M_1	1.04 (1.02)	7.28 (2.70)	4.77 (2.18)	12.83 (3.58)	25.73 (5.07)	14.45 (3.80)	0.54 (0.74)	0.64 (0.80)
F_4M_2	0.69 (0.83)	4.71 (2.17)	5.24 (2.29)	11.77 (3.43)	19.38 (4.40)	10.98 (3.31)	0.60 (0.78)	0.50 (0.71)
F_4M_3	0.83 (0.91)	2.94 (1.72)	5.87 (2.42)	14.45 (3.80)	14.82 (3.85)	6.40 (2.53)	0.64 (0.80)	0.50 (0.71)
F_4M_4	0.80 (0.89)	4.12 (2.03)	3.14 (1.77)	12.30 (3.51)	31.68 (5.63)	11.43 (3.38)	0.50 (0.71)	0.50 (0.71)
S.E. ±	0.06	0.14	0.23	0.22	0.27	0.42	0.04	0.04
C.D. at 5%	0.17	0.40	0.68	NS	0.79	1.25	NS	NS

3.3.2 Interaction effect of fertigation and mulching on jassids infesting okra

Data on interaction effect of fertigation and mulching on number of jassids per three leaves per plant were recorded at weekly interval and presented in Table 8. The observations recorded on interaction effect of fertigation and mulching on jassids during 3rdWAS showed that the treatment combination F_3M_3(80% RDF through fertigation + Paddy straw mulch) recorded lowest jassid population (0.84) which was at par with the treatments F_1M_3(120% RDF through fertigation + Paddy straw mulch), F_1M_4(120% RDF through fertigation + No mulch), F_2M_3(100% RDF through fertigation + Paddy straw mulch), F_3M_4 (80% RDF through fertigation + No mulch), F_4M_3 (Soil application of RDF+ Paddy straw mulch) and F_4M_4(Soil application of RDF+ No mulch) which recorded 0.89, 1.25, 0.95, 1.30, 0.92 and 1.03 jassids, respectively. The highest jassid population (2.77) was recorded in the treatment F_1M_1(120% RDF through fertigation + Black polythene mulch). The data during 4thWAS revealed that treatment combination F_1M_3(120% RDF through fertigation + Paddy straw mulch) recorded minimum jassid population(0.83) which was at par with the treatments F_2M_2(100% RDF through fertigation + Silver polythene mulch),F_2M_3(100% RDF through fertigation + Paddy straw mulch), F_2M_4 (100% RDF through fertigation + No mulch), F_3M_3(80% RDF through fertigation + Paddy straw mulch), F_3M_4 (80% RDF through fertigation + No mulch), F_4M_2(Soil application of RDF+ silver polythene mulch), F_4M_3 (Soil application of RDF+ Paddy straw mulch) and F_4M_4(Soil application of RDF+ No mulch) which recorded 1.43, 0.85, 0.99, 0.98, 0.99, 1.44, 0.85 and 1.37 jassids, respectively. The highest jassid population 2.12 jassids was recorded in the treatment F_2M_1 (100% RDF through fertigation + Black polythene mulch). During 5th WAS, results revealed that the treatment combination F_2M_4 (100% RDF through fertigation + No mulch) recorded minimum jassid population (1.89) which was at par with the treatments F_1M_3(120% RDF through fertigation + Paddy straw mulch), F_2M_3(100% RDF through fertigation + Paddy straw mulch), F_3M_3(80% RDF through fertigation + Paddy straw mulch), F_3M_4 (80% RDF through fertigation + No mulch), F_4M_3 (Soil application of RDF+ Paddy straw mulch) and F_4M_4(Soil application of RDF+ No mulch) which recorded 2.10, 2.05, 2.32, 2.37, 1.99 and 2.29 jassids, respectively. The highest jassid population (4.21) was recorded in the treatment F_3M_1 (80% RDF through fertigation + Black polythene mulch). Data on observation of jassids recorded in 6th WAS showed that treatment combination

F_2M_3(100% RDF through fertigation + Paddy straw mulch) recorded minimum jassid population (2.75) which was at par with the treatments F_1M_3(120% RDF through fertigation + Paddy straw mulch), F_1M_4(120% RDF through fertigation + No mulch), F_2M_4 (100% RDF through fertigation + No mulch), F_3M_3(80% RDF through fertigation + Paddy straw mulch), F_3M_4 (80% RDF through fertigation + No mulch), F_4M_3 (Soil application of RDF+ Paddy straw mulch) and F_4M_4(Soil application of RDF+ No mulch) which recorded 3.69, 3.37, 3.25, 3.73, 3.66, 3.21 and 3.13 jassids, respectively. The highest jassid population (6.65) was recorded in the treatment F_4M_2 (Soil application of RDF+ Silver polythene mulch). Data on during7th WAS showed that the treatment combination F_1M_3(120% RDF through fertigation + Paddy straw mulch) recorded 2.33 jassids which was at par with the treatments F_1M_4(120% RDF through fertigation + No mulch), F_2M_3(100% RDF through fertigation + Paddy straw mulch), F_2M_4(100% RDF through fertigation + No mulch), F_3M_3(80% RDF through fertigation + Paddy straw mulch), F_4M_3(Soil application of RDF+ Paddy straw mulch) and F_4M_4(Soil application of RDF+ No mulch) which recorded 2.79, 2.56, 2.72, 2.50, 3.29 and 3.79 jassids, respectively. The highest jassid population (8.88) was observed on the treatment F_3M_2 (80% RDF through fertigation + Silver polythene mulch). During 8th WAS, treatment combination F_1M_3(120% RDF through fertigation + Paddy straw mulch) recorded minimum (2.85) which was at par with the treatments F_1M_1(120% RDF through fertigation + Black polythene mulch), F_1M_2(120% RDF through fertigation + Silver polythene mulch), F_2M_1(100% RDF through fertigation + Black polythene mulch), F_2M_2(100% RDF through fertigation + Silver polythene mulch), F_2M_4(100% RDF through fertigation + No mulch), F_3M_1(80% RDF through fertigation + Black polythene mulch), F_3M_3(80% RDF through fertigation + Paddy straw mulch),F_3M_4 (80% RDF through fertigation + No mulch) and F_4M_3(Soil application of RDF+ Paddy straw mulch) which recorded 8.11, 7.10, 8.12, 6.71, 3.41, 6.91, 3.76, 6.74 and 4.40 jassids, respectively. The highest jassid population (18.48) was recorded in the treatment combination F_1M_4(120% RDF through fertigation + No mulch). During 9th WAS, data on jassid population recorded on various treatment combinations revealed that minimum jassid population(0.98) was recorded in the treatment combination F_4M_3(Soil application of RDF+ Paddy straw mulch) which was at par with the F_1M_3(120% RDF through fertigation + Paddy straw mulch), F_1M_4(120% RDF through fertigation + No mulch), F_2M_1(100% RDF through fertigation + Black polythene mulch), F_2M_2(100% RDF through fertigation + Silver polythene mulch), F_2M_3(100% RDF through fertigation + Paddy straw mulch), F_2M_4(100% RDF through fertigation + No mulch), F_3M_1(80% RDF through fertigation + Black polythene mulch), F_3M_3(80% RDF through fertigation + Paddy straw mulch), F_3M_4 (80% RDF through fertigation + No mulch) and F_4M_4(Soil application of RDF+ No mulch) which recorded 3.59, 4.01, 4.43, 4.44, 3.03, 2.62, 5.40, 4.15, 3.57 and 3.97 jassids, respectively. The highest jassid population was recorded on the F_4M_1 (Soil application of RDF+ Black polythene mulch) which recorded 11.43 jassids. Data on 10thWAS showed that lowest jassid population (2.14) was recorded in the F_3M_4 (80% RDF through fertigation + No mulch) which was at par with the treatments F_1M_2(120% RDF through fertigation + Silver polythene mulch), F_1M_3(120% RDF through fertigation + Paddy straw mulch), F_2M_2(100% RDF through fertigation + Silver polythene mulch), F_2M_3(100% RDF through fertigation + Paddy straw mulch), F_2M_4(100% RDF through fertigation + No mulch), F_4M_2(Soil application of RDF+ Silver polythene mulch), F_4M_3(Soil application of RDF+ Paddy straw mulch) and F_4M_4(Soil application of RDF+ No mulch) which recorded 3.62, 2.51, 2.96, 2.36, 2.95, 3.91, 3.14 and 3.84 jassids, respectively. The overall results of interaction effect of fertigation and mulches revealed that the treatment combinations of higher doses of N, P and K in splits in combination with paddy straw mulch and silver polythene were found to be the best for harboring less number of jassids resulting into reduced damage. Whereas, combination of soil application of fertilizers with black polythene mulch was found less effective of reducing the damage of jassids.

Table 8: Interaction effect of fertigation and mulching on jassids infesting okra

Treatment combinations: Main plot x sub plot	No. of Jassids/3 leaves/per plant							
	3rd WAS	4th WAS	5th WAS	6th WAS	7th WAS	8th WAS	9th WAS	10th WAS
F_1M_1	2.77 (1.66)	1.75 (1.32)	3.76 (1.94)	5.76 (2.40)	5.89 (2.43)	8.11 (2.85)	9.67 (3.11)	5.11 (2.26)
F_1M_2	2.76 (1.66)	2.10 (1.45)	3.90 (1.98)	5.82 (2.41)	6.19 (2.49)	7.10 (2.66)	9.73 (3.12)	3.62 (1.90)
F_1M_3	0.89 (0.94)	0.83 (0.91)	2.10 (1.45)	3.69 (1.92)	2.33 (1.53)	2.85 (1.69)	3.59 (1.90)	2.51 (1.58)
F_1M_4	1.25 (1.12)	1.47 (1.21)	2.62 (1.62)	3.37 (1.84)	2.79 (1.67)	18.48 (4.30)	4.01 (2.00)	5.36 (2.31)
F_2M_1	1.87 (1.37)	2.12 (1.45)	4.11 (2.03)	6.09 (2.47)	3.41 (1.85)	8.12 (2.85)	4.43 (2.11)	4.48 (2.12)
F_2M_2	2.46 (1.57)	1.43 (1.19)	3.93 (1.98)	6.42 (2.53)	8.85 (2.98)	6.71 (2.59)	4.44 (2.11)	2.96 (1.72)
F_2M_3	0.95 (0.97)	0.85 (0.92)	2.05 (1.43)	2.75 (1.66)	2.56 (1.60)	3.41 (1.85)	3.03 (1.74)	2.36 (1.54)
F_2M_4	1.85 (1.36)	0.99 (1.00)	1.89 (1.38)	3.25 (1.80)	2.72 (1.65)	10.91 (3.30)	2.62 (1.62)	2.95 (1.72)
F_3M_1	2.47 (1.57)	1.94 (1.39)	4.21 (2.05)	5.71 (2.39)	3.85 (1.96)	6.91 (2.63)	5.40 (2.32)	4.56 (2.14)
F_3M_2	2.58 (1.61)	1.99 (1.41)	3.98 (2.00)	5.97 (2.44)	8.88 (2.98)	9.73 (3.12)	7.02 (2.65)	3.96 (1.99)
F_3M_3	0.84 (0.92)	0.98 (0.99)	2.32 (1.52)	3.73 (1.93)	2.50 (1.58)	3.76 (1.94)	4.15 (2.04)	3.13 (1.77)
F_3M_4	1.30 (1.14)	0.99 (0.99)	2.37 (1.54)	3.66 (1.91)	4.75 (2.18)	6.74 (2.60)	3.57 (1.89)	2.14 (1.46)
F_4M_1	2.00 (1.41)	2.03 (1.43)	3.53 (1.88)	5.01 (2.24)	6.36 (2.52)	9.66 (3.11)	11.43 (3.38)	5.85 (2.45)
F_4M_2	2.48 (1.57)	1.44 (1.20)	4.05 (2.01)	6.65 (2.58)	6.41 (2.53)	9.86 (3.14)	9.04 (3.01)	3.91 (1.98)
F_4M_3	0.92 (0.96)	0.85 (0.92)	1.99 (1.41)	3.21 (1.79)	3.29 (1.81)	4.40 (2.10)	0.98 (0.99)	3.14 (1.77)
F_4M_4	1.03 (1.01)	1.37 (1.17)	2.29 (1.51)	3.13 (1.77)	3.79 (1.95)	13.52 (3.68)	3.97 (1.99)	3.84 (1.96)
S.E. ±	0.11	0.10	0.07	0.10	0.28	0.41	0.43	0.20
C.D. at 5%	0.32	0.30	0.21	0.30	0.82	1.21	1.26	0.58

3.3.3 Interaction effect of fertigation and mulching on whiteflies infesting okra

Data on interaction effect of fertigation and mulching on number of whiteflies per three leaves per plant were recorded at weekly interval and presented in Table 9. The observations of interaction effect of fertigation and mulching on whiteflies during 3rd,4th, 5th,7th, 8th,9th and 10th WAS was found to be non-significant. Data on observation of whiteflies recorded in 6th WAS showed that among different treatment combinations the treatment combination F_1M_3(120% RDF through fertigation + Paddy straw mulch), F_2M_3(100% RDF through fertigation + Paddy straw mulch), F_3M_3(80% RDF through fertigation + Paddy straw mulch) and F_4M_3(Soil application of RDF+ Paddy straw mulch) recorded minimum whitefly population(0.50 whiteflies/3 leaves/plant) which were at par with the treatments F_1M_4(120% RDF through fertigation + No mulch), F_3M_4(80% RDF through fertigation + No mulch) and F_4M_4(Soil application of RDF+ No mulch) which recorded 0.71,0.82 and 0.87 whiteflies per three leaves per plant. The highest whitefly population (3.58 whiteflies/three leaves/plant) was found in the treatment F_3M_2(80% RDF through fertigation + Silver polythene mulch). The interaction effect of fertigation and mulches on whitefly population infesting okra revealed that the whitefly population during the present study was less and therefore the interaction effect could not be obtained. Whereas, the combination of split doses of fertigation and paddy straw was proved to the best treatments for reducing the whitefly damage during *rabi*-summer okra. The literature pertaining to the present study was not available therefore could not quoted.

Table 9: Interaction effect of fertigation and mulching on whiteflies infesting okra

Treatment combination Main plot x sub plot	No. of whiteflies/3 leaves/per plant							
	3rd WAS	4th WAS	5th WAS	6th WAS	7th WAS	8th WAS	9th WAS	10th WAS
F_1M_1	0.54 (0.73)	0.68 (0.83)	0.50 (0.71)	1.89 (1.37)	0.65 (0.80)	0.74 (0.86)	0.71 (0.84)	0.54 (0.74)
F_1M_2	0.64 (0.80)	0.65 (0.81)	0.58 (0.76)	3.52 (1.88)	0.71 (0.84)	0.62 (0.79)	0.58 (0.76)	0.50 (0.71)
F_1M_3	0.52 (0.72)	0.59 (0.77)	0.52 (0.72)	0.50 (0.71)	0.63 (0.79)	0.56 (0.75)	0.50 (0.71)	0.56 (0.75)
F_1M_4	0.58 (0.76)	0.74 (0.86)	0.59 (0.77)	0.71 (0.84)	0.56 (0.75)	0.50 (0.71)	0.52 (0.72)	0.54 (0.74)
F_2M_1	0.54 (0.73)	0.74 (0.86)	0.52 (0.72)	1.65 (1.28)	0.54 (0.73)	0.77 (0.88)	0.62 (0.79)	0.50 (0.71)
F_2M_2	0.60 (0.78)	0.74 (0.86)	0.54 (0.74)	2.70 (1.66)	0.54 (0.73)	0.74 (0.86)	0.61 (0.78)	0.50 (0.71)
F_2M_3	0.56 (0.75)	0.50 (0.71)	0.59 (0.77)	0.50 (0.71)	0.56 (0.75)	0.50 (0.71)	0.56 (0.75)	0.69 (0.83)
F_2M_4	0.50 (0.71)	0.57 (0.75)	0.65 (0.81)	1.02 (1.01)	0.65 (0.81)	0.75 (0.87)	0.58 (0.76)	0.50 (0.71)
F_3M_1	0.54 (0.73)	0.61 (0.78)	0.54 (0.74)	1.53 (1.24)	0.60 (0.78)	0.50 (0.71)	0.63 (0.70)	0.69 (0.83)
F_3M_2	0.63 (0.79)	0.76 (0.87)	0.52 (0.72)	3.58 (1.89)	0.62 (0.79)	0.64 (0.80)	0.58 (0.76)	0.50 (0.71)
F_3M_3	0.52 (0.72)	0.54 (0.74)	0.50 (0.71)	0.50 (0.72)	0.56 (0.75)	0.71 (0.84)	0.50 (0.71)	0.59 (0.77)
F_3M_4	0.52 (0.72)	0.59 (0.77)	0.54 (0.74)	0.82 (0.91)	0.61 (0.78)	0.73 (0.85)	0.71 (0.84)	0.50 (0.71)
F_4M_1	0.60 (0.78)	0.57 (0.75)	0.59 (0.77)	1.54 (1.24)	0.58 (0.76)	0.74 (0.86)	0.59 (0.77)	0.54 (0.74)
F_4M_2	0.59 (0.77)	0.76 (0.87)	0.50 (0.71)	2.70 (1.64)	0.61 (0.78)	0.60 (0.78)	0.73 (0.85)	0.50 (0.71)
F_4M_3	0.56 (0.75)	0.52 (0.72)	0.54 (0.74)	0.50 (0.71)	0.71 (0.84)	0.68 (0.82)	0.52 (0.72)	0.50 (0.71)
F_4M_4	0.54 (0.73)	0.65 (0.81)	0.50 (0.71)	0.87 (0.93)	0.63 (0.70)	0.67 (0.82)	0.57 (0.75)	0.50 (0.71)
S.E. ±	0.03	0.06	0.03	0.09	0.04	0.07	0.05	0.08
C.D. at 5%	NS	NS	NS	0.26	NS	NS	NS	NS

4. Conclusion

The overall results of the present investigation revealed that the higher doses of N,P and K in different splits and paddy straw and silver polythene mulch were proved to be the best as single as well as in combinations for the management of sucking pests *viz.*, aphids, jassids and whiteflies and shoot and fruit borer of *rabi*-summer okra. Whereas black polythene mulch increased the incidence of aphids, jassids and whiteflies infesting *rabi*-summer okra. The results obtained in this investigation are based on one season and one location data. Therefore in order to arrive at definite conclusion, it is necessary to continue the studies with long duration trial.

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