

Original Research Article

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Evaluation of Effect of Different Nitrogen Sources on Major Insect Pests Infesting Okra, *Abelmoschus esculentus* (L.) Moench. under Semi Arid Region of Rajasthan, India

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Investigations on evaluation of effect of different nitrogen sources on major insect pests infesting okra was carried out at the Department of Entomology, Rajasthan Agricultural Research Institute, Durgapura, Jaipur during *kharif* 2016 and 2017. The major insect pests infesting okra observed during two consecutive seasons were leaf hopper, *A. biguttula biguttula*; whitefly, *B. tabaci* and okra shoot and fruit borer and *E. vittella*. Different sources of nitrogen were applied as different treatments to the okra crop. The fertilizers applied were urea, vermicompost and farm yard manure and their different combinations. Maximum nitrogen content in leaf of okra was observed in treatment where, 75 percent nitrogen was applied through urea and 25 per cent was applied through vermicompost. Maximum population of leaf hopper and whitefly was observed in treatment where, all the nitrogen was applied through urea (6.94 & 8.37 per plant) and minimum population was recorded from treatment where, all the nitrogen was applied through vermicompost (2.27 and 2.34 per plant). Maximum fruit infestation was recorded in treatment, where all the nitrogen was applied through urea i.e. 14.39% (on number basis) and 21.55% (on weight basis).

Introduction

India is the second largest producer of vegetables in the world (surpassed only by China) accounting for about 10 per cent of the world production. Okra, *Abelmoschus esculentus* (L.) Moench commonly known as *bhindi* or lady's finger (family: Malvaceae) is a popular fruit vegetable crop. In the plains of northern India, it is grown in summer as well as during the rainy season; whereas, in central

and south India, the crop can be grown throughout the year. It is cultivated in 528.4 thousand hectares with a total production of 6146.0 thousand metric tonnes with productivity of 11.6 tonnes per hectare in India (Anonymous, 2016-17).

Okra fruit is nutritionally very rich with a caloric value of 35. The fruits of okra contain carbohydrate (6.4%), protein (1.9%), fat (0.2%), fiber (1.2%), minerals (0.7%) and

moisture (89.6%) (Anonymous, 2016). One of the important limiting factors in the cultivation of okra is insect pests. As high as 72 species of insects have been recorded on okra (Srinivas Rao and Rajendran, 2003), of which, the sucking pests comprising of Aphids (*Aphis gossypii* Glover), leafhopper (*Amrasca biguttula biguttula* Ishida), whitefly (*Bemisia tabaci* Gennadius) and mite (*Tetranychus cinnabarinus* Boisduval) causes significant damage to the crop, while at later stage fruit borers like *Earias spp* and *Helicoverpa armigera* (Hb.) cause considerable losses to the crop to the tune of 91.6 per cent (Pareek and Bhargava, 2003).

Chemical control of insect pests is generally practiced for higher gains but due to shorter interval in periodical harvest, use of chemicals alone is not advisable. Under such situation, it becomes pertinent to look for alternatives which are effective and eco friendly.

Use of organic amendments applied to soil not only enhance the nutrient status but also reduces the pest incidence, Earlier, Surekha and Rao (2001) explored the utility of organic manures for managing the pests of okra. Thus, keeping these thematic areas in view, the present investigation' evaluation of effect of different nitrogen sources on major insect pests infesting okra, *Abelmoschus esculentus* (L.) Moench under Semi Arid region of Rajasthan' was undertaken.

Materials and Methods

To evaluate the effect of different sources of nitrogen on incidence of major insect pest of okra, the crop was sown in experimental field at normal sowing time in twenty nine plots of 3.0 × 2.25m size, nine treatment each replicated thrice, with keeping the row to row and plant to plant distance of 45 and 30 cm, respectively during both the year of study.

Observation methodology

Sucking pests

To record the incidence of various sucking pests, five plants were randomly selected from net plot area of each plot and tagged. Observations on population of sucking pests particularly jassid were recorded by counting the number of nymphs and adults, while only adults in case of whitefly from three leaves (top, middle and bottom) of selected plants. The observations were recorded at weekly interval starting from the germination of the crop. The data thus obtained was subjected to statistical analysis.

Shoot and fruit borer (*E. vittella*)

Observations on shoot infestation due to *E. vittella* was recorded on five randomly selected plants in each net plot area. The harvested fruits of each plot were carefully observed after each picking to ascertain fruit infestation and percentage of fruit infested was worked out. The data on per cent fruit damage was statistically analyzed after suitable transformation.

Treatments detail

Treatment	Particular
T ₁	100% Nitrogen through Urea
T ₂	100% Nitrogen through FYM
T ₃	100% Nitrogen though Vermicompost
T ₄	75% Nitrogen through Urea + 25 % Nitrogen through FYM
T ₅	75% Nitrogen through Urea + 25% Nitrogen though Vermicompost
T ₆	50% Nitrogen through Urea + 50% Nitrogen though FYM
T ₇	50% Nitrogen through Urea + 50% Nitrogen though Vermicompost
T ₈	25% Nitrogen through Urea + 75% Nitrogen though FYM
T ₉	25% Nitrogen through Urea + 75% Nitrogen though Vermicompost

Estimation of nitrogen content of leaf

Nitrogen content of leaves and fruits in different treatments was evaluated at the time of first appearance of pests. For estimation of nitrogen content in leaves and fruit samples were collected from each treatment. These sampled leaves were first dried in sun and then finally in an electric oven at 60°C and then ground in a mixer to make fine powder.

The nitrogen content was estimated by Kjeldahl's method as described by Jackson (1973). In this method, powdered sample of 1 g digested with concentrated H₂SO₄ in the presence of digestion mixture (K₂SO₄: CuSO₄.5H₂O: Se in the proportion of 100: 20:1) and distilled under alkaline medium. The liberated NH₃ was trapped in 4 percent Boric acid and containing mixed indicator and titrated against standard H₂SO₄.

Results and Discussion

Per cent nitrogen content in leaves of okra

During both the year of study the nitrogen content were applied through different sources as treatments in okra crop.

The maximum nitrogen content (2.22 percent) in leaves of okra was recorded in treatment where 75% nitrogen was applied through urea and remaining 25% was applied through vermicompost followed by 2.14 percent in treatment where all the nitrogen was applied through urea.

The minimum nitrogen content in leaves (1.83 percent) was recorded in treatment where all the nitrogen was applied through farm yard manure followed by treatment (1.95 percent) where all the nitrogen was applied through vermicompost. All the treatments had non-significant difference among them.

Effect of different sources of nitrogen of incidence of sucking pests of okra

The pooled data of both the year revealed that the significantly lower population of jassid (2.27 nymphs/ 3 leaves/ plant) was recorded in the treatment where 100 per cent of the recommended dose of nitrogen was applied through Vermicompost. Similarly maximum population (6.94 nymphs/ 3 leaves/ plant) was recorded in the treatment where only chemical fertilizer i.e. urea, was applied. The pooled data of both the year revealed that, significantly lower population of whitefly (2.34 whitefly/ 3 leaves/ plant) was recorded in the treatment where the total recommended dose of nitrogen was applied through vermicompost. Similarly maximum population (8.37 whitefly/ 3 leaves/ plant) was recorded in the treatment where only chemical fertilizer i.e. urea was applied to meet the nutritional requirements of the crop. Thus, the maximum nitrogen required for the crop growth given through the organic manures i.e. vermicompost and farm yard manure recorded the lower pest population as compared to the combination with chemical fertilizers (Fig. 1, Table 1 and 2).

Effect of different sources of nitrogen on incidence of shoot and fruit borer, *Earias vittella* (Fabricius)

The pooled data of both the year of study on fruit infestation due to fruit borer in okra on number basis revealed that significantly the lower fruit infestation (3.18%) due to fruit borer, *Earias* spp. was recorded in the treatment where total nitrogen requirement was supplied through vermicompost. Similarly, the maximum infestation 14.39 per cent was recorded where only the chemical fertilizers i.e. urea was applied. However, it was at par with the treatment where maximum dose of nitrogen (75%) was applied through urea and remaining 25 per cent was applied

through farm yard manure (12.96% infestation) (Fig. 2).

The pooled data of both the year of study on fruit infestation due to fruit borer in okra on weight basis revealed that significantly the lower fruit infestation (8.65%) due to fruit borer, *Earias* spp. was recorded in the

treatment where total nitrogen requirement was supplied through vermicompost. Similarly, the maximum infestation of 21.55 per cent was recorded where only the chemical fertilizer i.e. urea was applied. Rest of the treatment combinations showed moderate effects with the infestation of 12.30 to 14.98 per cent (Table 3 and 4).

Table.1 Effect of different source of nitrogen on population of jassid, *Amrasca biguttula biguttula* (Ishida) infesting okra

Sr. No.	Treatment	Percentage Nitrogen content in leaves	No. of jassids/3 leaves/ plant		
			2016	2017	Pooled
1.	T ₁ : 100% Nitrogen through Urea	2.14 (8.41*)	6.43 (2.62**)	7.45 (2.82)	6.94 (2.72)
2.	T ₂ : 100% Nitrogen through FYM	1.83 (7.77)	2.50 (1.73)	2.97 (1.85)	2.74 (1.80)
3.	T ₃ : 100% Nitrogen though Vermicompost	1.95 (8.03)	1.90 (1.55)	2.64 (1.67)	2.27 (1.63)
4.	T ₄ : 75% Nitrogen through Urea + 25 % Nitrogen through FYM	2.18 (8.49)	5.92 (2.47)	6.37 (2.60)	6.14 (2.57)
5.	T ₅ : 75% Nitrogen through Urea + 25% Nitrogen though Vermicompost	2.22 (8.57)	5.30 (2.41)	6.10 (2.55)	5.70 (2.49)
6.	T ₆ : 50% Nitrogen through Urea + 50% Nitrogen though FYM	1.98 (8.09)	5.01 (2.34)	5.72 (2.48)	5.36 (2.41)
7.	T ₇ : 50% Nitrogen through Urea + 50% Nitrogen though Vermicompost	2.12 (8.37)	2.98 (1.85)	3.73 (2.04)	3.36 (1.95)
8.	T ₈ : 25% Nitrogen through Urea + 75% Nitrogen though FYM	2.03 (8.19)	3.97 (2.11)	4.76 (2.26)	4.37 (2.20)
9.	T ₉ : 25% Nitrogen through Urea + 75% Nitrogen though Vermicompost	2.07 (8.27)	2.23 (1.65)	2.86 (1.77)	2.54 (1.72)
S. Em ±		0.08	0.17	0.26	0.15
C. D. at 5%		0.23	0.51	0.77	0.44
CV%		1.59	14.24	20.04	11.72

*Angular transformation,** Square root transformation. Figures in the parentheses are transformed values. Where, FYM= Farm Yard Manure

Table.2 Effect of different source of nitrogen on population of whitefly, *Bemisia tabaci* (Genn.) infesting okra

Sr. No	Treatment	Percentage Nitrogen content in leaves	No. of whitefly/3 leaves/ plant		
			2016	2017	Pooled
1.	T ₁ : 100% Nitrogen through Urea	2.14 (8.41*)	7.66 (2.85**)	9.09 (3.08)	8.37 (2.97)
2.	T ₂ : 100% Nitrogen through FYM	1.83 (7.77)	1.94 (1.52)	3.31 (1.91)	2.62 (1.74)
3.	T ₃ : 100% Nitrogen through Vermicompost	1.95 (8.03)	1.50 (1.41)	3.19 (1.82)	2.34 (1.66)
4.	T ₄ : 75% Nitrogen through Urea + 25 % Nitrogen through FYM	2.18 (8.49)	5.85 (2.45)	7.09 (2.69)	6.47 (2.64)
5.	T ₅ : 75% Nitrogen through Urea + 25% Nitrogen through Vermicompost	2.22 (8.57)	5.19 (2.38)	6.53 (2.63)	5.86 (2.51)
6.	T ₆ : 50% Nitrogen through Urea + 50% Nitrogen through FYM	1.98 (8.09)	4.88 (2.31)	6.07 (2.56)	5.47 (2.44)
7.	T ₇ : 50% Nitrogen through Urea + 50% Nitrogen through Vermicompost	2.12 (8.37)	2.82 (1.82)	4.10 (2.14)	3.46 (1.99)
8.	T ₈ : 25% Nitrogen through Urea + 75% Nitrogen through FYM	2.03 (8.19)	3.84 (2.08)	5.14 (2.36)	4.49 (2.23)
9.	T ₉ : 25% Nitrogen through Urea + 75% Nitrogen through Vermicompost	2.07 (8.27)	2.13 (1.62)	3.47 (1.99)	2.80 (1.82)
S. Em ±		0.08	0.17	0.25	0.14
C. D. at 5%		0.23	0.51	0.76	0.43
CV%		1.59	14.33	18.75	11.25

*Angular transformation, ** Square root transformation.

Figures in the parentheses are transformed values.

Where, FYM= Farm Yard Manure

Table.3 Effect of different source of nitrogen on fruit infestation (on number basis) due to shoot and fruit borer, *Earias vittella* (Fabricius) infesting okra

Sr. No	Treatment	Percentage Nitrogen content in leaves	Percent fruit infestation		
			2016	2017	Pooled
1.	T ₁ : 100% Nitrogen through Urea	2.14 (8.41*)	14.85 (22.66)	13.93 (21.91)	14.39 (22.29)
2.	T ₂ : 100% Nitrogen through FYM	1.83 (7.77)	5.01 (12.87)	4.65 (12.43)	4.83 (12.68)
3.	T ₃ : 100% Nitrogen through Vermicompost	1.95 (8.03)	3.13 (10.18)	3.23 (10.28)	3.18 (10.23)
4.	T ₄ : 75% Nitrogen through Urea + 25 % Nitrogen through FYM	2.18 (8.49)	14.03 (21.82)	11.89 (20.16)	12.96 (21.03)
5.	T ₅ : 75% Nitrogen through Urea + 25% Nitrogen through Vermicompost	2.22 (8.57)	9.33 (17.77)	9.71 (18.15)	9.52 (17.96)
6.	T ₆ : 50% Nitrogen through Urea + 50% Nitrogen through FYM	1.98 (8.09)	9.42 (17.70)	8.97 (17.39)	9.20 (17.56)
7.	T ₇ : 50% Nitrogen through Urea + 50% Nitrogen through Vermicompost	2.12 (8.37)	5.48 (13.53)	5.98 (14.15)	5.73 (13.85)
8.	T ₈ : 25% Nitrogen through Urea + 75% Nitrogen through FYM	2.03 (8.19)	4.12 (11.69)	4.95 (12.85)	4.54 (12.29)
9.	T ₉ : 25% Nitrogen through Urea + 75% Nitrogen through Vermicompost	2.07 (8.27)	3.67 (11.00)	3.75 (11.16)	3.71 (11.09)
S. Em ±		0.08	1.05	0.45	0.66
C. D. at 5%		0.23	3.14	1.35	1.98
CV%		1.59	11.71	5.07	7.42

* Angular transformation.

Figures in the parentheses are transformed values.

Where, FYM= Farm Yard Manure

Table.4 Effect of different source of nitrogen on fruit infestation (on weight basis) due to shoot and fruit borer, *Earias vittella* (Fabricius) infesting okra

Sr. No.	Treatment	Percentage Nitrogen content in leaves	Percent fruit infestation		
			2016	2017	Pooled
1.	T ₁ : 100% Nitrogen through Urea	2.14 (8.41*)	20.23 (26.71*)	22.87 (28.53)	21.55 (27.66)
2.	T ₂ : 100% Nitrogen through FYM	1.83 (7.77)	7.83 (16.23)	10.50 (18.82)	9.17 (17.58)
3.	T ₃ : 100% Nitrogen through Vermicompost	1.95 (8.03)	7.30 (15.67)	9.99 (18.3)	8.65 (17.08)
4.	T ₄ : 75% Nitrogen through Urea + 25 % Nitrogen through FYM	2.18 (8.49)	12.28 (20.46)	14.93 (22.62)	13.61 (21.57)
5.	T ₅ : 75% Nitrogen through Urea + 25% Nitrogen through Vermicompost	2.22 (8.57)	13.64 (21.64)	16.32 (23.81)	14.98 (22.76)
6.	T ₆ : 50% Nitrogen through Urea + 50% Nitrogen through FYM	1.98 (8.09)	10.96 (19.27)	13.64 (21.66)	12.30 (20.50)
7.	T ₇ : 50% Nitrogen through Urea + 50% Nitrogen through Vermicompost	2.12 (8.37)	9.63 (18.06)	12.31 (20.47)	10.97 (19.31)
8.	T ₈ : 25% Nitrogen through Urea + 75% Nitrogen through FYM	2.03 (8.19)	9.31 (17.61)	11.89 (20.06)	10.60 (18.87)
9.	T ₉ : 25% Nitrogen through Urea + 75% Nitrogen through Vermicompost	2.07 (8.27)	8.98 (17.31)	11.66 (19.82)	10.32 (18.70)
S. Em ±		0.08	1.12	0.91	0.82
C. D. at 5%		0.23	3.37	2.73	2.45
CV%		1.59	10.13	7.32	6.92

* Angular transformation.

Figures in the parentheses are transformed values.

Where, FYM= Farm Yard Manure

Fig.1 Effect of different source of nitrogen on population of Jassid and whitefly, infesting okra (Pooled, *kharif* 2016 & 2017)

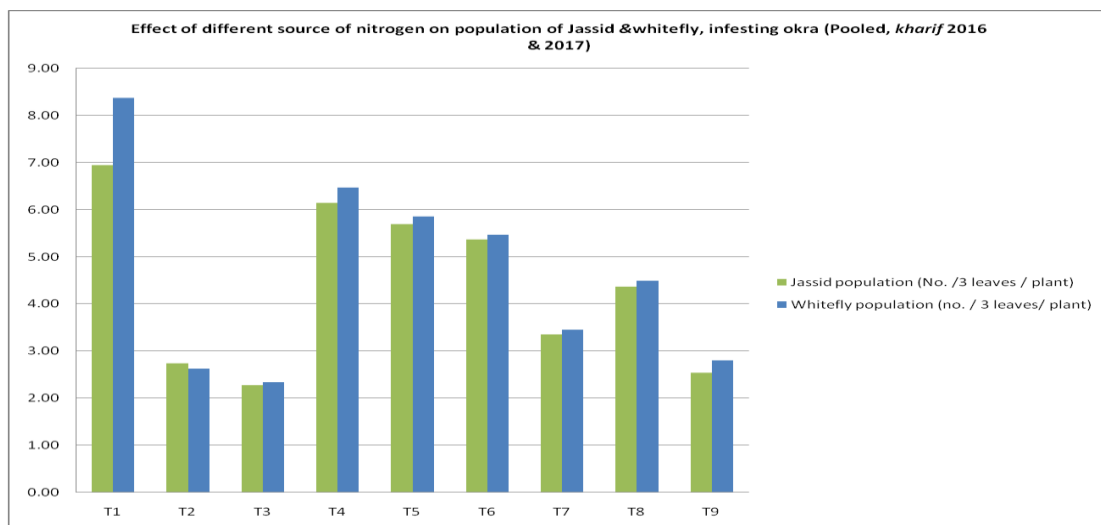
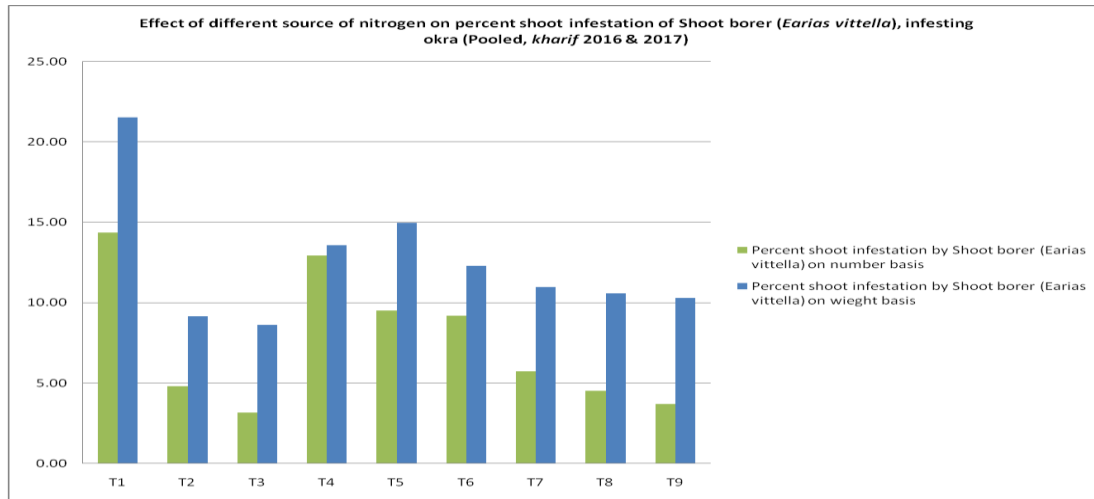


Fig.2 Effect of different source of nitrogen on percent shoot infestation of Shoot borer (*Earias vittella*), infesting okra (Pooled, *kharif* 2016 & 2017)



The finding of Prakash *et al.*, (2002), Prakash and Bhadoria (2004), Tripathy (2004), Yadav (2004) and Rakshit (2009) confirms the result of present investigation, where similar results were obtained. Prakash *et al.*, (2002) reported lower percentage of fruit borer infestation in okra treated with farm yard manure (FYM) and vermicompost. Prakash and Bhadoria (2004) evaluated the relative efficacy of organic manures in improving pest tolerance of okra. Among the organic manures tested, FYM showed the tolerance to attack by *E. vittella*. Tripathy *et al.*, (2004) found that the integrated application of 75 per cent recommended dose of fertilizer combined with vermicompost @ 5 t/ha gave significantly higher marketable fruit yield (91.75 q/ha) followed by 50 per cent recommended dose of fertilizer combined with vermicompost @ 5 t/ha (88.31 q/ha), 75 and 50 per cent recommended dose of fertilizer combined with neem cake @ 2.5 t/ha (86.03 q/ha and 78.5 q/ha, respectively). Yadav *et al.*, (2004) studied the effects of different levels of organic manures on yield of okra. The treatment with 50 per cent recommended dose of nitrogen as urea combined with 50 per cent recommended dose of nitrogen as poultry manure recorded

the highest yield. Rakshit (2009) observed that the application of chemical fertilizers resulted in significantly higher per cent of infested plants due to *E. vittella* in okra as compared to all treatments with organic nutrient sources. Suppression of shoot and fruit borer was significantly lower in FYM.

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