

Evaluation of different insecticides and botanicals against aphids and leafhoppers infesting fenugreek

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Abstract

Evaluation of different insecticides against aphids and leaf hoppers infesting fenugreek was undertaken during *Rabi* 2012-13 to 2015-16 at Seed Spices Research Station, Jagudan in a randomized block design with ten treatments and four replications. Among them, the aphid index was recorded significantly the least (0.46 A.I.) in thiamethoxam 25WG (0.0084%) at 7 days after second spray. Similarly, the plots sprayed with thiamethoxam 25WG (0.0084%) had also exhibited significantly the lowest population of leafhopper (0.50/three leaves) at 7 days after second spray. The plots sprayed with thiamethoxam 25WG (0.0084%) harvested the highest seed yield of fenugreek (1565kg ha⁻¹) followed by acetamiprid 20SP @ 0.004% (1439kg ha⁻¹). Acetamiprid (0.004%) treated plots gave maximum benefit (PCBR= 1:18.51) followed by thiamethoxam 0.0084% (PCBR= 1: 16.05).

Key words : Aphids, botanicals, fenugreek, insecticides, leafhopper

Introduction

Fenugreek (*Trigonella foenum-graceum* L.), an important seed spice crop is grown in India for domestic and export purposes. It is cultivated for seeds, vegetable and for medicinal purposes throughout the country. In India, Rajasthan, Gujarat, Uttaranchal, Uttar Pradesh, Madhya Pradesh, Maharashtra, Haryana and Punjab are major fenugreek producing states. Insect pests viz., aphid (*A. craccivora*), leafhopper (*E. spinosa*), leaf miner (*L. congestra*) and lucerne weevil (*H. prostica*) are one of the major limiting factors in fenugreek crop. Among different sucking pests, aphids and leafhoppers are key pests infesting the crop. Aphids feed on leaves, mainly on stem, inflorescence and pods. The damaged pods shrivel and become weak. The grains formed in the damaged pods are very thin and thus, results in a heavy loss in seed yield. A loss upto 62.3 to 68.8% was recorded due to aphid infestation in fenugreek (Sharma and Kalra, 2002). Both nymphs and adults of leafhopper suck the cell sap from underside of fenugreek leaves. The information on management of sucking pests of fenugreek is scanty in general and particularly from North Gujarat Agro-Climatic zone.

Material and methods

A field experiment was conducted at Seed Spices Research Station, Jagudan during *Rabi* 2012-13 to 2015-16 using the variety Gujarat Fenugreek 2 in RBD with ten treatments and four replications. The treatments consisted

of carbosulfan 25EC (0.05%), acetamiprid 20SP (0.004%), clothianidin 50WDG (0.025%), thiamethoxam 25WG (0.0084%), imidacloprid 17.8SL (0.005%), thiacloprid 21.7SC (0.024%), acephate 75SP (0.075%), Neem based formulation 1500ppm (3ml lit.⁻¹), *Verticillium lecanii* 1.15WP (4g lit.⁻¹) and untreated control. Two foliar sprays of respective insecticides were given by means of manually operated knapsack sprayer. First foliar spray was made at threshold level 1.5 aphid index and second spray made at ten days of the first spray. Five plants were selected randomly in each plot and population of aphid was recorded as per aphid index prior to spray and 3 and 7 days of each spray.

Patel (1980) gave the formula for estimating the population of aphid and the average aphid index was worked out by adopting the following formula.

$$\text{Average aphid index} = \frac{0N + 1N + 2N + 3N + 4N}{\text{Total number of plants observed}}$$

Where, 0, 1, 2, 3, 4 are aphid index

N = Number of plant showing respective aphid index

Five plants were selected randomly in each plot and the population of leafhopper were recorded from three leaves (top, middle and bottom) prior to spray and 3 and 7 days of each spray and mean number of leafhopper was computed. These data were analyzed for its statistical interpretation with due transformation. The seed yield of fenugreek from each net plot was recorded and economical analysis of different treatments were made.

Aphid Index	Degree of infestation
0	Plant free from aphid
1	Aphids present but colonies not built up. No injury due to apparent on plant
2	Small colonies of aphids present on tender parts of plant exhibit slight curling due to aphid feeding
3	Large colonies of aphids present on tender parts show damage symptoms due to aphid feeding
4	The tender plant parts completely covered with aphid colonies. Plant growth hindered due to pest feeding

Results and discussion

Aphid index (0-4 scale)

Four years' data individually, as well as the pooled data on aphid index as per 0-4 scale at 3days after first spray presented in table 1 revealed that the plots treated with thiamethoxam 25WG (0.0084%) registered the least aphid index (2.45 A.I.) at 3 days after first spray but it remained statistically at par with thiacloprid 21.7SC (0.024%), clothianidin 50WDG (0.025%), carbosulfan 25EC (0.05%), acetamiprid 20SP (0.004%) and imidacloprid 17.8SL (0.005%) recorded 2.49, 2.65, 2.69, 2.72, and 2.73 aphid index at 3days after first spray, respectively. Unprotected plots of fenugreek had recorded the highest aphid index (3.28 A.I.) at 3days after first spray. Similarly, four years' data individually as well as the pooled data on aphid index at 7days after first spray presented in table 2 showed that the plots sprayed with thiamethoxam 25WG (0.0084%) had registered the least aphid index (1.69A.I.) at 7days after first spray and remained significantly superior over rest of the treatments.

Four individual years as well as pooled data on aphid index at 3days after second spray presented in table 3 indicated that thiamethoxam 25WG (0.0084%) exhibited significantly least aphid index (1.00A.I.) as compared to unprotected plots of fenugreek (3.27A.I.). Similarly, pooled data on aphid index at 7days after second spray presented in table 4 showed that thiamethoxam 25WG (0.0084%) registered significantly least aphid index (0.46 A.I.) at in comparison to unprotected plots of fenugreek (3.07A.I.). Acetamiprid 20SP (0.004%) ranked second and exhibited 1.42 aphid index at 7days after second spray. Similar results were also reported by Patil and Patel (2013) in Isabgul crop. Thus, the present findings corroborate the earlier reports.

Leafhopper/Three leaves

The population of leafhopper had recorded the least (2.03/

3 leaves) in thiamethoxam 25WG (0.0084%), whereas, the unsprayed plots of fenugreek had registered the highest population of leaf hopper (2.67/3leaves) at 3days after first spray (Table 5). Similarly, pooled data on population of leafhopper at 7days after first spray presented in table 6 showed that the plots sprayed with thiamethoxam 25WG (0.0084%) had recorded significantly the least population of leafhopper (1.54/3leaves) at 7days after first spray as compared to the unprotected plots of fenugreek (2.70/ 3 leaves).

Pooled results on fenugreek leafhopper per 3 leaves presented in table 7 indicated that the population of leafhopper had also recorded significantly the lowest (0.94/3leaves) in thiamethoxam 25WG (0.0084%) at 3days after second spray. Acetamiprid 20SP (0.004%) stood second and registered 1.43 leafhopper per 3 leaves, whereas, unsprayed plots had registered the highest population of leafhopper (2.70/3leaves) at 3days after second spray. Similarly, population of leafhopper at 7 days after second spray presented in table 8 showed that thiamethoxam 25WG (0.0084%) had registered significantly the least population of leaf hopper (0.50/3leaves). Acetamiprid 20SP (0.004%) stood second and registered 1.09 leaf hopper per 3 leaves at 7 days after second spray, whereas, unprotected plots of fenugreek had exhibited the highest population of leafhopper (2.63/3 leaves) at 7 days after second spray. More or less similar results were also reported by Dangar (2003) as well as Mittal and Butani (1989) on fenugreek crop. Thus, the present findings corroborate the earlier reports.

Seed yield of fenugreek

Four years' data individually as well as the pooled data (Table 9) on seed yield of fenugreek showed that the plots treated with thiamethoxam 25WG (0.0084%) had harvested the highest seed yield of fenugreek (1565kg ha⁻¹) but it remained at par with acetamiprid 20SP (0.004%) (1439kg ha⁻¹). The unprotected plots of fenugreek had harvested the lowest seed yield of fenugreek (848kg ha⁻¹) and found inferior over all the treatments under testing.

Economics

Economics of different insecticides against sucking insect pests of fenugreek was worked out considering prevailing market price of seed yield of fenugreek and cost of different treatments including labour charges (Table 10). The gross realization, net realization and Protection Cost Benefit Ratio (PCBR) were also worked out for different treatments.

Looking to the economic analysis of different treatments, acetamiprid 20SP (0.004%) treated plots gave maximum benefit (PCBR= 1:18.51) followed by thiamethoxam 25WG

Table 1. Field evaluation of different insecticides/ botanicals against fenugreek aphid

Treat No.	Treatments	3days after first spray				
		2012-13	2013-14	2014-15	2015-16	Pooled
1.	Carbosulfan 25EC @ 0.05%	1.64*(2.19)	1.82*(2.81)	1.76*(2.60)	1.92*(3.19)	1.78*(2.69)
2.	Acetamiprid 20SP @ 0.004%	1.61(2.09)	1.84(2.89)	1.85(2.93)	1.88(3.03)	1.80(2.72)
3.	Clothianidin 50WDG @ 0.025%	1.63(2.14)	1.81(2.79)	1.76(2.58)	1.91(3.13)	1.77(2.65)
4.	Thiamethoxam 25WG @ 0.0084%	1.45(1.60)	1.83(2.86)	1.77(2.64)	1.81(2.79)	1.72(2.45)
5.	Imidacloprid 17.8SL@ 0.005%	1.64(2.19)	1.85(2.93)	1.80(2.73)	1.89(3.06)	1.80(2.73)
6.	Thiacloprid 21.7SC@ 0.024%	1.60(2.04)	1.78(2.67)	1.72(2.46)	1.83(2.83)	1.73(2.49)
7.	Acephate 75 SP @ 0.075%	1.67 (2.29)	1.86(2.95)	1.80 (2.73)	1.93(3.22)	1.81(2.79)
8.	Neem based formulation @1500 ppm	1.69(2.34)	1.90(3.09)	1.79(2.69)	1.98(3.43)	1.84(2.87)
9.	<i>Verticillium lecanii</i> 1.15 WP@ 4g lit ⁻¹ .	1.67(2.29)	1.91(3.14)	1.89(3.08)	1.96(3.33)	1.86(2.95)
10.	Untreated control	1.93(3.23)	1.95(3.28)	1.94(3.27)	1.97(3.38)	1.95(3.28)
	S.Em.±	0.028	0.043	0.052	0.038	0.021
	C.D.at 5%	0.081	NS	NS	0.11	0.058
	C.V.%	3.37	4.63	5.74	3.97	3.41
	YXT					NS

* $\sqrt{X + 0.5}$ transformed values

Figures in parenthesis are retransformed values

Table 2. Field evaluation of different insecticides/ botanicals against fenugreek aphid

Treat No.	Treatments	7days after first spray				
		2012-13	2013-14	2014-15	2015-16	Pooled
1.	Carbosulfan 25EC @ 0.05%	1.61*(2.09)	1.75*(2.55)	1.69*(2.34)	1.88*(3.03)	1.73*(2.49)
2.	Acetamiprid 20SP @ 0.004%	1.36(1.35)	1.77(2.63)	1.71(2.43)	1.87(2.98)	1.67(2.31)
3.	Clothianidin 50WDG @ 0.025%	1.57(1.95)	1.76(2.58)	1.70(2.38)	1.85(2.93)	1.72(2.45)
4.	Thiamethoxam 25WG @ 0.0084%	1.24(1.04)	1.50(1.74)	1.48 (1.69)	1.70(2.39)	1.48(1.69)
5.	Imidacloprid 17.8SL@ 0.005%	1.60 (2.04)	1.76(2.58)	1.72(2.44)	1.83(2.83)	1.72(2.47)
6.	Thiacloprid 21.7SC@ 0.024%	1.50(1.75)	1.77(2.62)	1.74(2.53)	1.76(2.58)	1.69(2.36)
7.	Acephate 75 SP @ 0.075%	1.60(2.04)	1.80(2.73)	1.79(2.69)	1.88(3.03)	1.76(2.61)
8.	Neem based formulation @1500 ppm	1.63(2.14)	1.86(2.94)	1.85 (2.93)	1.93(3.23)	1.81(2.80)
9.	<i>Verticillium lecanii</i> 1.15 WP@ 4g lit ⁻¹ .	1.64(2.19)	1.89(3.08)	1.83(2.84)	1.92(3.19)	1.82(2.81)
10.	Untreated control	1.90(3.09)	1.96(3.33)	1.96(3.33)	1.96(3.33)	1.94(3.27)
	S.Em.±	0.023	0.047	0.040	0.038	0.029
	C.D.at 5%	0.067	0.136	0.116	0.11	0.085
	C.V.%	2.92	5.29	4.54	4.13	3.35
	YXT					0.11

* $\sqrt{X + 0.5}$ transformed values

Figures in parenthesis are retransformed values

Table 3. Field evaluation of different insecticides/ botanicals against fenugreek aphid

Treat No.	Treatments	3days after second spray				
		2012-13	2013-14	2014-15	2015-16	Pooled
1.	Carbosulfan 25EC @ 0.05%	1.52*(1.80)	1.66*(2.24)	1.60*(2.04)	1.74*(2.53)	1.62*(2.14)
2.	Acetamiprid 20SP @ 0.004%	1.48(1.70)	1.77(2.63)	1.62(2.13)	1.69(2.34)	1.64(2.19)
3.	Clothianidin 50WDG @ 0.025%	1.49 (1.71)	1.74(2.54)	1.66(2.24)	1.80(2.73)	1.67(2.29)
4.	Thiamethoxam 25WG @ 0.0084%	0.81(0.15)	1.32(1.24)	1.22(0.98)	1.55(1.89)	1.22(1.00)
5.	Imidacloprid 17.8SL@ 0.005%	1.57(1.95)	1.64(2.18)	1.58(1.99)	1.78(2.68)	1.64(2.19)
6.	Thiacloprid 21.7SC@ 0.024%	1.42(1.50)	1.64(2.17)	1.61(2.08)	1.73(2.48)	1.59(2.05)
7.	Acephate 75 SP @ 0.075%	1.53(1.85)	1.75(2.55)	1.69(2.34)	1.76(2.59)	1.68(2.32)
8.	Neem based formulation @1500 ppm	1.73(2.49)	1.77(2.63)	1.66(2.24)	1.77(2.63)	1.73(2.50)
9.	<i>Verticillium lecanii</i> 1.15 WP@ 4g lit ⁻¹	1.60(2.04)	1.79(2.69)	1.73(2.49)	1.81(2.79)	1.73(2.50)
10.	Untreated control	1.93(3.23)	1.96(3.33)	1.94(3.27)	1.93(3.22)	1.94(3.27)
	S.Em.±	0.032	0.046	0.039	0.041	0.045
	C.D.at 5%	0.093	0.133	0.113	0.12	0.13
	C.V.%	4.27	5.43	4.83	4.62	3.63
	YXT					0.11

* $\sqrt{X + 0.5}$ transformed values

Figures in parenthesis are retransformed values

Table 4. Field evaluation of different insecticides/ botanicals against fenugreek aphid

Treat No.	Treatments	7days after second spray				
		2012-13	2013-14	2014-15	2015-16	Pooled
1.	Carbosulfan 25EC @ 0.05%	1.49*(1.71)	1.64*(2.19)	1.51*(1.79)	1.56*(1.94)	1.55*(1.90)
2.	Acetamiprid 20SP @ 0.004%	1.24(1.04)	1.45(1.60)	1.44(1.58)	1.41(1.50)	1.38(1.42)
3.	Clothianidin 50WDG @ 0.025%	1.41(1.50)	1.74(2.54)	1.55(1.89)	1.64(2.19)	1.58(2.01)
4.	Thiamethoxam 25WG @ 0.0084%	0.74(0.05)	1.03(0.56)	0.92(0.35)	1.22(0.99)	0.97(0.46)
5.	Imidacloprid 17.8SL@ 0.005%	1.45(1.60)	1.64(2.18)	1.56(1.93)	1.69(2.34)	1.58(2.01)
6.	Thiacloprid 21.7SC@ 0.024%	1.36(1.34)	1.46(1.64)	1.42(1.50)	1.61(2.09)	1.46(1.63)
7.	Acephate 75 SP @ 0.075%	1.54(1.86)	1.67(2.29)	1.60(2.04)	1.73(2.48)	1.63(2.16)
8.	Neem based formulation @1500 ppm	1.53(1.85)	1.72(2.44)	1.61 (2.09)	1.76(2.60)	1.65(2.24)
9.	<i>Verticillium lecanii</i> 1.15 WP@ 4g lit ⁻¹ .	1.60 (2.04)	1.73(2.49)	1.63(2.14)	1.67(2.29)	1.65(2.24)
10.	Untreated control	1.88(3.03)	1.92(3.19)	1.91(3.13)	1.86(2.94)	1.89(3.07)
	S.Em.±	0.036	0.035	0.037	0.027	0.033
	C.D.at 5%	0.104	0.102	0.107	0.078	0.097
	C.V.%	5.08	4.40	4.84	3.34	3.31
	YXT					0.095

* $\sqrt{X + 0.5}$ transformed values

Figures in parenthesis are retransformed values

Table 5. Field evaluation of different insecticides/ botanicals against fenugreek leafhopper

Treat No.	Treatments	3days after first spray				
		2012-13	2013-14	2014-15	2015-16	Pooled
1.	Carbosulfan 25EC @ 0.05%	1.73*(2.49)	1.58*(1.99)	1.44*(1.58)	1.81*(2.79)	1.64*(2.19)
2.	Acetamiprid 20SP @ 0.004%	1.75(2.55)	1.64(2.19)	1.58(1.99)	1.73(2.49)	1.67(2.29)
3.	Clothianidin 50WDG @ 0.025%	1.76(2.60)	1.64(2.19)	1.58(2.00)	1.80(2.73)	1.69(2.36)
4.	Thiamethoxam 25WG @ 0.0084%	1.57(1.95)	1.53(1.83)	1.58(2.00)	1.69(2.34)	1.59(2.03)
5.	Imidacloprid 17.8SL@ 0.005%	1.76(2.60)	1.59(2.04)	1.47(1.65)	1.76(2.59)	1.64(2.19)
6.	Thiacloprid 21.7SC@ 0.024%	1.73(2.49)	1.58(1.99)	1.53(1.83)	1.74(2.53)	1.64(2.19)
7.	Acephate 75 SP @ 0.075%	1.76(2.60)	1.72 (2.44)	1.51(1.79)	1.77(2.62)	1.69(2.36)
8.	Neem based formulation @1500 ppm	1.74(2.54)	1.67(2.29)	1.61(2.08)	1.83(2.83)	1.71(2.42)
9.	<i>Verticillium lecanii</i> 1.15 WP@ 4g lit ⁻¹ .	1.76(2.60)	1.63(2.14)	1.59(2.04)	1.77(2.63)	1.68(2.36)
10.	Untreated control	1.80(2.74)	1.73(2.49)	1.67(2.29)	1.95(3.28)	1.78(2.67)
	S.Em.±	0.039	0.032	0.035	0.032	0.024
	C.D.at 5%	0.113	0.093	0.102	0.093	0.068
	C.V.%	4.47	3.99	4.44	3.61	3.10
	YXT					0.097

* $\sqrt{X + 0.5}$ transformed values

Figures in parenthesis are retransformed values

Table 6. Field evaluation of different insecticides/ botanicals against fenugreek leafhopper

Treat No.	Treatments	7days after first spray				
		2012-13	2013-14	2014-15	2015-16	Pooled
1.	Carbosulfan 25EC @ 0.05%	1.69*(2.34)	1.51*(1.79)	1.38*(1.39)	1.76*(2.59)	1.58*(2.00)
2.	Acetamiprid 20SP @ 0.004%	1.53(1.85)	1.58(1.99)	1.43(1.55)	1.66(2.24)	1.55(1.90)
3.	Clothianidin 50WDG @ 0.025%	1.73(2.49)	1.58(1.99)	1.45(1.60)	1.76(2.59)	1.63(2.16)
4.	Thiamethoxam 25WG @ 0.0084%	1.45(1.60)	1.47(1.65)	1.32(1.24)	1.50(1.74)	1.43(1.54)
5.	Imidacloprid 17.8SL@ 0.005%	1.67(2.29)	1.53(1.83)	1.47(1.65)	1.72(2.44)	1.59(2.03)
6.	Thiacloprid 21.7SC@ 0.024%	1.64(2.19)	1.51(1.79)	1.48(1.69)	1.70(2.38)	1.58(2.00)
7.	Acephate 75 SP @ 0.075%	1.75(2.55)	1.66(2.24)	1.53(1.84)	1.74(2.54)	1.67(2.29)
8.	Neem based formulation @1500 ppm	1.70(2.39)	1.61(2.08)	1.54(1.88)	1.80 (2.73)	1.66(2.26)
9.	<i>Verticillium lecanii</i> 1.15 WP@ 4g lit ⁻¹ .	1.73(2.49)	1.56(1.94)	1.50(1.74)	1.75(2.55)	1.63(2.16)
10.	Untreated control	1.81(2.76)	1.72(2.44)	1.70(2.39)	1.97(3.38)	1.79(2.70)
	S.Em.±	0.029	0.032	0.031	0.031	0.023
	C.D.at 5%	0.084	0.092	0.090	0.090	0.067
	C.V.%	3.49	3.99	4.14	3.56	2.98
	YXT					0.090

* $\sqrt{X + 0.5}$ transformed values

Figures in parenthesis are retransformed values

Table 7. Field evaluation of different insecticides/ botanicals against fenugreek leafhopper

Treat No.	Treatments	3days after second spray				
		2012-13	2013-14	2014-15	2015-16	Pooled
1.	Carbosulfan 25EC @ 0.05%	1.57*(1.95)	1.38*(1.39)	1.30*(1.19)	1.70*(2.39)	1.48*(1.69)
2.	Acetamiprid 20SP @ 0.004%	1.26(1.09)	1.45(1.60)	1.36(1.35)	1.51(1.79)	1.39(1.43)
3.	Clothianidin 50WDG @ 0.025%	1.63(2.14)	1.51(1.78)	1.45(1.60)	1.70(2.39)	1.57(1.96)
4.	Thiamethoxam 25WG @ 0.0084%	1.09(0.69)	1.22(0.99)	1.12(0.75)	1.38(1.40)	1.20(0.94)
5.	Imidacloprid 17.8SL@ 0.005%	1.49(1.71)	1.47(1.65)	1.39(1.44)	1.67(2.29)	1.50(1.75)
6.	Thiacloprid 21.7SC@ 0.024%	1.39(1.44)	1.45(1.60)	1.38(1.40)	1.58(1.98)	1.45(1.60)
7.	Acephate 75 SP @ 0.075%	1.69(2.34)	1.58(1.99)	1.51(1.79)	1.68(2.32)	1.61(2.09)
8.	Neem based formulation @1500 ppm	1.60(2.04)	1.54(1.88)	1.48(1.69)	1.75(2.55)	1.59(2.03)
9.	<i>Verticillium lecanii</i> 1.15 WP@ 4g lit ⁻¹ .	1.67(2.29)	1.51(1.78)	1.45(1.60)	1.72(2.44)	1.58(2.00)
10.	Untreated control	1.79(2.70)	1.72(2.44)	1.74(2.54)	1.95(3.28)	1.79(2.70)
	S.Em.±	0.036	0.031	0.033	0.032	0.032
	C.D.at 5%	0.104	0.09	0.096	0.093	0.092
	C.V.%	4.78	4.23	4.66	3.90	3.29
	YXT					0.093

* $\sqrt{X + 0.5}$ transformed values

Figures in parenthesis are retransformed values

Table 8. Field evaluation of different insecticides/ botanicals against fenugreek leafhopper

Treat No.	Treatments	7days after second spray				
		2012-13	2013-14	2014-15	2015-16	Pooled
1.	Carbosulfan 25EC @ 0.05%	1.45*(1.60)	1.30*(1.19)	1.24*(1.04)	1.64*(2.19)	1.42*(1.52)
2.	Acetamiprid 20SP @ 0.004%	1.09(0.69)	1.32(1.24)	1.20(0.94)	1.44(1.58)	1.26(1.09)
3.	Clothianidin 50WDG @ 0.025%	1.52(1.81)	1.45(1.60)	1.38(1.40)	1.64(2.19)	1.49(1.72)
4.	Thiamethoxam 25WG @ 0.0084%	0.78(0.10)	1.12(0.75)	0.95(0.40)	1.16(0.85)	1.00(0.50)
5.	Imidacloprid 17.8SL@ 0.005%	1.20(0.94)	1.43(1.54)	1.35(1.33)	1.60(2.04)	1.39(1.43)
6.	Thiacloprid 21.7SC@ 0.024%	1.16(0.85)	1.36(1.34)	1.32(1.24)	1.47(1.65)	1.32(1.24)
7.	Acephate 75 SP @ 0.075%	1.38(1.40)	1.51(1.79)	1.43(1.54)	1.58(1.99)	1.47(1.66)
8.	Neem based formulation @1500 ppm	1.42(1.50)	1.47(1.65)	1.40(1.45)	1.62(2.13)	1.47(1.66)
9.	<i>Verticillium lecanii</i> 1.15 WP@ 4g lit ⁻¹ .	1.45(1.60)	1.46(1.64)	1.32(1.24)	1.63(2.14)	1.46(1.63)
10.	Untreated control	1.79(2.70)	1.76(2.59)	1.68(2.32)	1.87(2.98)	1.77(2.63)
	S.Em.±	0.035	0.04	0.043	0.032	0.039
	C.D.at 5%	0.102	0.116	0.125	0.093	0.112
	C.V.%	5.24	5.28	6.45	4.05	3.99
	YXT					0.105

* $\sqrt{X + 0.5}$ transformed values

Figures in parenthesis are retransformed values

Table 9. Seed yield of fenugreek in different treatments

Treat No.	Treatments	Seed yield (kg ha ⁻¹)				
		2012-13	2013-14	2014-15	2015-16	Pooled
1.	Carbosulfan 25EC @ 0.05%	1225	1141	1132	1456	1238
2.	Acetamiprid 20SP @ 0.004%	1484	1396	1386	1490	1439
3.	Clothianidin 50WDG @ 0.025%	1106	1060	1051	1302	1130
4.	Thiamethoxam 25WG @ 0.0084%	1567	1505	1496	1695	1565
5.	Imidacloprid 17.8SL @ 0.005%	1336	1160	1148	1422	1266
6.	Thiacloprid 21.7SC @ 0.024%	1380	1287	1275	1375	1329
7.	Acephate 75 SP @ 0.075%	1002	1051	1035	1285	1093
8.	Neem based formulation @1500 ppm	891	752	741	1223	902
9.	<i>Verticillium lecanii</i> 1.15 WP @ 4g lit ⁻¹ .	1032	831	824	1340	1007
10.	Untreated control	822	720	708	1143	848
	S.Em.±	55	45	46	71	38
	C.D.at 5%	159	130	133	208	109
	C.V.%	9.26	8.26	8.47	10.44	7.03
	YXT					155

Table 10. Economical analysis of different treatments

Sr. No.	Qty. of insecticides (L/kg ha ⁻¹)	Price of insecticide (₹ ha ⁻¹)	Labour cost (day ⁻¹)	Total cost of treatment (₹ ha ⁻¹)	Yield (kg ha ⁻¹)	Gross realization (₹ ha ⁻¹)	Net realization over control (₹ ha ⁻¹)	Net gain (₹ ha ⁻¹)	PCBR
1.	2.000	900	800	1700	1238	43330	13650	11950	7.03
2.	0.200	260	800	1060	1439	50365	20685	19625	18.51
3.	0.500	6250	800	7050	1130	39550	9870	2820	0.40
4.	0.336	672	800	1472	1565	54775	25095	23623	16.05
5.	0.280	448	800	1248	1266	44310	14630	13382	10.72
6.	1.105	2100	800	2900	1329	46515	16835	13936	4.81
7.	1.000	700	800	1500	1093	38255	8575	7075	4.72
8.	3.000	900	800	1700	902	31570	1890	190	0.11
9.	4.000	720	800	1520	1007	35245	5565	4045	2.66
10.	-	-	-	-	848	29680	-	-	-

Price of fenugreek: ` 35 kg⁻¹; Carbosulfan: ` 450 lit⁻¹ Acetamiprid : ` 1300 kg⁻¹ Clothianidin : ` 12500 kg⁻¹
 Thiamethoxam: ` 2000 kg⁻¹; Imidacloprid: ` 1600 lit⁻¹ Thiacloprid : ` 1600 lit⁻¹ Acephate: ` 700 kg⁻¹
 Neem based formulation: ` 300 lit⁻¹ *Verticillium lecanii* : ` 180 kg⁻¹ Labour cost: ` 200 day⁻¹

(0.0084%) (PCBR=1:16.05) and imidacloprid 17.8SL (0.005%) (PCBR=1:10.72). Thiamethoxam 25WG (0.0084%) found best in controlling sucking insect pests of fenugreek but the market price of insecticide is higher among the insecticides under tested.

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