Research Article

Effect of Bio-Efficacy of Newer Molecules of Insecticides against Leafhopper, *Emposca* (*Distantasca*) *Terminalis* in Yard Long Bean, *Vigna Unguiculata* Subsp. *Sesquipedalis*

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Abstract

A field experiment were carried out to evaluate the efficacy of newer molecules of insecticides *viz.*, acetamiprid, imidacloprid, chlorfenapyr, diafenthiuron, spiromesifen, fenazaquin, azadirachtin and acephate against leafhoppers under natural field condition during 2018-2019 at Agricultural and Horticultural Research Station (AHRS), Bhavikere, UAHS, Shivamogga, Karnataka. Observations on the population counts of leafhoppers were recorded 1DBS and 3, 7 and 10 DAS on five randomly selected plants on three leaves from top, middle and bottom in each plot. Among the insecticides tested, the highest percent reduction of leafhoppers was recorded in the treatments acetamiprid (84.39 %) followed by, imidacloprid (80.70 %), acephate (76.06 %) and diafenthiuron (72.14 %). However, least percent reduction of leafhopper population was observed in azadirachtin (53.02 %) treated plot when compared to untreated control (Pooled data). Highest B: C ratio was also recorded in the treatment acetamiprid (1:3.73) and lowest in azadirachtin (1:1.26). Thus, it is concluded that all the studied insecticides proved effective against the leafhoppers but the toxicity studies of the insecticides was observed from maximum to minimum in the following order, Acetamaprid > Imidacloprid > Acephate > Diafenthiuron > Spiromecifen > Fenazaquin > Chlorfenapyr > Azadirachtin.

Keywords: Yard long bean, Leafhopper, Different Insecticides, Yield, B: C Ratio.

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Introduction

Yard long bean, *Vigna unguiculata* sub spp. *sesquipedalis* is a delicious fresh vegetable belonging to the family Fabaceae. It is also known by other names like asparagus bean, sting bean, long podded cowpea, snake bean and body bean [1]. The yard long bean was originated probably in the Middle West Africa or Southern China. In India, Kerala contributes a major share, accounting for nearly 90 per cent in terms of both area and production followed by Karnataka and Tamil Nadu. The area of yard long beans in India is about 18,560–20,160 ha [2]. It is a highly nutritive vegetable containing a good amount of digestible protein both in pods (23.5 - 26.3%) and in leaves [3]. It can be used as fodder, vegetable, green legume as well as green manure crop.

During the cultivation, the farmer faces various problems in pest management [4]. The important constraints for lowering yield and poor quality of yard long bean is incidence of insect pests. The major insect pests which severely damage yard long bean during all growth stages are the bean aphid, *Aphis craccivora*, leafhopper, *Emposca terminalis Distanct*, thrips, *Megalurothrips usitatus* and red spider mites, *Tetranychus urticae.* Among these, leafhopper was the major one and it has been reported as a cosmopolitan species causing direct and indirect (as vectors) damage to the cultivated crops [5]. About 150 species of insect pests are known to attack beans in India, of which about 25 species are reported to be serious [6]. The yield loss in yard long bean due to leafhoppers is reported to be about 10-20 per cent [7]. Reports on incidence of insect pests and their management techniques for the yard long beans in its major growing areas of India are limited. Review of literature revealed that in our state, no work has been conducted on the insect pests of the yard long bean. The present study was, therefore, undertaken to know the incidence of leafhoppers, their level of infestation and management of leafhopper by using different insecticides in yard long bean.

Materials and Methods

Efficacy of selected insecticides against Leafhoppers

A field experiment was conducted to evaluate the efficacy of newer molecules of insecticides *viz*., acetamiprid 20 SP, imidacloprid 17.5 SL, chlorfenapyr 10 EC, diafenthiuron 50 EC, spiromesifen 22.9 SC, fenazaquin 10 EC, azadirachtin 10000 ppm and acephate 75 SP against leafhoppers under natural field condition during 2018-2019 at Agricultural and Horticultural Research Station (AHRS), Bhavikere, UAHS, Shivamogga, Karnataka. Arka Mangala variety of yard long bean was sown with a spacing of 120 cm x 30 cm in a gross plot size of 660 m^2 area. The crop was raised as per package of practices except plant protection measures against sucking pests. The field experiment was laid out in randomized block design (RCBD) with nine treatments and three replications comprising of different newer molecules of insecticides along with an untreated control (**Table 1, Figure 1**).

Sampling procedure

The nymphs and adults of leafhoppers were counted from three leaves *i.e*., one each from top, middle and bottom canopy of five randomly selected plants. Total number of leafhoppers from each plant was estimated and the population was expressed in terms of mean number of leafhoppers per leaf (**Figures 2** and **3**).

Table 1 Details of the insecticides tested against sucking pest of yard long bean

Treatments	Chemicals	Dosage (ml or gm per lit)	Trade name
T1	Acetamiprid 20 SP	0.3 g/l	Pride
T2	Imidacloprid 17.8 SL	0.5 ml/l	Confider
T3	Chlorfenapyr 10 EC	1.0 ml/l	Interprid
T4	Diafenthiuron 50 WP	1.0 g/l	Peagasus
T5	Spiromesifen 22.9 SC	0.50 ml/l	Oberon
T6	Fenazaquin 10 EC	2.0 ml/l	Magister
T7	Azadirachtin 10000 ppm	2.0 ml/l	Neembicidine
T8	Acephate 75 SP	1.5 gm/l	Acetaf
T9	Untreated control	-	-

Figure 1 General view of experimental plot

Figure 2 Leaf hopper, Emposca terminalis

Figure 3 Leafhoppers infected plant

Recording observation

Two sprays of insecticides were given at 15 days interval during the study period. The first spray was initiated when the crop was uniformly infected with single pest. The data on the population of leafhoppers were recorded at one day before spraying and 1, 3, 5 and 7 days after each spraying. At the time of harvesting yield (t/ha) and B: C ratio was also recorded.

Per cent reduction over control was also worked out using the following formula.

$$\text{Per cent reduction over control} = \frac{\text{Pest population in control} - \text{Pest population in treatment}}{\text{Pest population in control}} \times 100$$

Benefit- Cost ratio was also worked out using the following formula.

$$\text{B: C ratio} = \text{Net profit} / \text{Gross cost}$$

Where, Net Profit= Gross income / Gross cost and Gross Cost= Fixed cost + Variable cost

Statistical analysis

For statistical analysis of data SPSS software and WASP softwares were used and for average data, square root transformation, for percentage data arc sine transformation were used.

Results and Discussion

First spray

There was no significant difference among the treatments with respect to number of leafhoppers per leaf before imposition of treatments. The mean population varied from 4.98 to 5.83 leafhoppers per leaf, respectively (**Table 2**).

Table 2 Efficacy of different insecticides against leafhoppers, *Emposca terminalis* during *Kharif* 2018-19 (first spray)

Sl. No.	Treatments	Dosage (g or ml per ltr.)	Mean no. of leaf hoppers per leaf						Per cent reduction over control
			1 DBS	1 DAS	3 DAS	5 DAS	7 DAS	Mean	
1	Acetamiprid 20 SP	0.3g/ ltr	5.37 (2.31)	1.94 (1.39)^{f}	1.25 (1.11)^{e}	0.86 (0.95)^{f}	0.37 (0.60)^{e}	1.10	80.00
2	Imidacloprid 17.8 SL	0.5ml/ltr	5.33 (2.30)	2.10 (1.44)^{ef}	1.40 (1.18)^{e}	1.01 (1.03)^{f}	0.60 (0.77)^{e}	1.27	76.56
3	Chlorfenapyr 10 EC	1.5ml/ltr	5.83 (2.41)	3.06 (1.74)^{bc}	2.88 (1.69)^{bc}	2.76 (1.65)^{bc}	2.53 (1.58)^{b}	2.80	48.33
4	Diafenthiuron 50 WP	1.5g/ltr	5.68 (2.38)	2.41 (1.55)^{b}	2.09 (1.46)^{cd}	1.50 (1.22)^{de}	1.15 (1.07)^{c}	1.78	67.15
5	Spiromesifen 22.9 SC	0.5ml/ltr	5.36 (2.31)	2.79 (1.67)^{cde}	2.46 (1.56)^{cd}	2.13 (1.45)^{cd}	2.06 (1.42)^{bc}	2.36	56.45
6	Fenazaquin 10 EC	2.0ml/ltr	5.10 (2.25)	2.92 (1.70)^{cd}	2.62 (1.57)^{bc}	2.34 (1.52)^{bd}	2.15 (1.45)^{bc}	2.50	53.87
7	Azadirachtin 10,000 ppm	2.0ml/ltr	4.98 (2.23)	3.50 (1.87)^{b}	3.00 (1.82)^{b}	2.90 (1.70)^{b}	2.35 (1.53)^{b}	2.93	46.00
8	Acephate 75 SP	1.5g/ltr	5.21 (2.28)	2.31 (1.52)^{def}	1.70 (1.32)^{de}	1.40 (1.19)^{ef}	1.00 (1.00)^{d}	1.60	70.47
9	Control	-	5.07 (2.25)	5.09 (2.30)^{a}	5.32 (2.31)^{a}	5.55 (2.35)^{a}	5.72 (2.39)^{a}	5.42	-
	SEM±	-	NS	0.67	0.46	0.45	0.44	-	-
	CD (P=0.05)	-	NS	1.43	1.40	1.37	1.33	-	-
	CV (%)	-	8.10	8.38	8.90	9.42	9.95	-	-

Figures in parentheses are √x + 0.5 transformed values; Means in the columns followed by the same alphabet do not differ significantly by DMRT (P = 0.05); DBS-Day before spray; DAS- Days after spray.

One day after spray, lowest population 1.94 leafhoppers per leaf was observed in the treatment of acetamiprid 20 SP which was on par with imidacloprid 17.8 SL which recorded of 2.10 leafhoppers per leaf followed by acephate 75 (2.31 leafhoppers per leaf), diafenthiuron 50 EC (2.41 leafhoppers peleaf), spiromecifen 22.9 SC (2.79 leafhoppers per leaf), fenazaquin10 EC (2.92 leafhoppers per leaf) and chlorfenapyr 10 EC. Highest population of 3.50 leafhoppers per leaf was recorded in botanical Azadirachtin 10,000 ppm. Whereas, in untreated plot highest population of 5.09 leafhoppers per leaf was observed.

Three days after spraying, the treatment acetamaprid 20 SP was found most effective and recorded significantly less leafhopper population of 1.25 per leaf followed by imidacloprid 17.8 SL, acephate 75 SP (1.70 leafhopper per leaf) and diafenthiuron 50 EC (2.09 leafhopper per leaf). Azadirachtin10, 000 ppm showed maximum leafhopper population of 3.00 per leaf. At five days after spraying acetamiprid 20 SP was most effective and promising insecticideand recorded lowest leafhopper population of 0.86 per leaf. Further, the population of leafhopper in imidacloprid 17.8 was 1.01 per leaf, which was on par with treatment of that acetamiprid 20 SP and significantly higher leafhopper population was noticed in azadirachtin 10,000 ppm of 2.90 in treated plots. In control, leafhopper population increased from 5.07 to 5.55 per leaf (Table 2).

Seven days after spray lowest population of leafhoppers was observed in the treatment with acetamiprid 20 SP (0.37 leafhoppers per leaf) with of 80.00 per cent reduction in population which was on par with imidacloprid 17.8 SL (0.60 leafhoppers per leaf) with protection of 76.56 per cent which was followed acephate 75 SP (1.00 leafhoppers per leaf) and 70.47 per cent reduction. Whereas, spiromecifen 22.9 SC (2.06 leafhoppers per leaf) with reduction of 56.45 per cent and fenazaquin 10 EC (2.15 leafhoppers per leaf) and with reduction of 53.87 per cent which were on far with each other. Least per cent protection was observed in the treatment azadirachtin 10,000 ppm (2.35leafhoppers per leaf) of about 46.00 per cent. Whereas, in case of untreated plot recorded the highest population of leafhoppers (5.72 leafhoppers / leaf).

Second spray

When the leafhoppers population on different treatments started to retained up in different treatment second spray was taken up at 15 days after first spray. The data pertaining to the efficacy of insecticides after second spray is presented in the **Table 3**.

Table 3 Efficacy of different insecticides against leafhoppers, *Emposca terminalis* during *Kharif* 2018-19 (second spray)

Sl. No.	Treatments	Dosage (g or ml per ltr.)	Mean no. of leafhoppers per leaf						Per cent reduction over control
			1DBS	1DAS	3DAS	5DAS	7DAS	Mean	
1	Acetamiprid 20 SP	0.3g/ ltr	2.92 (1.70)^{e}	1.20 (1.08)^{f}	0.96 (0.97)^{e}	0.53 (0.74)^{e}	0.33 (0.56)^{e}	0.75	88.46
2	Imidacloprid 17.8 SL	0.5ml/ltr	3.23 (1.79)^{de}	1.65 (1.28)^{ef}	1.09 (1.04)^{de}	0.85 (0.92)^{e}	0.57 (0.75)^{de}	1.04	84.00
3	Chlorfenapyr 10 EC	1.5ml/ltr	4.10 (2.02)^{bc}	3.12 (1.76)^{bcd}	2.72 (1.64)^{bc}	2.25 (1.50)^{bc}	1.84 (1.35)^{bc}	2.39	61.84
4	Diafenthiuron 50 WP	1.5g/ltr	3.60 (1.88)^{a}	2.23 (1.49)^{cde}	1.46 (1.20)^{cde}	1.30 (1.14)^{cd}	1.16 (1.07)^{d}	1.53	76.46
5	Spiromesifen 22.9 SC	0.5ml/ltr	4.13 (2.02)^{cd}	2.83 (1.68)^{cd}	1.89 (1.37)^{cd}	1.70 (1.30)^{cd}	1.40 (1.18)^{c}	1.95	70.00
6	Fenazaquin 10 EC	2.0ml/ltr	3.40 (1.83)^{bcd}	3.09 (1.75)^{bcd}	2.13 (1.45)^{bcd}	1.91 (1.38)^{bc}	1.70 (1.30)^{c}	2.20	66.15
7	Azadirachtin 10,000 ppm	2.0ml/ltr	3.33 (1.82)^{b}	3.16 (1.77)^{ab}	2.95 (1.71)^{b}	2.61 (1.61)^{b}	1.98 (1.40)^{b}	22.67	58.92
8	Acephate 75 SP	1.5g/ltr	3.83 (1.95)^{de}	1.96 (1.40)^{def}	1.33 (1.15)^{de}	1.20 (1.09)^{de}	0.60 (0.74)^{d}	1.26	80.61
9	Control		6.01 (2.45)^{a}	6.07 (2.46)^{a}	6.32 (2.51)^{a}	6.61 (2.57)^{a}	7.02 (2.64)^{a}	6.50	-
	SEM±		0.53	0.74	0.53	0.45	0.32	-	-
	CD (P=0.05)		1.59	1.58	1.59	1.37	0.97	-	-
	CV (%)		8.43	10.77	12.62	11.75	9.29	-	-

Figures in parentheses are $\sqrt{x} + 0.5$ transformed values; Means in the columns followed by the same alphabet do not differ significantly by DMRT (P = 0.05); DBS-Day before spray; DAS- Days after spray

At one day after spraying population of leafhopper ranged from 1.20 to 3.16 per leaf. Acetamiprid 20 SP was retained its superiority in reduction of leafhopper population from 2.92 to 1.20 per leaf followed by imidacloprid 17.8 SL which recorded 1.65 leafhopper per leaf which was on with acetamiprid 20 SP. Whereas, acephate 75 SP and diafenthiuron 50 EC recorded 1.96 and 2.23 leafhopper per leaf respectively. In untreated control aphid population increased from 6.01 to 6.07 per leaf at one day after spraying (Table 3).

The mean population of leafhopper recorded at three days after spraying indicated that acetamiprid 20 SP and imidacloprid 17.8 are on par with each other and significantly reduce the leafhopper population to 0.96 and 1.09 per leaf, respectively. Azadirachtin 10,000 ppm recorded highest leafhopper population of 2.13 per leaf compared to other treatment included in the study.

The data recorded on five days after spraying showed the leafhopper population ranged from 0.53 to 2.61 per leaf. All the treatments were significantly superior over the control in reducing leafhopper population. The lowest number of 0.53 leafhoppers per leaf was observed in plots treated with acetamiprid 20 SP and emerged as significantly superior treatment. However, it was on par with imidacloprid 17.80 recorded leafhopper population of 0.85 per leaf, respectively (Table 3).

It was evident from the leafhopper population recorded at seven days after treatment varied from 0.33 to 1.98 per leaf and 7.02 in the untreated control. The treatment with azadirachtin 10,000 ppm treated plot recorded least leafhopper population of 1.98 per leaf (Table 3).

The mean leafhopper population after second spray of insecticides across the treatments indicated that least population of leafhopper was recorded in acetamaprid 20 SP (0.75 leafhopper per leaf) followed by imidacloprid 17.8 SL with the population of 1.04 leafhopper per leaf. Whereas, untreated control recording the highest population of 6.50 leafhopper per leaf (Table 3**).** Among the treatments, highest per cent reduction of 88.46 was recorded in acetamaprid 20 SP followed by imidacloprid 17.8 SL, acephate 75 SP and diafenthiuron 50 EC (84.00, 80.61 and

76.46 %, respectively.

Pooled data

The data after pooling first and second spray, the selected insecticides were effective in reducing the leafhopper population over untreated control. However, the treatment acetamaprid 20 SP recorded the highest per cent reduction of 84.39 per cent leafhopper population and proved to be superior against leafhoppers followed by imidacloprid 17.8 SL (80.70 %), acephate 75 SP (76.06 %) and diafenthiuron 50 EC (72.14 per cent) (**Table 4**).

Table 4 Efficacy of different insecticides against leafhoppers, *Emposca terminalis* during *Kharif* 2018-19 (pooled)

Sl. No.	Treatments	Dosage (g or ml per ltr.)	Mean no. of leafhoppers per leaf											Per cent reductio n over control
			First spray					Second spray						
			1DBS	1DAS	3DAS	5DAS	7DAS	1DBS	1DAS	3DAS	5DAS	7DAS	Mean	
1	Acetamiprid 20 SP	0.3g/ ltr	5.37 (2.31)	1.94 (1.39)^{f}	1.25 (1.11)^{e}	0.86 (0.95)^{f}	0.37 (0.60)^{e}	2.92 (1.70)^{e}	1.20 (1.08)^{f}	0.96 (0.97)^{e}	0.53 (0.74)^{e}	0.33 (0.56)^{e}	0.93	84.39
2	Imidacloprid 17.8 SL	0.5ml/ltr	5.33 (2.30)	2.10 (1.44)^{ef}	1.40 (1.18)^{e}	1.01 (1.03)^{f}	0.60 (0.77)^{e}	3.23 (1.79)^{de}	1.65 (1.28)^{ef}	1.09 (1.04)^{de}	0.85 (0.92)^{e}	0.57 (0.75)^{de}	1.15	80.70
3	Chlorfenapyr 10 EC	1.5ml/ltr	5.83 (2.41)	3.06 (1.74)^{bc}	2.88 (1.69)^{bc}	2.76 (1.65)^{bc}	2.53 (1.58)^{b}	4.10 (2.02)^{bc}	3.12 (1.76)^{bcd}	2.72 (1.64)^{bc}	2.25 (1.50)^{bc}	1.84 (1.35)^{bc}	2.64	55.70
4	Diafenthiuro n 50 WP	1.5g/ltr	5.68 (2.38)	2.41 (1.55)^{b}	2.09 (1.46)^{cd}	1.50 (1.22)^{de}	1.15 (1.07)^{c}	3.60 (1.88)^{a}	2.23 (1.49)^{cde}	1.46 (1.20)^{cde}	1.30 (1.14)^{cd}	1.16 (1.07)^{d}	1.66	72.14
5	Spiromesifen 22.9 SC	0.5ml/ltr	5.36 (2.31)	2.79 (1.67)^{cde}	2.46 (1.56)^{cd}	2.13 (1.45)^{cd}	2.06 (1.42)^{bc}	4.13 (2.02)^{cd}	2.83 (1.68)^{cd}	1.89 (1.37)^{cd}	1.70 (1.30)^{cd}	1.40 (1.18)^{c}	2.15	63.92
6	Fenazaquin 10 EC	2.0ml/ltr	5.10 (2.25)	2.92 (1.70)^{cd}	2.62 (1.57)^{bc}	2.34 (1.52)^{bd}	2.15 (1.45)^{bc}	3.40 (1.83)^{bcd}	3.09 (1.75)^{bcd}	2.13 (1.45)^{bcd}	1.91 (1.38)^{bc}	1.70 (1.30)^{c}	2.35	60.57
7	Azadirachtin 10,000 ppm	2.0ml/ltr	4.98 (2.23)	3.50 (1.87)^{b}	3.00 (1.82)^{b}	2.90 (1.70)^{b}	2.35 (1.53)^{b}	3.33 (1.82)^{b}	3.16 (1.77)^{ab}	2.95 (1.71)^{b}	2.61 (1.61)^{b}	1.98 (1.40)^{b}	2.80	53.02
8	Acephate 75 SP	1.5g/ltr	5.21 (2.28)	2.31 (1.52)^{def}	1.70 (1.32)^{de}	1.40 (1.19)^{ef}	1.00 (1.00)^{d}	3.83 (1.95)^{de}	1.96 (1.40)^{def}	1.33 (1.15)^{de}	1.20 (1.09)^{de}	0.60 (0.74)^{d}	1.43	76.06
9	Control	-	5.07 (2.25)	5.09 (2.30)^{a}	5.32 (2.31)^{a}	5.55 (2.35)^{a}	5.72 (2.39)^{a}	6.01 (2.45)^{a}	6.07 (2.46)^{a}	6.32 (2.51)^{a}	6.61 (2.57)^{a}	7.02 (2.64)^{a}	5.96	-
	SEM±	-	NS	0.67	0.46	0.45	0.44	0.53	0.74	0.53	0.45	0.32	-	-
	CD (P=0.05)	-	NS	1.43	1.40	1.37	1.33	1.59	1.58	1.59	1.37	0.97	-	-
	CV (%)	-	8.10	8.38	8.90	9.42	9.95	8.43	10.77	12.62	11.75	9.29	-	-

Figures in parentheses are √x + 0.5 transformed values; Means in the columns followed by the same alphabet do not differ significantly by DMRT (P = 0.05); DBS-Day before spray; DAS- Days after spray

The present findings are in agreement with [8] reported that acetamiprid (0.004 %) and imidacloprid (0.01 %) were the most effective treatments for the control of leafhoppers in soybean. [9] Recorded the reduced infestation of leafhoppers, *E. kerri* by 34.95 per cent over control and obtained yield increase of 28.6 per cent over control by treating with acetamiprid in groundnut crop. [10] Showed that imidacloprid 200 SL @ 100, 150, 200 and 250 ml/ha were found effective against, *E. kerri* on groundnut. The results of the present findings are in accordance with the above reports. [11] Reported that acetamiprid (20 g a.i/ha) and imidacloprid (25 g a.i/ha) were most effective in controlling okra jassids.

Yield and cost economics

The data on yield of yard long bean revealed that, the significantly higher yield of 15.57 t/ha was recorded in imidacloprid 17.8 SL treated plot followed by acetamaprid 20 SP (15.10 t/ha), diafenthiuron 50 EC (13.72 t/ha), acephate 75 SP (10.62 t/ha), spiromecifen 22.9 SC (12.15 t/ha), fenazaquin 10 EC (11.74 t/ha), chlorfenapyr 10 EC(11.35 t/ha) and azadirachtin 10,000 ppm (10.62 t/ha). Significantly lower yield of 8.47 t/ha was recorded in untreated control (**Table 5**).

The higher cost benefit ratio of 1:4.76 was recorded in imidacloprid 17.8 SL applied plot followed by acetamaprid 20 SP (1:4.73), acephate 75 SP (1:4.01), diafenthiuron 50 EC (1:3.88), spiromecifen 22.9 SC (1:3.61), fenazaquin10 EC (1:3.19), chlorfenapyr 10 EC (1:3.25) and azadirachtin 10,000 (1:3.26). However lower benefit cost ratio of 1:2.82 was recorded in untreated check.

The present investigations are in close agreement with the reports [12] revealed that, higher yield was recorded in imidacloprid 17.8 SL proving them to be on par with acetamiprid 20 SP in Pigeon pea.

Table 5 Cost benefit ratio of different insecticides against sucking pests of yard long bean during 2018-19

Sl. No.	Treatments	Dosage (g or ml per ltr.)	Yield (t/ha)	Cost of protection (Rs/ha)	Total cost of production (Rs/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	C:B ratio
1	Acetamiprid 20 SP	0.3g/ ltr	15.10	1860	31860	151000	119140	1:3.73
2	Imidacloprid 17.8 SL	0.5ml/ltr	15.47	2700	32700	154700	122000	1:3.73
3	Chlorfenapyr 10 EC	1.5ml/ltr	11.35	4850	34850	115200	80350	1:2.30
4	Diafenthiuron 50 WP	1.5g/ltr	13.72	5274	35274	160500	125226	1:3.55
5	Spiromesifen 22.9 SC	0.5ml/ltr	12.15	3620	33620	131100	97480	1:2.89
6	Fenazaquin 10 EC	2.0ml/ltr	11.74	6728	36280	127050	90770	1:2.50
7	Azadirachtin 10,000 ppm	2.0ml/ltr	10.62	2576	32576	106500	73924	1:2.26
8	Acephate 75 SP	1.5g/ltr	13.48	3600	33600	147300	11370	1:3.38
9	Control	-	8.47	-	30000	84700	52050	1:1.82

Note: Market price of yard long bean Rs. 10/kg
Cost of insecticides: 1: Acetamiprid 20 SP (100g) - Rs.220.00/-, 2: Imidacloprid 17.8 SL (1000 ml)- 3000.00/-, 3: Acephate 75 SP (200g) -320.00/-, 4: Chlorfenapyr 10 EC (100ml) - 365.00/-, 5: Diafenthiuron 50 WP (500 g): 2037.00/-, 6: Spiromesifen22.9 SC (100 ml) - 484.00/-, 7:
Fenazaquin 10 EC (250 ml) - 691.00/-, 8: Azadirachtin 1000 ppm (250ml)- 172.00/-
Cost of labour: Rs. 300/day; Standard spray volume: 500 lit/ha and cost of production 30000

Conclusion

Based on the results of the present study, it may be concluded that yard long bean is growing round the year in some parts of Karnataka. Farmers are unaware of loss by leafhoppers. To overcome the loss caused by the leafhoppers acetamiprid 20 SP and imidacloprid 17.8 SL proved to be the most promising insecticides with minimum population of leafhoppers followed by acephate 75 SP and diafenthiuron 50 EC. Result of experiment concluded that all the treatment was found significantly superior over control in reducing the leafhoppers population and toxicity studies of the insecticides was observed from maximum to minimum in the following order, Acetamaprid > Imidacloprid > Acephate > Diafenthiuron > Spiromecifen > Fenazaquin > Chlorfenapyr > Azadirachtin.

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