MANAGEMENT OF *Polyphagotarsonemus latus* (BANKS) IN CLUSTERBEAN WITH NEWER INSECTICIDES

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ABSTRACT

A field experiment was conducted to determine the efficacy of eleven chemical insecticides against mite of clusterbean at Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during kharif 2013-14. The results revealed that abamectin 0.003 per cent, difenthiuron 0.07 per cent, fenazaquin 0.02 per cent, spiromecifen 0.024 per cent and ethion 0.05 per cent were found most effective treatments against mite of clusterbean, while treatment of buprofezin 0.05 per cent was found next in order for the control of this pest. The highest green pod yield of clusterbean (2291 kg/ha) was recorded in the treatment of difenthiuron 0.07 per cent which was at par with imidacloprid 0.0006 per cent (2194 kg/ha). Both these treatments also recorded higher per cent increase in yield over control i.e. 211.27 and 198.09 per cent, respectively. Looking to the economics of these insecticides, imidacloprid 0.006 per cent gave the highest cost benefit ratio (1:39.29) followed by spiromesifen 0.024 per cent (1:26.99), thiacloprid 0.008 per cent (1:25.51), ethion 0.05 per cent (1:24.25), acephate 0.15 per cent (1:19.33), difenthiuron 0.07 per cent (1:12.39), cartap hydrochloride 0.1 per cent (1:09.26) and buprofezin 0.05 per cent (1:09.03).

KEY WORDS: Bio-efficacy, clusterbean, mite,

INTRODUCTION

Clusterbean [*Cyamopsis tetragonoloba* (Linn.) Taub.] represent its derivation from the Sanskrit word "GAUAAHAR" which means cow fodder or otherwise fodder of the livestock. It belongs to the Fabaceae family. Basically, guar is a drought hardy, deep rooted crop of *kharif* grown in arid and semi-arid region of North-Western India. It is one of the important a leguminous vegetable crop due to its nutritional and industrial values. India accounts for 80 per cent of the total clusterbean seed produced in the world. About 70 per cent of India's production comes from Rajasthan. India produces 9.0 lakh tones of clusterbean annually. It contributes 80 per cent share in the world's total production (Anonymous, 2012a). In Gujarat State, it is mainly cultivated in Ahmadabad, Vadodara, Gandhinagar, Kheda, Surat, Navsari, Valsad, Kutch, Banaskantha, Mehsana and Sabarkantha. The estimated area under clusterbean crop for vegetable purpose in Gujarat is 1359 hectares with a production of 568 lakh MT. (Anonymous, 2012b).

Such an important vegetable crop is found to be attacked by various insects and mite pests (Singh *et al*., 1981; Butani and Jotwani, 1984) during its different growth stages and causing heavy yield losses. A spider mite *P. latus* (Banks) (family: Tarsonemidae) (Order: Acarina) is an

important non-insect pest of crop (Singh *et al.*, 1981). In case of mite, both nymphs and adults are found to suck cell sap from the leaves. They prefer upper side of the leaves for feeding, but in case of severe infestation, both the sides are covered. Breeding usually takes place under webbing. The damage is done by rasping the surface of the leaves and feeding on the exuding juice. The damage is severe under drought stress, when complete drying of the foliage can occur. According to Amin (1988), the mite infested leaves show stippling, followed by yellowing and finally turns almost white. Such plants show extensive webbing and tips of the plants may appear reddish ultimately the whole plant may withers and dies. Many research workers had strongly advocated the chemical control measures as the most effective and economical method of insect control than any other techniques. Keeping all above factors in mind, the present investigation was undertaken to management of newer insecticides against mite of cluster bean under Junagadh conditions of Gujarat State.

MATERIALS AND METHODS

With a view to evaluate the bio-efficacy of newer insecticides against mite of clusterbean, a field experiment was conducted at Instructional Farm, Junagadh Agricultural University, Junagadh during *kharif* 2013-14. "Pusa Navbahar" variety of clusterbean was sown with spacing 0f 60 cm x 20 cm with following recommended package of practices except plant protection. The experiment consists of three replication and eleven treatments. For deciding the quantity of spray fluid required, control plots were sprayed with water. Sprayed fluid was prepared by mixing measured quantity of water and insecticides. All necessary care was taken to prevent the drift of insecticides to reach the adjacent plots. When the population of mite was sufficient, the first spray was given on 15th November, 2013. Similarly, the second spray was given at fifteen days interval, i.e. on 30th November, 2013. Observation of mite was recorded at weekly interval by observing three leaves (upper, middle and lower) of each tagged clusterbean plant. Observations on mite recorded by help of 10 X magnifying lens. The observation of mite was recorded during early morning. Based on the population of insect-pest recorded so far per cent mortality was calculated by using the following formula given by Henderson and Tilton (1955) and then transformed into arcsine percentage before statistical analysis. The data on pest count were converted to per cent mortality

$$\text{Corrected mortality (\%)} = 100 \times 1 - \left(\frac{Ta - Cb}{Tb - Ca} \right)$$

Where,
Tb = No. of insect pests observed before treatment,
Ta = No. of insect pests observed after treatment,
Cb = No. of insect-pests observed from untreated plot before treatment,
Ca = N0. of insect-pests observed from untreated plot after treatment.

The green pod yield of clusterbean was recorded from different treatments along with control. Yield of green pod of clusterbean was collected by three picking and finally total green pod yield was calculated and was converted to hectare basis and subjected to statistical analyze. The percentage of yield increased and avoidable yield losses were worked out by using the following formula.

$$\text{Per cent yield increase} = 100 \times \left(\frac{T - C}{C} \right)$$

$$\text{Avoidable loss (\%)} = 100 \times \left(\frac{T - C}{T} \right)$$

Where,
T = Yield of cluster bean from treated (protected) crop (kg/ha)
C = Yield of cluster bean from untreated (unprotected) crop (kg/ha)

Efforts have been made to work out incremental cost benefit ratio (ICBR) from the experimental data to assess economics of the different insecticidal treatments. Economics of the insecticidal treatments worked out by considering the current market price of clusterbean green pod, cost of insecticide and labour charges.

Incremental cost benefit ratio (ICBR) was also worked out to compare the economics of different insecticidal treatments by using the following formula.

i. Gross realization (₹/ha) =Yield (kg/ha) × Market price of produce (₹/kg)

ii.Net realization (₹/ha) =Gross realization of treated plot (₹/ha) – Gross realization of control plot

iii. Total cost of control measure (₹/ha) = Cost of insecticide (₹/ha) + Labour charge (₹/ha)

iv. C: B ratio =Net realization (₹/ha) ÷ Total cost of control measure (₹/ha)

RESULTS AND DISCUSSION

First spray

Three days after first spraying

The results on mortality of mite recorded at three days after spray of different insecticidal treatments (Table 1) revealed that the treatment of abamectin 0.003 per cent proved to be the most effective, which recorded 91.28 per cent mortality of this pest and it was statistically at par with difenthiuron 0.07 per cent, fenazaquin 0.02 per cent, spiromesifen 0.024 per cent and ethion 0.05 per cent, as they registered 90.76, 89.62, 83.97 and 83.74 per cent mortality, respectively. However, the treatment of buprofezin 0.05 per cent was found next in order, as it recorded 70.23 cent mortality. The rest of the insecticidal treatments were found least effective for the control of mite.

Five days after first spraying

The results presented in Table 1 indicated that the treatment of abamectin 0.003 per cent was proved to be the most effective, which recorded 93.07 per cent mortality of mite and it did not differ significantly from difenthiuron 0.07 per cent, fenazaquin 0.02 per cent, spiromesifen 0.024 per cent and ethion 0.05 per cent, as they registered 91.16, 90.66, 85.82 and 85.41 per cent mortality, respectively. The treatment of buprofezin 0.05 per cent was found next in order, as it noted 72.97 per cent mortality of this pest. The remaining insecticidal treatments were found least effective against mite.

Seven days after first spraying

The mean per cent mortality of mite at seven days after spray of different insecticidal treatments (Table 1) revealed that the difference in mortality per cent of mite was found statistically significant. The treatment of abamectin 0.003 per cent recorded the highest per cent mortality of mite *i.e.* 89.51 per cent. However, it was statistically at par with difenthiuron 0.07, fenazaquin 0.02 per cent, spiromesifen 0.024 per cent and ethion 0.05 per cent, as they registered 88.49, 86.09, 84.08 and 79.56 per cent mortality, respectively. It was followed by the treatment of buprofezin 0.05 per cent with 71.37 per cent mortality of this pest. The rest of the insecticidal treatments were found less effective for control of mite, as they recorded less than 65 per cent mortality of this pest.

Second spray

Three days after first spraying

The results presented in Table 1 revealed that among the different insecticides tested against mite, abamectin 0.003 per cent was found to be the most effective, which registered the highest *i.e.* 92.66 per cent mortality of this pest and it was statistically at par with difenthiuron 0.07 per cent, fenazaquin 0.02 per cent, ethion 0.05 per cent and spiromesifen 0.024 per cent, as they registered 91.67, 87.57, 84.67 and 82.50 per cent mortality, respectively. It was followed by the treatment of buprofezin 0.05 per cent found next in order with 70.48 per cent mortality of this pest. The rest of the insecticidal treatment found least effective for the control of mite, as they noted less than 65 per cent mortality of this pest.

Five days after first spraying

Abamectin 0.003 per cent was found the most effective insecticidal treatment against mite, as it registered the highest *i.e.* 93.28 per cent mortality at five days after spray (Table 1) and which was statistically at par with difenthiuron 0.07 per cent, fenazaquin 0.02 per cent, ethion 0.05 per cent and spiromesifen 0.024 per cent, as they recorded 91.03, 89.98, 85.95 and 85.60 per

cent mortality, respectively. It was followed by the treatment of buprofezin 0.05 per cent and found next in order for their effectiveness against mite with 72.19 per cent mortality. The rest of the insecticidal treatments were found least effective against mite of cluster bean.

Seven days after spraying

The mean per cent mortality of mite at seven days after spray (Table 1) revealed that the treatments of abamectin 0.003 per cent found most effective for the control of mite, which recorded 90.66 per cent mortality of this pest. However, it was statistically at par with difenthiuron 0.07 per cent, fenazaquin 0.02 per cent and spiromesifen 0.024 per and ethion 0.05 per cent, as they noted 88.28, 87.25, 86.38 and 80.09 per cent mortality, respectively. The next best treatment was buprofezin 0.05 per cent with 73.41 per cent mortality of this pest. The rest of the insecticidal treatments were found least effective for the control of mite.

These findings are more or less research carried out at Junagadh Agricultural University, Junagadh during the year of 2009, in which the lowest leaf damage percentage (28.24%) by this pest was recorded in the treatment of abamectin 0.003%, which was at par with difenthiuron 0.07 per cent (29.53%). The next best treatment was buprofazin 0.025 per cent (73.57%) (Anonymous, 2009). In another study carried out at Junagadh Agricultural University, Junagadh during the year of 2012, it was found that the treatment of difenthiuron 50 WP 0.07 per cent, abamectin 1.9 EC 0.003 per cent and buprofazin 25 EC 0.025 per cent were found most effective, which recorded lower per cent leaves and pods damage caused by mite (*P. latus*) in clusterbean (Anonymous, 2012c). Thus, the present finding confirms the results obtained in earlier research and proved its validity against mite.

Yield and economics of different insecticidal treatments

Considering the green pod yield of clusterbean, the treatment of difenthiuron 0.07 per cent registered the highest pod yield of 2291 kg/ha and found at par with imidacloprid 0.006 per cent (2194 kg/ha). Both these treatments also recorded higher per cent increase in yield over control *i.e.* 211.27 and 198.09 per cent, respectively. The economics of different insecticidal treatments have been worked out along with cost benefit ratio (CBR) are presented in Table 2. Cost benefit ratio is a very important criterion, which indicates the efficacy and suitability of a recommendation for wide scale adoption. The economics of various insecticidal treatments presented in Table 2 revealed that the highest cost benefit ratio (1:39.29) was obtained in the treatment of imidacloprid 0.006 per cent followed by spiromesifen 0.024 per cent (1:26.99), thiacloprid 0.008 per cent (1:25.51), ethion 0.05 per cent (1:24.25), acephate 0.15 per cent (1:19.33), difenthiuron 0.07 per cent (1:12.39), cartap hydrochloride 0.1 per cent (1:09.26) and buprofezin 0.05 per cent (1:09.03). The treatments of fenazequin 0.02 per cent (1:06.99), clothianidin 0.025 per cent (1:04.96) and abamectin 0.003 per cent (1:02.60) were found next in order with comparatively low cost benefit ratio. Kalasariya *et al.* (2013) reported that the treatment of imidacloprid 0.006 per cent, fenazequin 0.01 per cent and difenthiuron 0.05 per cent gave highest cost benefit ratio of (1:34.17), (1:31.40) and (1:23.48), respectively.

CONCLUSION

Looking to the overall results of two sprays of different insecticides, it can be concluded that abamectin 0.003 per cent was proved to be the most effective against mite and it did not differ significantly from difenthiuron 0.07 per cent, fenazaquin 0.02 per cent, ethion 0.05 per cent and spiromesifen 0.024 per cent. While, treatment of buprofezin 0.05 per cent was found next in order for the control of this pest. The treatments of imidacloprid 0.006

per cent (1:39.29), spiromesifen 0.024 per cent (1:26.99), thiacloprid 0.008 per cent (1:25.51), ethion 0.05 per cent (1:24.25), acephate 0.15 per cent (1:19.33) and difenthiuron 0.07 per cent (1:12.39) were found not only effective for the control of pest complex of clusterbean but also proved its effectiveness by giving comparatively higher cost benefit ratio.

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Table 1: Efficacy of different insecticides against *P. latus* on clusterbean.

Sr. No.	Treatments	Per Cent Mortality of Mite					
		First Spray			Second Spray		
		3 DAS	5 DAS	7 DAS	3 DAS	5 DAS	7 DAS
1	Spiromesifen 0.024%	66.40 (83.97)	67.88 (85.82)	66.48 (84.08)	65.27 (82.50)	67.70 (85.60)	68.34 (86.38)
2	Buprofezin 0.05%	56.93 (70.23)	58.67 (72.97)	57.65 (71.37)	57.09 (70.48)	58.17 (72.19)	58.96 (73.41)
3	Abamectin 0.003%	72.83 (91.28)	74.74 (93.07)	71.11 (89.51)	74.28 (92.66)	74.97 (93.28)	72.20 (90.66)
4	Difenthiuron 0.07%	72.30 (90.76)	72.70 (91.16)	70.17 (88.49)	73.22 (91.67)	72.57 (91.03)	69.98 (88.28)
5	Ethion 0.05%	66.22 (83.74)	67.55 (85.41)	63.12 (79.56)	66.95 (84.67)	67.99 (85.95)	63.50 (80.09)
6	Thiacloprid 0.008%	52.70 (63.28)	52.29 (62.58)	48.13 (55.45)	50.22 (59.06)	49.16 (57.23)	48.82 (56.65)
7	Cartap hydrochloride 0.1%	52.41 (62.78)	53.20 (64.12)	46.15 (52.00)	48.67 (56.22)	45.02 (50.03)	43.07 (46.63)
8	Clothianidin 0.025%	52.05 (62.19)	53.35 (64.37)	52.19 (62.41)	52.67 (63.24)	53.00 (63.79)	50.33 (59.25)
9	Imidacloprid 0.006%	49.54 (57.90)	50.45 (59.45)	48.89 (56.76)	51.61 (61.43)	50.50 (59.55)	48.66 (56.37)
10	Fenazaquin 0.02%	71.21 (89.62)	72.20 (90.66)	68.10 (86.09)	69.36 (87.57)	71.55 (89.98)	69.08 (87.25)
11	Acephate 0.15%	50.53 (59.60)	48.94 (56.86)	46.14 (51.99)	51.29 (60.90)	50.19 (59.01)	47.31 (54.03)
S.Em.±		3.64	3.55	3.67	4.28	3.77	3.38
C. D. at 5%		10.68	10.43	10.76	12.56	11.07	9.93
C. V.%		11.41	11.00	11.94	13.47	11.87	10.99

Figures in parentheses ( ) are retransformed values, those outside are arcsine value
DAS – Days After Spraying

Table 2: Economics of insecticidal treatments applied for the control of major insect pests of clusterbean.

Sr. No.	Treatments	Total Quantity of Insecticides for 2 Sprays (lit or kg/ha)	Price of Insecticides (₹/ lit or kg)	Cost of Insecticides (₹/ha)	Cost of Treatments (₹/ha)	Yield (kg/ha)	Gross Realization (₹/ha)	Net Realization (₹/ha)	ICBR
1	Spiromesifen 0.024%	0.12	3965	475.8	1275.8	1597	63880	34440	1:26.99
2	Buprofezin 0.05%	2.4	1512	3628.8	4428.8	1736	69440	40000	1:09.03
3	Abamectin 0.003%	1.9	7100	13490	14290	1666	66640	37200	1:02.60
4	Difenthiuron 0.07%	1.68	2510	4216.8	5016.8	2291	91640	62200	1:12.39
5	Ethion 0.05%	1.2	592	710.4	1510.4	1652	66080	36640	1:24.25
6	Thiacloprid 0.008%	0.40	2190	876	1676	1805	72200	42760	1:25.51
7	Cartap hydrochloride 0.1%	2.4	440	1056	1856	1166	46640	17200	1:09.26
8	Clothianidin 0.025%	0.6	14500	8700	9500	1916	76640	47200	1:04.96
9	Imidacloprid 0.006%	0.40	1710	684	1484	2194	87760	58320	1:39.29
10	Fenazaquin 0.02%	2.4	2180	5232	6032	1791	71640	42200	1:06.99
11	Acephate 0.15%	2.4	600	1440	2240	1819	72760	43320	1:19.33
12	Control	-	-	-	-	736	29440		

1. Labour charges: ₹400/ha/spray. ***2. Market price of cluster bean green pod is calculated: ₹40/kg***

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