International Journal of Applied and Pure Science and Agriculture
ISSN Online - 2394-5532 Impact Factor: 3.762 by SJIF ISSN Print - 2394-823X

Chemical Compatibility of Insecticides and Fungicides/ Bactericide on Cabbage aphid - *Brevicoryne brassicae*

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Abstract

The present studies were carried out in Students Farm, College of Agriculture, Rajendranagar during kharif and rabi, 2012-13 with an objective to evaluate chemical compatibility of six insecticides viz., spinosad, indoxacarb, cartap hydrochloride, chlorfenapyr, flubendiamide, Bacillus thuringiensis and two fungicides viz., copper oxychloride and metalaxyl MZ and one bactericide, streptocycline against cabbage aphid. The results under field conditions showed that the aphid incidence reduced upto 5 DAS in all the combinations during both kharif and rabi seasons and subsequently increased. Spinosad in combination with all the fungicides/bactericide viz., copper oxychloride, metalaxyl MZ and streptocycline were highly effective in reducing the population of aphids during both the seasons.

Keywords: Chemical compatibility, insecticides, fungicides, bactericide, cabbage aphid

I. INTRODUCTION

At present, highly effective fungicides and insecticides with novel modes of action are available and these are becoming increasingly important in modern agriculture as a component of integrated pest management and resistance management strategies. Although, combined application of pesticides is a labour- saving short cut method, but an understanding and knowledge of pesticide compatibility is essential in order to avoid problems which may arise from combinations of some pesticides. Pesticide combinations may show physical, chemical or phytotoxic incompatibility causing undesirable results. Hence, information on compatibility of different fungicides and insecticides is essential for adopting the technology in field.

'Chemical incompatibility' is when two or more pesticides are mixed together, there is a resultant loss or reduction of effectiveness of one or all components. For this reason most of the organic pesticides should not be used in combination with alkaline compounds having pH > 7.0. Alkaline reactions usually reduce the fungitoxicity of carbamate fungicides. In chemical incompatibility, the activity of the mixture may be different than if the products were applied separately. The results can be either increased activity called synergism or decreased activity which is called antagonism. Bhaskaran and Praveen Kumar (1982) reported maximum enhancement of insecticidal activity in the combinations of quinalphos + zineb, malathion + ediphenphos and malathion + Cuman-L against red rust flour beetle, *Tribolium castaneum* (Herbst). The combination of monocrotophos with mancozeb showed decreased insecticidal activity against red cotton bug (Lakshminarayana and Subbaratnam, 2000). The present study was conducted to evaluate the chemical compatibility between insecticides and fungicides/ bactericide against cabbage aphid *Brevicoryne brassicae*.

II. METHODOLOGY

A short duration (90 days) F_1 cabbage hybrid (Sindhu) was used for this study. The experiment was laid out in Randomized Block Design (RBD) with nineteen treatments including an untreated control. Each treatment was replicated thrice. Plots measuring a net area of 20 m^2 (5m x 4m) were made with irrigation channels according to the design. Single super phosphate and Murate of potash were applied as basal @ 200 kg P_2O_5 ha^{-1} and 220 K_2O ha^{-1} respectively. Twenty nine days old seedlings were transplanted with 45 cm X 45 cm spacing and irrigated simultaneously. Nitrogen was applied in the form of urea @ 80 kg ha^{-1} as pocket application in two equal split doses at 25 and 50 days after transplantation.

Eighteen combinations were tested for their compatibility against cabbage aphid *B. brassicae* along with an untreated control. On the basis of plot area the quantity of spray fluid was worked out to be one litre. The pesticides and their dosages are given in the table 1. Ten plants were randomly selected in each plot leaving the border rows. The data of aphid population on top, middle and bottom leaves of on 10 plants was counted.

Pre treatment counts were taken at one day before spraying. Post treatment counts were taken at two, five, and 10 days after spraying. The per cent reduction of the pest population over untreated control for the post treatment counts of aphids was calculated using the modified Abbott's formula (Flemming and Ratnakaran, 1985) given below.

$$\text{Per cent population reduction} = \left(1 - \left(\frac{\text{Post treatment population in treatment}}{\text{Pre treatment population in treatment}} \times \frac{\text{Pre treatment population in control}}{\text{Post treatment population in control}}\right)\right) \times 100$$

The data was analysed by adopting randomized block design as suggested by Panse and Sukhatme (1985). The values of per cent reduction were transformed to angular values and subjected to analysis of variance to test the significance between the treatments. The cabbage heads were harvested from each plot and the mean yield in kg $plot^{-1}$ for each treatment containing of three replications was converted to t ha^{-1} during both *kharif* 2012 and *rabi* 2013 seasons.

Table 1. Details of Pesticides Tested for Chemical Compatibility

S.no	Pesticide	Trade name	Formulation	Dosage (g or ml l^{-1})
1	Spinosad	Tracer	45 SC	0.3
2	Indoxacarb	Avaunt	15.8 EC	1
3	Cartap hydrochloride	Taz	50 SP	2
4	Chlorfenapyr	Intrepid	10 SC	1.5
5	Flubendiamide	Fame	48SC	0.1
6	*Bacillus thuringiensis*	Delfin	WG	1
7	Metalaxyl MZ	Ridomil MZ	25 WP	2
8	Copper oxychloride	Blitox	50 WP	3
9	Streptocycline	Streptomil	WP	0.2

III. RESULTS AND DISCUSSION

3.1. Kharif, 2012

The mean % reduction of the aphids during kharif in all treatments was significantly higher than untreated control (Table 2). Spinosad was the most effective insecticide which was highly compatible with metalaxyl MZ, copper oxychloride and streptocycline. Spinosad + metalaxyl MZ recorded 88.90 per cent reduction of aphid population and was on par with spinosad + copper oxychloride and spinosad + streptocycline (85.55 and 84.78%). Cartap hydrochloride in combination with copper oxychloride and metalaxyl MZ recorded 70.10 and 67.12 % reduction of aphids and was on par with cartap hydrochloride + streptocycline (65.70%). Flubendiamide + copper oxychloride recorded 55.96 per cent reduction and was on par with flubendiamide + metalaxyl MZ (48.83%) and flubendiamide + streptocycline (48.66%). Similar to flubendiamide, chlorfenapyr + copper oxychloride recorded 32.82 per cent reduction in cabbage aphid, *B. brassicae* population. It was on par with chlorfenapyr + metalaxyl MZ and chlorfenapyr + streptocycline which recorded 32.22 and 29.26 per cent reduction in aphid population, respectively. Indoxacarb in combination with streptocycline recorded only 26.47 per cent reduction of aphid population and was on par with indoxacarb + metalaxyl MZ and indoxacarb + copper oxychloride which recorded 25.81 and 22.08 per cent reduction of aphid population, respectively. The combinations of *Bacillus thuringiensis* with copper oxychloride, metalaxyl MZ and streptocycline were on par with each other by recording 28.91, 26.35 and 23.01 per cent reduction of cabbage aphid, respectively

3.2. Rabi, 2013

The mean % reduction of the aphids during rabi in all treatments was significantly higher than untreated control (Table 2). Spinosad was the best insecticide against the aphids and highly compatible with metalaxyl MZ, copper oxychloride and streptocycline. Spinosad + metalaxyl MZ recorded 84.22 per cent reduction of aphid population and was on par with spinosad + copper oxychloride and spinosad + streptocycline (81.23 and 80.94%). Cartap hydrochloride in combination with copper oxychloride recorded 72.88% reduction of aphids and was on par with cartap hydrochloride + metalaxyl MZ (71.59 %) and showed significant difference over cartap hydrochloride + streptocycline (63.94%). Among the flubendiamide combinations, flubendiamide + copper oxychloride recorded greater compatibility against aphids by recording 52.27 per cent reduction and was on par with flubendiamide + streptocycline (48.49%) and flubendiamide + metalaxyl MZ (45.80%). Chlorfenapyr + metalaxyl MZ recorded 35.82 per cent reduction in cabbage aphid population. It was on par with chlorfenapyr + streptocycline and chlorfenapyr + copper oxychloride which recorded 32.53 and 32.07 per cent reduction in cabbage aphid population, respectively. Indoxacarb in combination with streptocycline recorded 31.79 per cent reduction of aphid population and was on par with indoxacarb + metalaxyl MZ and indoxacarb + copper oxychloride which recorded 28.53 and 27.15 per cent reduction, respectively. The combinations of *Bacillus thuringiensis* with copper oxychloride, metalaxyl MZ and streptocycline were on par with each other by recording 32.86, 27.67 and 26.44 per cent reduction, respectively.

Table 2. Effect of Pesticide Combinations against Cabbage Aphid Brevicoryne brassicae during Kharif and Rabi, 2012-13.

Treatments	Mean % of reduction over untreated control		Mean Yield (t ha^{-1})
	Kharif	*Rabi*	
T1 - Spinosad + Copper oxychloride	85.55 (67.93)	81.23 (64.38)	11.20
T2 - Indoxacarb + Copper oxychloride	22.08 (27.98)	27.15 (31.14)	4.50

T3 - Cartap hydrochloride + Coppe oxychloride	70.10 (57.45)	72.88 (58.69)	9.58
T4 - Chlorfenapyr + Copper oxychloride	32.82 (34.92)	32.07 (34.48)	6.24
T5 - Flubendiamide + Copper oxychloride	55.96 (48.50)	52.27 (46.29)	7.17
T6 - *Bacillus thuringiensis* + Copper oxychloride	28.91 (32.44)	32.86 (34.90)	4.15
T7 - Spinosad + Metalaxyl MZ	88.90 (70.61)	84.22 (66.71)	13.70
T8 - Indoxacarb + Metalaxyl MZ	25.81 (30.50)	28.53 (32.25)	4.71
T9 - Cartap hydrochloride + Metalaxyl MZ	67.12 (55.04)	71.59 (58.45)	7.84
T10 - Chlorfenapyr + Metalaxyl MZ	32.22 (34.52)	35.82 (36.70)	6.12
T11 - Flubendiamide + Metalaxyl MZ	48.83 (44.31)	45.80 (42.55)	6.83
T12 - *Bacillus thuringiensis* + Metalaxyl MZ	26.35 (30.84)	27.67 (31.63)	3.89
T13 - Spinosad + Streptocycline	84.78 (67.02)	80.94 (64.11)	10.58
T14 - Indoxacarb + Streptocycline	26.47 (30.89)	31.79 (34.25)	5.18
T15 - Cartap hydrochloride + Streptocycline	65.70 (54.21)	63.94 (53.07)	7.38
T16 - Chlorfenapyr + Streptocycline	29.26 (32.71)	32.53 (34.74)	5.84
T17 - Flubendiamide + Streptocycline	48.66 (44.21)	48.49 (44.12)	6.41
T18 - *Bacillus thuringiensis* + Streptocycline	23.01 (28.66)	26.44 (30.92)	2.87
T19 - Untreated control	0.00 (0.00)	0.00 (0.00)	3.58
SEm±	1.60	1.88	0.63
CD (P = 0.05%)	4.60	5.41	1.89

** Figures in the parentheses are angular transformed values*

It is clearly evident from the results that the overall efficacy over the untreated control clearly showed that the combinations containing spinosad + metalaxyl MZ, spinosad + copper oxychloride and spinosad + streptocycline were highly effective in reducing the population of aphids during both the seasons. Bibliography [4] reported that spinosad and neem treatments were the best to protect organic cabbage from aphid, *B. brassicae* and caterpillars, *P. brassicae*, *P. rapae* and *Mamestra brassicae.* Bibliography [6] reported that cartap hydrochloride, spinosad and Delfin gave moderate control of cabbage aphid, *L. erysimi* population. Bibliography [10] showed that spinosad was very effective in the control of *Aphis gossypii* on cotton. Spinosad and milbemectin had an efficacy ranging between 95 and 98% against aphid *Aphis spiraephaga* [1]. Bibliography [3] reported that spinosad was the next best treatment against okra aphids after imidacloprid and acetamiprid. In contrast, Bibliography [8] reported that spinosad @ 10, 12.5, 15, 20 and 25 g ai./ha was not effective against cabbage aphid, *L.erysimi.*

According to [9] mancozeb enhanced the insecticidal activity of methyl demeton or phosphamidon and resulted in higher mortality of mustard aphid *L. erysimi.* Bibliography [7] revealed that spraying of Dithane M-45 in combination with metasystox resulted in low intensity of

L.erysimi infestation. The insecticidal action of methamidophos was enhanced with maneb and captafol against chilli aphid, *M. persicae* (Sulz.) with 88.5 per cent and 87.1 per cent reduction of aphid population, respectively, compared to 85.3 % in only methamidophos treatment [2]. There was no adverse effect due to addition of dicofol, zineb and urea on the bio-efficacy of malathion against major pests of cabbage and brinjal *viz., S. litura, B. brassicae* (L.) and *A. biguttula biguttula.*[5]

Thus, based on the results obtained it can be concluded that spinosad in combination with all the fungicides/bactericide *viz.,* copper oxychloride, metalaxyl MZ and streptocycline was effective against aphids. Among spinosad combinations spinosad + metalaxyl MZ was most effective compared to other two combinations and also recorded highest yield.

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