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Field bioefficacy of insecticide pre mix (Chlorpyriphos 50% + Cypermethrin 5% EC) against major insect pests of cabbage

Shivaleela G and Rajesh Chowdary L

Abstract
Field experiment was conducted during *rabi* season at MARS, Raichur, Karnataka to study the efficacy of premix insecticide against aphids, diamond back moth and *Spodoptera exigua* infesting on cabbage. Experiment was laid out in Randomized Block Design with eight treatments including control. Insecticides used in the experiments were Chlorpyriphos 50% + Cypermethrin 5% EC @ 1000+100, 500+50, 375+37.5 and 250+25 g a.i./ha, Chlorpyriphos 20% EC @ 400 g a.i./ha, Cypermethrin 10% EC @ 70 g a.i./ha, Fipronil 5% SC @ 50 g a.i./ha. Among the insecticides tested chlorpyriphos 50% + cypermethrin 5% EC @ 1000+100 g a.i./ha in recording minimum larval population per plant both in diamond back moth and *Spodoptera exigua* and was superior compared to rest of the treatments. The treatments chlorpyriphos 50% + cypermethrin 5% EC @ 1000 ml/ha and its next lower dosage treatment @ 750 ml/ha were on par with each other which recorded larval population and aphids. Chlorpyriphos 50% + cypermethrin 5% EC @ 2000 ml/ha recorded minimum damage of 2.29, 2.54 per cent with highest yield (23.81 q/ha in 2015-16) and (22.86 q/ha in 2016-17) respectively. The next best treatment at all doses followed by Chlorpyriphos 50% + cypermethrin 5% EC was Cypermethrin 10% EC @ 760 g a.i./ha.

Keywords: Cabbage, diamond back moth, aphids, *Spodoptera exigua*, efficacy, premix

1. Introduction
Among crucifer's vegetables, cabbage (*Brassica oleraceae* var. *capitata* L.) is a most popular and widely cultivated winter crop throughout India. Cabbage (*Brassica oleracea* var. capitata Linn.) is an important vegetable of cole group, cultivated in about 0.39 million hectare area with a production of 8.80 million tonnes during 2015-16 (Anon., 2017) [2]. Cabbage is grown for its edible part known as head which is rich source of Vitamin A, B1 and C and also contains the essential minerals which includes phosphorous, potassium, sodium, calcium and iron.

With respect to production China is the leading country is the world followed by India and Russia. Even though the production is higher the yields of cabbage are reducing because of the biotic and abiotic factors of which major being the insect pests occurring on cabbage. Among the insect pests in cabbage some of the major insect pests causing the maximum yield losses *viz.*, cabbage head borer, *Hellula undalis* Fab. mustard aphid, *Lipaphis erysimi* Kalt. and cabbage aphid, *Brevicoryne brassicae* L. which occur during the vegetative stage of the crop. Whereas, diamond back moth (DBM), *Plutella xylostella* L.; cabbage butterfly, *Pieris brassicae* L.; Leaf webber, *Crocidolomia binotalis* which occur at curd formation stage and damages head of the crop (Anon., 2011) [1].

Totally there are 37 insect pests have been reported causing damage on cabbage crop in India of which the major insect pests attacking the crop are diamondback moth, *Plutella xylostella* Linneaus, cabbage butterfly, *Pieris brassicae* Linneaus and the mustard aphid, *Lipaphis erysimi* Kaltenbach (Sachan and Gangwar, 1980) [7]. To mitigate the losses due to these pests, large quantities of pesticides is used in vegetable crops by the farmers. To manage the insect pests several insecticides were used indiscriminately over for the past several years which has led to changed pest complex scenario and development of resistance in insects, secondary pests developing to the primary pests, adverse effect of non-target organisms and natural enemies and finally pesticide residues in the food and soil causing health hazards (Patra *et al*, 2016) [5]. Considering yield losses due to the different insect pests in cabbage, chemical control measures are suggested and in many cases seed yield loss have been minimized. It is therefore

necessary to use some new insecticide molecules with high toxicity to insect pests even at lower doses that should also be safer to the natural enemies present in agro-ecosystem and also to the consumer. The present investigation was carried out with the objective to study on the efficacy of premix insecticide on the insect pests of cabbage.

2. Materials and Methods

Field experiment was carried out at Main Agriculture Research Station, Raichur for two consecutive years during 2015-16 and 2016-17 Rabi season. The experiments were laid out in randomized block design and three replications in each treatment were maintained. Row to row and plant to plant distance was maintained as 60 and 30 cm, respectively. The hybrid (Titan) was used for sowing. The size of each replicated plot was maintained as 5.20 m x 4.20 m. Totally eight treatments were evaluated including the untreated control and the treatments were: T1= Chlorpyriphos 50% + Cypermethrin 5% EC @ 1000+100 g a.i./ha (2000 ml/ha), T2= Chlorpyriphos 50% + Cypermethrin 5% EC @ 500+50 g a.i./ha (1000 ml/ha), T3= Chlorpyriphos 50% + Cypermethrin 5% EC @ 375+37.5 g a.i./ha (750 ml/ha), T4= Chlorpyriphos 50% + Cypermethrin 5% EC @ 250+25 g a.i./ha (500 ml/ha), T5= Chlorpyriphos 20% EC @ 400 g a.i./ha (2000 ml/ha), T6= Cypermethrin 10% EC @ 70 g a.i./ha (760 ml/ha), T7= Fipronil 5% SC @ 50 g a.i./ha (1000 ml/ha) and T8= Untreated Control. Five plants were randomly selected from each replicated plot and tagged. Pre spraying population of insects was recorded according to their specified technique, 24 hours before the scheduled spray and one, three, seven and ten days after spray was recorded to know the efficacy of the treatment. Head damage and yield was recorded from each treatment and was converted to per cent head damage and statistical analysis was carried out.

3. Results and Discussion

Efficacy on *Plutella xylostella*

A day before spray during the year 2015-16, population of DBM larvae ranged from 9.39 to 9.62 per plant in various treatments and there was no significant difference among the treatments. One day after spray, among the different chemical treatments, chlorpyriphos 50% + cypermethrin 5% EC @ 2000 ml/ha recorded minimum of 4.21 larvae per plant and was superior. The treatments chlorpyriphos 50% + cypermethrin 5% EC @ 1000 ml/ha and its next lower dosage treatment @ 750 ml/ha were on par with each other which recorded larval population of 5.36 and 5.44 per plant, respectively. Chlorpyriphos 50% + cypermethrin 5% EC @ 500 ml/ha (6.09 larvae/plant) was on par with cypermethrin 10% EC @ 760 ml/ha (6.19 larvae/plant). Untreated control recorded highest population of 9.68 larvae per plant. Three days after spray lowest larval population was observed in the highest dosage treatment of chlorpyriphos 50% + cypermethrin 5% EC @ 2000 ml/ha (3.62 larvae/plant) followed by chlorpyriphos 50% + cypermethrin 5% EC @ 1000 ml/ha (5.36 larvae/plant) and this was on par with chlorpyriphos 50% + cypermethrin 5% EC @ 750 ml/ha (5.44 larvae/plant). Similar trend was noticed even after seven and ten days after spraying (Table 1).

In the year 2016-17 one day after spray, among the different chemical treatments, chlorpyriphos 50% + cypermethrin 5% EC @ 1000+100 g. a.i/ha recorded minimum of 4.47 larvae per plant and was superior. The treatments chlorpyriphos 50% + cypermethrin 5% EC @ 500+50 g. a.i/ha and its next lower dosage treatment @ 375+37.5 g. a.i/ha were on par with each other which recorded larval population of 5.62 and 5.70 per plant respectively. Chlorpyriphos 50% + cypermethrin 5% EC @ 250+25 g. a.i/ha (6.35 larvae/plant) was on par with cypermethrin 10% EC @ 70 g. a.i/ha (6.45 larvae/plant). Three days after spray lowest larval population was observed in the highest dosage treatment of chlorpyriphos 50% + cypermethrin 5% EC @ 1000+100 g. a.i/ha (3.81 larvae/plant) followed by chlorpyriphos 50% + cypermethrin 5% EC @ 500+50 g. a.i/ha (4.96 larvae/plant) and this was on par with chlorpyriphos 50% + cypermethrin 5% EC @ 375+37.5 g. a.i/ha (5.04 larvae/plant) (Table 1).

Table 1: Effect of chlorpyriphos 50% + cypermethrin 5% EC against diamond back

Sl. No.	Treatments	Dosage (g or ml/ha)	larvae / plant									
			2015-16					2016-17				
			1DBS	1DAS	3DAS	7DAS	10DAS	1DBS	1DAS	3DAS	7DAS	10DAS
1	Chlorpyriphos 50% + Cypermethrin 5% EC	2000	9.36	4.21 (2.17)	3.62 (2.03)	2.66 (1.78)	1.27 (1.33)	10.20	4.47 (2.23)	3.81 (2.08)	2.79 (1.81)	1.35 (1.36)
2	Chlorpyriphos 50% + Cypermethrin 5% EC	1000	9.44	5.36 (2.42)	4.77 (2.30)	3.81 (2.08)	2.42 (1.71)	10.32	5.62 (2.47)	4.96 (2.34)	3.94 (2.11)	2.50 (1.73)
3	Chlorpyriphos 50% + Cypermethrin 5% EC	750	9.32	5.44 (2.44)	4.85 (2.31)	3.89 (2.10)	2.50 (1.73)	10.22	5.70 (2.49)	5.04 (2.35)	4.02 (2.13)	2.58 (1.75)
4	Chlorpyriphos 50% + Cypermethrin 5% EC	500	9.41	6.09 (2.57)	5.50 (2.45)	4.54 (2.24)	3.15 (1.91)	10.29	6.35 (2.62)	5.69 (2.49)	4.67 (2.27)	3.23 (1.93)
5	Chlorpyriphos 20% EC	2000	9.39	6.93 (2.73)	6.34 (2.62)	5.38 (2.42)	3.99 (2.12)	10.42	7.19 (2.77)	6.53 (2.65)	5.51 (2.45)	4.07 (2.14)
6	Cypermethrin 10% EC	760	9.54	6.19 (2.59)	5.60 (2.47)	4.64 (2.27)	3.25 (1.94)	10.27	6.45 (2.64)	5.79 (2.51)	4.77 (2.30)	3.33 (1.96)
7	Fipronil 5% SC	1000	9.62	8.72 (3.04)	8.93 (3.07)	8.88 (3.06)	8.56 (3.01)	10.50	8.98 (3.08)	9.12 (3.10)	9.01 (3.08)	8.88 (3.06)
8	Untreated control	--	9.51	9.68 (3.19)	9.76 (3.20)	10.08 (3.25)	9.55 (3.17)	10.39	10.31 (3.29)	10.46 (3.31)	10.38 (3.30)	10.02 (3.24)
S. Em ±			0.43	0.03	0.04	0.02	0.03	0.35	0.02	0.05	0.04	0.03
CD at 5%			NS	0.10	0.10	0.06	0.08	NS	0.05	0.13	0.10	0.08

DBS: Day before spray DAS: Day after spray
Figures in parentheses are square root transformed values

Efficacy on *Spodoptera exigua*

Larval population of *spodoptera exigua* a day before spray ranged from 12.98 to 13.28 per plant in various treatments and there was no significant difference among the treatments

statistically during 2015-16 season. One day after spray, among the different chemical treatments, chlorpyriphos 50% + cypermethrin 5% EC @ 2000 ml/ha recorded minimum of 10.20 larvae per plant. The treatments chlorpyriphos 50% + cypermethrin 5% EC @ 1000 ml/ha (11.35 larvae per plant) and its next lower dosage treatment @ 750 ml/ha (11.43 larvae per plant) were on par with each other. Untreated control recorded highest population of 13.96 larvae per plant. Three days after spray lowest larval population was observed in the highest dosage treatment of chlorpyriphos 50% + cypermethrin 5% EC @ 2000 ml/ha (6.65 larvae/plant) followed by chlorpyriphos 50% + cypermethrin 5% EC @ 1000 ml/ha (7.80 larvae/plant) and this was on par with chlorpyriphos 50% + cypermethrin 5% EC @ 750 ml/ha (7.88 larvae/plant). The trend remained same even after seven and ten days after spray (Table 2).

A day after spray, among the different chemical treatments, chlorpyriphos 50% + cypermethrin 5% EC @ 1000+100 g. a.i/ha recorded minimum of 8.61 larvae per plant and was superior among all the treatments. The treatments chlorpyriphos 50% + cypermethrin 5% EC @ 500+50 g. a.i/ha (9.76 larvae per plant) and its next lower dosage treatment @ 375+37.5 g. a.i/ha (9.84 larvae per plant) were on par with each other. Chlorpyriphos 50% + cypermethrin 5% EC @ 250+25 g. a.i/ha (10.49 larvae/plant) was on par with cypermethrin 10% EC @ 70 g. a.i/ha (10.59 larvae/plant). Untreated control recorded highest population of 12.37 larvae per plant. Three days after spray lowest larval population was observed in the highest dosage treatment of chlorpyriphos 50% + cypermethrin 5% EC @ 1000+100 g. a.i/ha (4.47 larvae/plant) followed by chlorpyriphos 50% + cypermethrin 5% EC @ 500+50 g. a.i/ha (5.62 larvae/plant) and this was on par with chlorpyriphos 50% + cypermethrin 5% EC @ 375+37.5 g. a.i/ha (5.70 larvae/plant). The trend remained same even after seven and fifteen days after spray during the year 2016-17 (Table 2).

Table 2: Effect of chlorpyriphos 50% + cypermethrin 5% EC against *Spodoptera exigua*

Sl. No.	Treatments	Dosage (g or ml/ha)	larvae / plant									
			2015-16					2016-17				
			1DBS	1DAS	3DAS	7DAS	10DAS	1DBS	1DAS	3DAS	7DAS	10DAS
1	Chlorpyriphos 50% + Cypermethrin 5% EC	2000	13.02	10.20 (3.27)	6.65 (2.67)	2.69 (1.79)	1.02 (1.23)	11.14	8.61 (3.02)	4.47 (2.23)	1.71 (1.49)	0.69 (1.09)
2	Chlorpyriphos 50% + Cypermethrin 5% EC	1000	13.10	11.35 (3.44)	7.80 (2.88)	3.84 (2.08)	2.17 (1.63)	11.22	9.76 (3.20)	5.62 (2.47)	2.86 (1.83)	1.84 (1.53)
3	Chlorpyriphos 50% + Cypermethrin 5% EC	750	12.98	11.43 (3.45)	7.88 (2.89)	3.92 (2.10)	2.25 (1.66)	11.40	9.84 (3.22)	5.70 (2.49)	2.94 (1.85)	1.92 (1.56)
4	Chlorpyriphos 50% + Cypermethrin 5% EC	500	13.07	12.08 (3.55)	8.53 (3.00)	4.57 (2.25)	2.90 (1.84)	11.19	10.49 (3.32)	6.35 (2.62)	3.59 (2.02)	2.57 (1.75)
5	Chlorpyriphos 20% EC	2000	13.05	12.92 (3.66)	9.37 (3.14)	5.41 (2.43)	3.74 (2.06)	11.17	11.33 (3.44)	7.19 (2.77)	4.43 (2.22)	3.41 (1.98)
6	Cypermethrin 10% EC	760	13.28	12.18 (3.56)	8.63 (3.02)	4.67 (2.27)	3.00 (1.81)	11.10	10.59 (3.33)	6.45 (2.64)	3.69 (2.05)	2.67 (1.78)
7	Fipronil 5% SC	1000	13.20	12.64 (3.62)	12.46 (3.60)	11.86 (3.52)	11.03 (3.40)	11.32	11.05 (3.40)	10.08 (3.25)	10.25 (3.28)	9.58 (3.17)
8	Untreated control	--	13.17	13.96 (3.80)	14.08 (3.82)	13.64 (3.76)	12.08 (3.55)	11.29	12.37 (3.59)	11.23 (3.42)	11.33 (3.44)	10.73 (3.35)
S. Em ±			0.36	0.04	0.05	0.06	0.05	0.48	0.03	0.04	0.06	0.04
CD at 5%			NS	0.11	0.12	0.17	0.15	NS	0.10	0.11	0.15	0.13

DBS: Day before spray DAS: Day after spray

Figures in parentheses are square root transformed values

Efficacy on aphids

The treatments chlorpyriphos 50% + cypermethrin 5% EC @ 1000 ml/ha and its next lower dosage treatment @ 375+37.5 750 ml/ha were on par with each other which recorded larval population of 12.34 and 12.48 aphids per plant respectively. Chlorpyriphos 50% + cypermethrin 5% EC @ 500 ml/ha (13.13 aphids/plant) was on par with Fipronil 5% SC @ 1000 ml/ha (13.29 aphids/plant). Untreated control recorded highest population of 16.29 aphids per plant. Three days after spray lowest larval population was observed in the highest dosage treatment of chlorpyriphos 50% + cypermethrin 5% EC @ 2000ml/ha (9.37 aphids/plant) followed by chlorpyriphos 50% + cypermethrin 5% EC @ 1000 ml/ha (10.05 aphids/plant) and this was on par with chlorpyriphos 50% + cypermethrin 5% EC @ 750 ml/ha (10.19 aphids/plant). Similar trend was noticed even after seven and ten days after spraying during the year 2015-16 (Table 3).

A day before first spray aphids population ranged from 13.65 to 13.87 per plant in various treatments and there was no significant difference among the treatments during the year 2016-17. One day after spray, among the different chemical treatments, chlorpyriphos 50% + cypermethrin 5% EC @ 1000+100 g. a.i/ha recorded minimum of 10.01 aphids per plant. The treatments chlorpyriphos 50% + cypermethrin 5% EC @ 500+50 g. a.i/ha and its next lower dosage treatment @ 375+37.5 g. a.i/ha were on par with each other which recorded population of 10.69 and 10.83 aphids per plant respectively. Chlorpyriphos 50% + cypermethrin 5% EC @ 250+25 g. a.i/ha (11.48 aphids/plant) was on par with Fipronil 5% SC @ 50 g. a.i/ha (11.64 aphids/plant). Untreated control recorded highest population of 13.79 aphids per plant. Three days after spray lowest larval population was observed in the highest dosage treatment of chlorpyriphos 50% + cypermethrin 5% EC @ 1000+100 g. a.i/ha (7.28 aphids/plant) followed by chlorpyriphos 50% + cypermethrin 5% EC @ 500+50 g. a.i/ha (7.96 aphids/plant) and this was on par with chlorpyriphos 50% + cypermethrin 5% EC @ 375+37.5 g. a.i/ha (8.10 aphids/plant) (Table 3).

Table 3: Effect of chlorpyriphos 50% + cypermethrin 5% EC against aphids

Sl. No.	Treatments	Dosage (g or ml/ha)	Aphids / plant									
			2015-16					2016-17				
			1DBS	1DAS	3DAS	7DAS	10DAS	1DBS	1DAS	3DAS	7DAS	10DAS
1	Chlorpyriphos 50% + Cypermethrin 5% EC	2000	15.98	11.66 (3.49)	9.37 (3.14)	5.74 (2.50)	1.98 (1.57)	13.69	10.01 (3.24)	7.28 (2.79)	3.09 (1.89)	1.25 (1.32)
2	Chlorpyriphos 50% + Cypermethrin 5% EC	1000	16.06	12.34 (3.58)	10.05 (3.25)	6.42 (2.63)	2.66 (1.78)	13.77	10.69 (3.35)	7.96 (2.91)	3.77 (2.07)	1.93 (1.56)
3	Chlorpyriphos 50% + Cypermethrin 5% EC	750	15.94	12.48 (3.60)	10.19 (3.27)	6.56 (2.66)	2.80 (1.82)	13.65	10.83 (3.37)	8.10 (2.93)	3.91 (2.10)	2.07 (1.60)
4	Chlorpyriphos 50% + Cypermethrin 5% EC	500	16.03	13.13 (3.69)	10.84 (3.37)	7.21 (2.78)	3.45 (1.99)	13.74	11.48 (3.46)	8.75 (3.04)	4.56 (2.25)	2.72 (1.79)
5	Chlorpyriphos 20% EC	2000	16.01	15.02 (3.94)	12.73 (3.64)	11.98 (3.53)	9.56 (3.17)	13.72	13.37 (3.72)	10.64 (3.34)	9.33 (3.14)	8.83 (3.05)
6	Cypermethrin 10% EC	760	16.16	14.93 (3.93)	12.64 (3.62)	11.81 (3.51)	9.42 (3.15)	13.87	13.28 (3.71)	10.55 (3.32)	9.16 (3.11)	8.69 (3.03)
7	Fipronil 5% SC	1000	16.13	13.29 (3.71)	11.00 (3.39)	7.37 (2.81)	3.61 (2.03)	13.84	11.64 (3.48)	8.91 (3.07)	4.72 (2.28)	2.88 (1.84)
8	Untreated control	--	16.24	16.26 (4.09)	16.41 (4.11)	15.08 (3.95)	14.12 (3.82)	13.95	13.79 (3.78)	13.93 (3.80)	13.16 (3.70)	11.93 (3.53)
S. Em ±			0.57	0.02	0.03	0.05	0.04	0.42	0.04	0.06	0.05	0.03
CD at 5%			NS	0.05	0.10	0.13	0.12	NS	0.10	0.14	0.12	0.11

DBS: Day before spray DAS: Day after spray
Figures in parentheses are square root transformed values

Damage and yield

Among the different chemical treatments during the year 2015-16, chlorpyriphos 50% + cypermethrin 5% EC @ 2000 ml/ha recorded minimum damage of 2.29 per cent with highest yield (23.81 q/ha) followed by chlorpyriphos 50% + cypermethrin 5% EC @ 1000 ml/ha which was on par with chlorpyriphos 50% + cypermethrin 5% EC @ 750 ml/ha which recorded damage of 3.15 (23.81 q/ha) and 3.24 (22.54 q/ha) respectively. In the year 2016-17 chlorpyriphos 50% + cypermethrin 5% EC @ 1000+100 g. a.i/ha recorded minimum damage of 2.54 per cent followed by chlorpyriphos 50% + cypermethrin 5% EC @ 500+50 g. a.i/ha with highest yield (22.86 q/ha) which was on par with chlorpyriphos 50% + cypermethrin 5% EC @ 375+37.5 g. a.i/ha (Table 4).

The reports from the earlier studies of Dipak Mandal *et al.* (2012) [4] revealed that chlorpyriphos + cypermethrin (92.76%) was most effective followed by thiamethoxam (90.70%) and imidacloprid (90.46%) and di-chlorvos (82.81%) showed least effective. The grain yield data revealed that all the insecticidal treatments of Chlorantriniliprole 18.5% SC followed by chlorpyriphos 50% + cypermethrin 5% EC were significantly superior over untreated control and comparable to check insecticide (Rohit Rana and Gaje Singh, 2017) [6]. Further the present findings corroborate with the results of Chakraborty (2012) [3] who reported flubendamide with higher C:B ratio followed by chlorantraniliprole, and chlorpyriphos 50% + cypermethrin 5% EC. Sharma *et al.* (2012) [8] conducted experiments to know the efficacy of combination insecticides and revealed that three sprays of Chlorpyriphos + Cypermethrin @ 0.01 percent a.i. at 15 days intervals resulted in minimum shoot infestation damage of 2.15 per cent and 12.95 per cent fruit damage and suggested that the combination of Chlorpyriphos 50% EC + Cypermethrin 5% EC can be utilized as a valuable chemical component in Integrated Pest Management for *L. orbonalis* in eggplant crop.

Table 4: Effect of chlorpyriphos 50% + cypermethrin 5% EC on damage and yield in cabbage

Sl. No.	Treatments	Dosage (g or ml/ha)	Per cent head damage		Yield (q/ha)	
			2015-16	2016-17	2015-16	2016-17
1	Chlorpyriphos 50% + Cypermethrin 5% EC	2000	2.29(8.70)	2.54(9.17)	23.81	22.86
2	Chlorpyriphos 50% + Cypermethrin 5% EC	1000	3.15(10.22)	3.40(10.63)	22.66	21.71
3	Chlorpyriphos 50% + Cypermethrin 5% EC	750	3.24(10.37)	3.49(10.77)	22.54	21.59
4	Chlorpyriphos 50% + Cypermethrin 5% EC	500	5.45(13.50)	5.70(13.81)	21.76	20.81
5	Chlorpyriphos 20% EC	2000	9.23(17.69)	9.48(17.93)	18.11	17.16
6	Cypermethrin 10% EC	760	6.53(14.81)	6.78(15.09)	21.51	20.56
7	Fipronil 5% SC	1000	13.54(21.59)	13.79(21.80)	16.54	15.59
8	Untreated control	--	25.46(30.30)	25.71(30.47)	10.59	10.12
SEm ±			0.51	0.62	0.43	0.45
CD at 5%			1.56	1.82	1.31	1.36

* Figures in parentheses are arcsine transformed values

Conclusion

Bio-efficacy of premix insecticide at different doses was assessed against aphids, *Spodoptera exigua* and diamondback moth on cabbage crop revealed that chlorpyriphos 50% + cypermethrin 5% EC @ 1000+100 g. a.i/ha was found most effective against all the insect pests of cabbage and it was significantly superior over rest of the treatments and its lower dosage treatments. The lower dosage treatments of chlorpyriphos 50% + cypermethrin 5% EC @ 1000+100 g. a.i/ha.

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