

Efficacy of biopesticides and newer insecticides against major insect pests of cauliflower

ABSTRACT

A field trial comprising of nine insecticides conducted at farmers' field in endemic area of pest in Siwan district of Bihar revealed that **Indoxacarb 45 SC** @ 1.0 ml/L of water was found to be most effective over all other treatments in terms of significantly lowest flowerhead damage and resulted in higher yield (144.26 q/ha). However, Cost-benefit analysis revealed the highest cost-benefit ratio of 1:11.15 in treatment of Cartap hydrochloride 50 SP @ 1.0 gm/L of water. **Comment:** how about 'Indoxacarb 45 SC', wouldn't it be better to include its cost-benefit in Abstract?]

Key Words: Cauliflower, Insecticides, *Brevicoris brassicae*, *Crociodolmiabinotalis*, *Plutella xylostella*, *Spodopteralitura*.

INTRODUCTION

Cauliflower, *Brassica oleracea* L. var botrytis is the most popular winter vegetable grown in India. It is consumed as vegetable in curries, soups, pickles and has low fat content with rich source of dietary fibers, vitamins and minerals. The chief constraint in the production of cauliflower is the damage caused by the pest complex right from germination to till harvesting stage with enormous yield loss. **The economics losses in the crop production every year caused by insect pest is a threat to global agriculture.** Sometimes the yield loss by insect pests reaches as high as 60-70 percent (Dhaliwal *et al.*, 2007). In India, 37 insect pest species have been reported to feed on the crop (Lal, 1975). Among all, the crop is ravaged by aphid, *Brevicoris brassicae* Linn., leaf webber, *Crociodolmiabinotalis* Zell., tobacco caterpillar, *Spodopteralitura* Fab, and diamond back moth, *Plutella xylostella* Linn. **and** chemical insecticides are widely used by the growers to control these pests. Several insecticides have been recommended through ages to avert pest damage. But, almost all of them are obsolete due to development of insect resistance to insecticides and there is

possibility of presence residue in the edible parts of cauliflower. The other issues like resurgence and secondary pest's outbreak. Keeping the facts in view, the present investigation is undertaken with bio-rational and newer insecticides in order to formulate on effective and economic packages of control measures for the management of these pests on cauliflower crop and it's also compared with the local check insecticide (Farmer's practice).

Materials and Methods

The field experiment was carried out at village of Chiroli in Siwan district of Bihar. The cauliflower crop (cv. PusaKataki) was transplanted in first week of November. The following treatments were evaluated : T₁ – Indoxacarb 14.5 SC @ 1.0 ml/L, T₂ – Emamectin benzoate 5 WSG @ 0.25 ml/L, T₃ – Thiodicarb 75 WP @ 1.0gm/L, T₄ – Novaluran 10 EC @ 1.00 ml/L, T₅ – Azadirachtin 0.15% @ 4.00 ml/L, T₆ – Avermectin 1.9 EC @ 0.50 ml/L, T₇ – Spinosad 45 SC @ 0.33 ml/L, T₈ Cartap hydrochloride 50 SP @ 1.00 gm/L, T₉ – Chlorpyrifos 20 EC @ 1.00 ml/L at weekly interval (Farmer's Practice), T₁₀ – Untreated check.

Two sprays were given at 15 days interval (Except farmer's practice) in the evening hrs by knapsack sprayer. Observations were recorded on the population of major pests on 10 randomly selected plants with treatmentwise at one day before spraying (DBS) and at 5 and 10 days after each spraying (DAS). The Yield of marketable flower heads was recorded treatment-wise and converted per hectare basis before subjected to statistical analysis.

Results and Discussion

During the crop season, all the treatments were statistically significant over untreated control in reducing the pest incidence during early stages of the crop. Among the different sets of treatments, T₁, comprising spray of Indoxacarb 45 SC @ 1 ml/L. proved to be the most effective with significantly lower percent of leaf webber damage 8.15 and 6.94 after first spray and second spray, respectively. The other effective treatments in respect to leaf webber damage were T₃ and T₈ the latter being at par with T₇, having leaf webber damage varying from 8.38 to 8.87 and 7.31 to 7.52 percent after first and second spray, respectively (Table-1) The higher percentage of leaf

webber damage (9.89-9.49) was recorded with T₉ (Farmer's practice). In comparison, the mean percent of leaf webber damage of 11.85 and 13.76 were recorded in untreated control. Overall the lowest mean percent of leaf webber damage (7.55) was recorded in T₁ which was significantly at par with T₃ (7.85) and T₈ (8.20). However, T₅ recorded mean highest percent of leaf webber damage (9.42) which is at par with farmer's practice as T₉ (9.65) and were least effective against leaf webber. The percentage reduction of leaf webber damage over untreated control was varying from 24.67 to 41.06 (Table-1). Similar findings were also reported by Sharma and Misra, 2004 and Mandala *et al.*, (2020) on cabbage.

Statistically significant highest reduction in percentage head damage due to *S. lutra* was also recorded with T₁ (48.91) over untreated control (Table-2). The results being comparable with T₃ (47.02) and T₈ (45.05). Although, the other treatments, the per cent reduction in head damage to *S. lutra* was varied from 27.86 to 40.49 which is in conformity with the findings of Sharma and Misra (2003), and Monobullah *et al.*, (2001). Rao *et al.*, (2006) reported Indoxacarb @ 0.0145% and Thiodicarb @ 0.075% to be most effective in reducing larval population of *S. lutra* on fenugreek, while Prasad *et al.*, (2007) and Stanley *et al.*, (2006) reported Emamectin benzoate to be the best treatment with the highest relative toxicity. Similar results were also recorded [comment: reported?] by Parthiban *et al.*, (2014) and Yadav *et al.*, (2015) on reducing the larval population of *S. lutra*. [comments: 1. Revision is expected to reword this paragraph to make your point(s) clearly; 2. Is '*S. lutra*' and '*S. lutra*' the same ?]

The results (Table-3) observed that T₃ comprising spray of Indoxacarb 48 SC @ 1.0ml/L of water was recorded 3.54 and 1.69 larvae/plant after first and second spray, respectively, proved to be most effective and which was followed by T₃ with mean number of 3.98 and 1.94 larvae/plant and it was at par with T₈ (4.18 and 2.38 larvae/plant) during first and second spray, respectively. The highest mean population of 5.72 and 4.23 larvae/plant was recorded in T₉ with the spraying of chlorpyrifos 20EC @ 1.5 ml/L of water as farmer's practice, and which was significantly at par with T₅, comprising spray of Azadirachtin 0.15 % @ 4ml/L of water with larval count of 4.84 and

3.18 larvae/plant, respectively. In comparison, the mean population of 6.87 and 7.84 larvae/plant were recorded in untreated control (T₁₀). Overall lowest mean population of 2.62 larvae/plant was also recorded in T₁ which was followed by T₃(2.96 larvae/plant) and T₈(3.28 larvae/plant). However, T₉(farmer's practice) recorded 4.97 larvae/plant and at par with T₅(4.01 larvae/plant) and which were least effective in reducing the larval population (Table-3). Marked reduction of larvae/plant over untreated control varied from 32.47 to 64.40 was observed with different sets of the treatments. **Similar, result** of effectiveness of bio-pesticides and newer insecticides in reducing the insect pests of Cole crops by Singh *et al.*, (2018). The present results on the effectiveness of Spinosad and certain newer insecticides in management of *P. xylostella* are in conformity with those of Wale and Mohite (2019), Dhawan *et al.*, (2007), Kumar *et al.*, (2007), Stanikzi *et al.*, (2016) and Manda *et al.*, (2020).

Similarly, the treatment T₁ recorded the lowest aphid population of 63.75 and 36.95/leaf after first and second spray, respectively and which was followed by T₃ (74.52 and 48.74 aphids/leaf) and T₈ (83.34 and 55.54 aphids/leaf). Among the treatments, T₉ (Farmer's practice) was recorded higher aphid population of 123.67 and 94.86 aphids/leaf after first and second spray, respectively over untreated control (Table- 4). The reduction of aphid population over untreated control was varied from 34.81 to 69.96 percent. The present finding is in conformity with these of shaliniet *al.*, (2020) and Manda *et al.*, 2020).

The yield data (Table-5) was found statistically higher marketable cauliflower yield of 144.26 q/ha in T₁ followed by T₃ (140.63 q/ha) and T₈ (134.70 q/ha). The next best treatment was T₇ (128.15 q/ha) and which at par with other treatments, but significantly more than T₉ as farmer's practice (110.26 q/ha) and untreated control (95.84 q/ha). The cost-benefit analysis of different sets of treatments revealed that the maximum monetary benefit of Rs. 50840/ha found from T₁. The most effective treatment in reducing the pest's incidence as well as yield realised as per hectare basis. Yet the highest cost: benefit ratio (1:11.15) obtained in T₈. This was followed by T₃ (1:9.37), T₁ (1:7.96) and T₂ (1:7.22) and rather less efficiently by T₄ (1:6.48), T₇ (1:6.34), T₆(1:5.57) and T₅

(1.4.10). In comparison the cost: benefit ratio of 1:3.10 were lowest recorded in farmer's practice (T₉) due to high cost of insecticidal treatment and received lower yield. Similar results were obtained by Muna *et al.*, (2011) and Manda *et al.*, (2020).

The spray of Indoxacarb 14.5 SC @ 1.0 ml/L of water was found to be superior over all other package of the treatments in terms of statistically lower flower head damaged by these pests thereby obtaining higher yield of 144.26 q/ha. However, the cost benefit analysis resulted the highest ratio of 1:11.15 with spray of cartap hydrochloride 50 SP @ 1.0 gm/L of water.

Conclusion:

Present investigation, it could be concluded that **Indoxacarb 45 C** @ 1.0 ml/L was found most effective insecticides for all insect in cauliflower and resulted as well as provide higher yield and profit as compared to farmer's practices.

[Comment: what is exactly T₁: Indoxacarb 14.5 SC, Indoxacarb 45 SC, Indoxacarb 48 SC, Indoxacarb 45 C]

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UNDER PEER REVIEW

Table - 1 : Efficacy of insecticides against leaf webber on cauliflower

Treatment	Dose g/ml/L	Leaf webber damaged plant (%)								Over all mean	% reduction over control
		Frist Spray				Second Spray					
		1 DBS	5 DAS	10 DAS	Mean	1 DBS	5 DAS	10 DAS	Mean		
T ₁ – Indoxacarb 14.5 SC	1.0 ml	9.42 (17.83)	8.26 (16.74)	8.04 (16.43)	8.15 (16.64)	7.62 (16.00)	7.31 (15.68)	6.56 (14.89)	6.94 (15.23)	7.55 (16.00)	41.06
T ₂ – Emamectin benzoate 5WSG	0.25 ml	9.62 (18.05)	9.35 (17.85)	9.12 (17.56)	9.24 (17.66)	8.73 (17.16)	8.24 (16.64)	8.02 (16.43)	8.13 (16.54)	8.69 (17.16)	32.17
T ₃ – Thiodicarb 75 WP	1.0 gm	9.83 (18.24)	8.51 (17.05)	8.24 (16.64)	8.38 (16.85)	8.04 (16.43)	7.52 (15.89)	7.10 (15.45)	7.31 (15.68)	7.85 (16.32)	38.72
T ₄ Novaluron 10 EC	1.0 ml	9.74 (18.15)	9.83 (18.24)	9.61 (18.05)	9.72 (18.15)	8.26 (17.36)	8.39 (16.85)	8.28 (16.74)	8.34 (16.74)	9.03 (17.46)	29.51
T ₅ Azadirachtin 0.15%	4 ml	10.25 (18.72)	10.02 (18.44)	9.59 (17.95)	9.81 (18.24)	8.72 (17.16)	9.41 (17.85)	8.65 (17.16)	9.03 (17.46)	9.42 (17.85)	26.46
T ₆ – Avermectin 1.9 EC	0.5 ml	9.46 (18.05)	9.81 (18.24)	9.54 (17.85)	9.68 (18.05)	8.91 (17.36)	8.33 (16.74)	8.10 (16.54)	8.22 (16.64)	8.95 (17.36)	30.13
T ₇ – Spinosad 45 SC	0.33 ml	9.51 (17.94)	9.12 (17.56)	9.00 (17.46)	9.06 (17.56)	8.37 (16.85)	8.00 (16.43)	7.86 (16.32)	7.93 (16.32)	8.50 (16.95)	33.65
T ₈ – Cartap hydrochloride 50 SP	1.0 gm	9.36 (17.85)	9.31 (17.76)	8.43 (16.85)	8.87 (17.36)	8.63 (17.05)	7.84 (16.22)	7.20 (15.56)	7.52 (15.89)	8.20 (16.64)	35.98
T ₉ – Chlorpyriphos 20 EC (Former's Practice)	1.50 ml	10.72 (19.09)	10.42 (18.81)	9.36 (17.76)	9.89 (18.34)	9.86 (18.34)	9.47 (17.95)	9.32 (17.76)	9.49 (17.85)	9.65 (18.15)	24.67
T ₁₀ Untreated Check	-	9.68 (18.15)	10.87 (19.28)	12.82 (20.96)	11.85 (20.18)	12.53 (20.70)	14.17 (22.14)	13.34 (21.39)	13.76 (21.81)	12.81 (20.96)	-
SEm (±)	-	N.S.	0.121	0.540	0.446	0.362	0.421	0.437	0.638	0.375	-
CD (P= 0.05)	-	-	0.364	1.621	1.342	1.086	1.264	1.315	1.276	1.124	-

Average mean of there replications; Figure in parentheses are Arc sine transformed values.

DBS = Days before spraying : DAS = Days after spraying : NS = Non significant

Table - 2 : Efficacy of insecticides against tobacco caterpillar on cauliflower

Treatment	Dose g/ml/L	Tobacco caterpillar damaged (%)								Over all mean	% reduction over control
		First Spray				Second Spray					
		1 DBS	5 DAS	10 DAS	Mean	1 DBS	5 DAS	10 DAS	Mean		
T ₁ – Indoxacarb 14.5 SC	1.0 ml	11.62 (19.91)	8.12 (16.54)	8.00 (16.43)	8.06 (16.54)	7.34 (15.68)	6.73 (15.00)	6.25 (14.54)	6.49 (14.77)	7.28 (15.68)	48.91
T ₂ – Emamectin benzoate 5WSG	0.25 ml	12.41 (20.62)	9.91 (18.44)	9.39 (14.85)	9.65 (18.15)	8.52 (16.95)	8.21 (16.64)	7.93 (16.32)	8.07 (16.43)	8.86 (17.36)	37.82
T ₃ – Thiodicarb 75 WP	1.0 gm	12.53 (20.70)	8.61 (17.05)	8.04 (17.46)	8.33 (16.74)	7.46 (15.89)	7.00 (15.34)	6.52 (14.77)	6.76 (15.12)	7.55 (16.00)	47.02
T ₄ - Novaluron 10 EC	1.0 ml	12.34 (19.64)	10.45 (18.91)	10.11 (18.53)	10.28 (18.72)	9.05 (17.46)	8.92 (17.36)	8.46 (16.95)	8.69 (17.16)	9.49 (17.95)	33.40
T ₅ -Azadirachtin 0.15%	4 ml	11.85 (20.18)	10.91 (19.28)	10.53 (18.91)	10.72 (19.09)	9.48 (17.95)	9.16 (17.66)	8.72 (17.16)	8.94 (17.36)	9.83 (18.24)	31.02
T ₆ – Avermectin 1.9 EC	0.5 ml	12.40 (20.62)	10.00 (18.44)	9.62 (18.05)	9.81 (18.24)	8.67 (17.16)	8.34 (16.74)	8.00 (16.43)	8.17 (16.64)	8.99 (17.46)	36.91
T ₇ – Spinosad 45 SC	0.33 ml	12.36 (20.53)	9.82 (18.24)	9.33 (17.76)	9.58 (18.05)	8.20 (16.64)	7.63 (16.00)	7.13 (15.45)	7.38 (15.89)	8.48 (16.95)	40.49
T ₈ – Cartap hydrochloride 50 SP	1.0 gm	11.62 (19.91)	9.16 (17.66)	8.54 (16.95)	8.85 (17.46)	7.80 (16.22)	7.36 (15.79)	6.24 (14.42)	6.80 (15.12)	7.83 (16.22)	45.05
T ₉ – Chlorpyrifos 20 EC (Former's Practice)	1.50 ml	12.00 (20.27)	11.51 (19.82)	10.76 (19.19)	11.14 (19.46)	10.32 (18.72)	9.74 (18.15)	9.10 (17.56)	9.42 (17.85)	10.28 (18.72)	27.86
T ₁₀ - Untreated Check	-	12.51 (20.70)	12.46 (20.62)	12.87 (21.05)	12.67 (22.88)	12.93 (21.05)	14.38 (22.30)	17.26 (24.58)	15.82 (23.42)	14.25 (22.22)	-
SEm (±)	-	N.S.	0.245	0.376	0.475	0.621	0.450	0.643	0.574	0.512	-
CD (P= 0.05)	-	-	0.734	1.125	1.428	1.865	1.352	1.927	1.723	1.536	-

Average mean of there replications; Figure in parentheses are Arc sine transformed values. [Comment: briefly tell readers about 'Arc']

DBS = Days before spraying : DAS = Days after spraying : NS = Non significant

[Comment: what is SEm? what is CD?]

Table - 3 : Efficacy of insecticides against diamond back moth on cauliflower

Treatment	Dose g/ml/L	Mean number of diamond back moth larvae / plant								Over all mean	% reduction over control
		First Spray				Second Spray					
		1 DBS	5 DAS	10 DAS	Mean	1 DBS	5 DAS	10 DAS	Mean		
T ₁ – Indoxacarb 14.5 SC	1.0 ml	6.70 (2.68)	3.91 (2.10)	3.17 (1.92)	3.54 (2.01)	3.02 (1.88)	2.31 (1.68)	1.06 (1.25)	1.69 (1.48)	2.62 (1.77)	64.40
T ₂ – Emamectin benzoate 5WSG	0.25 ml	6.62 (2.67)	4.72 (2.28)	3.98 (2.12)	4.35 (2.20)	3.90 (2.10)	3.00 (1.87)	2.41 (1.71)	2.71 (1.79)	3.53 (2.00)	52.04
T ₃ – Thiodicarb 75 WP	1.0 gm	6.14 (2.58)	4.56 (2.25)	3.42 (1.97)	3.98 (2.12)	3.13 (1.91)	2.16 (1.63)	1.72 (1.49)	1.94 (1.56)	2.96 (1.86)	59.78
T ₄ - Novaluron 10 EC	1.0 ml	6.25 (2.60)	5.12 (2.37)	4.31 (2.19)	4.72 (2.28)	4.00 (2.12)	3.24 (1.93)	2.83 (1.82)	3.04 (1.88)	3.88 (2.09)	47.28
T ₅ -Azadirachtin 0.15%	4 ml	6.16 (2.58)	5.05 (2.36)	4.63 (2.26)	4.84 (2.31)	4.21 (2.17)	3.35 (2.01)	3.00 (1.87)	3.18 (1.92)	4.01 (2.12)	45.52
T ₆ – Avermectin 1.9 EC	0.5 ml	6.73 (2.69)	5.21 (2.39)	3.90 (2.10)	4.56 (2.25)	3.46 (1.99)	3.11 (1.90)	2.45 (1.72)	2.78 (1.81)	3.67 (2.04)	50.14
T ₇ – Spinosad 45 SC	0.33 ml	5.91 (2.53)	4.62 (2.26)	3.80 (2.07)	4.21 (2.17)	3.31 (1.95)	2.85 (1.83)	2.16 (1.63)	2.51 (1.73)	3.36 (1.96)	54.35
T ₈ – Cartap hydrochloride 50 SP	1.0 gm	6.54 (2.65)	4.43 (2.22)	3.92 (2.10)	4.18 (2.16)	2.84 (1.83)	2.52 (1.74)	2.23 (1.65)	2.38 (1.70)	3.28 (1.94)	55.43
T ₉ – Chlorpyrifos 20 EC (Former's Practice)	1.50 ml	6.61 (2.67)	6.12 (2.57)	5.31 (2.41)	5.72 (2.49)	5.00 (2.35)	4.35 (2.20)	4.10 (2.14)	4.23 (2.17)	4.97 (2.34)	32.47
T ₁₀ - Untreated Check	-	6.53 (2.65)	6.94 (2.73)	6.79 (2.70)	6.87 (2.71)	7.56 (2.84)	7.74 (2.87)	7.93 (2.90)	7.84 (2.89)	7.36 (2.80)	-
SEm (±)	-	N.S.	0.043	0.058	0.064	0.072	0.092	0.156	0.127	0.046	-
CD (P= 0.05)	-	-	0.131	0.174	0.192	0.216	0.275	0.468	0.381	0.142	-

Average mean of there replications; Figure in parentheses are Arc sine transformed values.

DBS = Days before spraying : DAS = Days after spraying : NS = Non significant

Table - 4 : Efficacy of insecticides against aphids on cauliflower

Treatment	Dose g/ml/L	Mean number of aphid population / leaf								Over all mean	% reduction over control
		First Spray				Second Spray					
		1 DBS	5 DAS	10 DAS	Mean	1 DBS	5 DAS	10 DAS	Mean		
T ₁ – Indoxacarb 14.5 SC	1.0 ml	135.82 (11.68)	75.16 (8.70)	52.34 (7.27)	63.75 (8.02)	53.21 (7.33)	42.38 (6.55)	31.52 (5.75)	36.95 (6.12)	50.35 (7.13)	69.96
T ₂ – Emamectin benzoate 5WSG	0.25 ml	133.24 (11.56)	108.42 (10.44)	80.17 (8.98)	94.30 (9.74)	82.00 (9.08)	74.32 (8.65)	65.30 (8.11)	69.81 (8.39)	82.06 (9.09)	48.95
T ₃ – Thiodicarb 75 WP	1.0 gm	116.12 (10.80)	84.61 (9.23)	64.43 (8.06)	74.52 (8.66)	63.72 (18.01)	53.41 (7.34)	44.08 (6.68)	48.74 (7.02)	61.63 (7.88)	36.77
T ₄ - Novaluron 10 EC	1.0 ml	144.26 (12.03)	120.25 (10.99)	99.65 (10.00)	109.95 (10.51)	97.20 (9.88)	86.82 (9.34)	79.21 (8.93)	83.02 (9.14)	96.49 (9.85)	42.45
T ₅ -Azadirachtin 0.15%	4 ml	150.41 (12.28)	126.84 (11.28)	103.47 (10.20)	115.16 (10.75)	102.32 (10.14)	92.50 (9.64)	83.00 (9.14)	87.75 (9.39)	101.46 (10.10)	39.47
T ₆ – Avermectin 1.9 EC	0.5 ml	123.52 (11.14)	112.36 (10.62)	94.32 (9.74)	103.34 (10.19)	93.10 (9.67)	79.86 (8.96)	70.42 (8.42)	75.14 (8.70)	89.24 (9.47)	46.76
T ₇ – Spinosad 45 SC	0.33 ml	118.34 (10.90)	102.17 (10.13)	78.90 (8.91)	90.57 (9.54)	75.23 (8.70)	68.00 (8.28)	63.41 (7.99)	66.71 (8.20)	78.63 (8.90)	28.19
T ₈ – Cartap hydrochloride 50 SP	1.0 gm	140.65 (11.88)	98.42 (9.95)	72.26 (8.53)	83.34 (9.26)	71.10 (8.46)	63.12 (7.97)	47.96 (6.96)	55.54 (7.49)	79.44 (8.42)	57.98
T ₉ – Chlorpyrifos 20 EC (Former's Practice)	1.50 ml	145.34 (12.08)	134.86 (11.63)	112.48 (10.63)	123.67 (11.14)	110.44 (10.53)	98.27 (9.94)	91.45 (9.59)	94.86 (9.77)	109.27 (10.48)	34.81
T ₁₀ - Untreated Check	-	126.87 (11.29)	145.24 (12.07)	158.52 (12.61)	151.88 (12.34)	162.93 (12.78)	174.45 (13.23)	192.24 (13.88)	183.35 (13.56)	167.62 (12.97)	-
SEm (±)	-	N.S.	0.138	0.543	0.412	0.451	0.574	0.715	0.805	0.641	-
CD (P= 0.05)	-	-	0.415	1.628	1.236	1.352	1.721	2.143	2.416	1.924	-

Average mean of there replications; Figure in parentheses are Arc sine transformed values.

DBS = Days before spraying : DAS = Days after spraying : NS = Non significant

Table – 5 : Economics of insecticides against the pests on cauliflower.

Treatments	Dost g/ml/l	Yield (q/ha)	Increased Yield over control	Value of additional yield over control (Rs./ha)	Cost of treatment (Rs/ha)	Incremental benefit (Rs/ha)	CB ratio
T ₁ – Indoxacarb 14.5 SC	1.0 ml	144.26	48.42	50841.00	5672.00	45169.00	1:7.96
T ₂ – Emamectin benzoate 5WSG	0.25 ml	123.75	27.91	29306.00	3565.00	25741.00	1:7.22
T ₃ – Thiodicarb 75 WP	1.0 gm	140.63	44.84	47082.00	4536.00	42456.00	1:9.37
T ₄ - Novaluron 10 EC	1.0 ml	120.42	24.58	25809.00	3452.00	22357.00	1:6.48
T ₅ -Azadirachtin 0.15%	4 ml	118.56	22.72	23856.00	4680.00	19176.00	1:4.10
T ₆ – Avermectin 1.9 EC	0.5 ml	121.34	25.50	26775.00	4078.00	22697.00	1:5.57
T ₇ – Spinosad 45 SC	0.33 ml	128.15	32.31	33926.00	4625.00	29301.00	1:6.34
T ₈ – Cartap hydrochloride 50 SP	1.0 gm	134.70	38.86	40803.00	3358.00	37445.00	1:11.15
T ₉ – Chlorpyriphos 20 EC (Former's Practice)	1.50 ml	110.26	14.42	15141.00	3690.00	11451.00	1:3.10
T ₁₀ - Untreated Check	-	95.84	-	-	-	-	-
SEm (±)	-	3.154	-	-	-	-	-
CD (P= 0.05)	-	9.462	-	-	-	-	-

Average mean of there replications; Market price of cauliflower @ Rs. 1050/quintal.