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Bio efficacy of quinalphos 20% EC + deltamethrin 1%ec against whitefly and thrips and its phytotoxicity on chilli in gird region

Rashmi Bajpai and Bharat Lal

Abstract
Diseases and Pests are very important constraints for production of chilli. Whitefly, Aphids, Thrips and Red mites (Sucking Pests) are the major insect/pest to do the major crop loss. A foliar application of Agro Chemicals is very effective control measures of disease and pests. The objective of present research work is to control the various sucking pests like whitefly and thrips by foliar application of Quinalphos 20% EC and Deltamethrin 1% EC. The experiment was laid out in a Randomized Block Design with three replications. After two foliar spray (at 5 days, 10 days & 15 days respectively) the lowest whitefly population (0.54 whitefly/3 leaves) was recorded in the treatment T_9 (Quinalphos 20% EC + Deltamethrin 1% EC @ 3200 ml/ha) over control (5.65 whitefly/3 leaves), while, it was at par with the treatment T_3 (Quinalphos 20% EC + Deltamethrin 1% EC @ 800 ml/ha) *i.e.* 0.61 whitefly/3 leaves) and T_8 (Quinalphos 20% EC + Deltamethrin 1% EC @ 1600 ml/ha) *i.e.* 0.60 whitefly/3 leaves. Similarly lowest thrips population was recorded in the treatment T_9 (Quinalphos 20% EC + Deltamethrin 1% EC@ 3200 ml/ha) *i.e.* 1.20 of thrips/plant over the control *i.e.* 8.44 thrips/plant, while it was at par with the treatment T_3 (Quinalphos 20% EC + Deltamethrin 1% EC @ 800 ml/ha) *i.e.*1.28 thrips/plant and T_8 Quinalphos (20% EC + Deltamethrin 1% EC @ 1600 ml/ha) *i.e.* 1.27 thrips/plant. Application of Quinalphos 20% EC & Deltamethrin 1% EC at various doses @ 600-3200 ml/ha did not cause any phytotoxic effect on chilli crop. Highest yield was recorded in T_9 (Quinalphos 20% EC + Deltamethrin 1% EC@ 3200 ml/ha) *i.e.* 15.27 t/ha. The study indicated that Quinalphos 20% EC & Deltamethrin 1% EC @ 800 ml/ha is economically effective against whitefly and thrips in a chilli. The study showed no buildup of resistance in targeted sucking pests like whitefly and thrips against this chemical.

Keywords: Whitefly, jassid, disease, phytotoxicity and chilli crop

Introduction
Chilli (*Capsicum annuum* L.) is an important vegetable cum spice crop grown in almost all parts of tropical & subtropical regions of the world. It belongs to the family Solanaceae & originated from South & Central America. Chilli has many culinary advantages. It comprises of numerous chemicals including steam volatile oils, fatty oils, capsaicinoids, carotenoids, Vitamins, Proteins, fibres and mineral elements (Bosland and Votava, 2000) [4]. Capsicum fruit may serve as a source of natural bactericidal agents to be used in food and medicinal system. Red Chilli is an important vegetable & spice crop in India. India is largest producer consumer & exporter of chilli in the world.

India produces on average 1.3 to 1.5 million tons of red chilli annually. Nearly 80% of India's production is consumed within the country and only about 15-20% of domestic production is exported. The major chilli growing states are Andhra Pradesh, Telangana, Tamilnadu, Maharashtra, Orissa and Rajasthan. Andhra Pradesh is the largest producer of chilli in India and contributes about (>50%) of the total area followed by Karnataka (10-15%), while other states contributing nearly 25-30% of total area under chilli (NHB, 2018-19 Estimated). Both green and dry chillies are used as spices for the preparation of various Curries. Dry chilli is an ingredient of curry powder, sauces & Pickles.

A number of factors is responsible for low yield that include adverse climate, poor quality seeds, diseases, insect & mites significantly affects both the quality & production of chilli. The yield losses range from 50-90% due to insects-pests of chilli.

Materials and Methods
Evaluation of Quinalphos 20% EC & Deltamethrin 1% EC against major pests of chilli was undertaken in an experimental block at department of horticulture, RVSKVV, College of

Agriculture, Gwalior during *rabi* season 2020-21. The Experiment was laid out in a Randomized Block Design (RBD) with three replications. The test molecule Quinalphos 20% EC & Deltamethrin 1 % EC were tested at five different doses as 600, 700, 800, 1600 and 3200 ml/ha for its efficacy against major pests and the concentration 1600 and 3200 ml/ha was also tested for its phytotoxicity reaction. They were compared with three standard checks *viz* Quinalphos 25% EC@ 1500 ml/ha, Deltamethrin 2.8% EC @ 500 ml/ha and Emamectin benzoate 5% SG @ 200 ml/ha along with an untreated control against major pests. Treatments were imposed three times based on pest population build up (above ETL). All the agronomic practices were followed as per recommended package of practices in chilli for north Indian conditions. Observations were recorded on number of aphids, thrips and mites from top three leaves of randomly selected and tagged five plants in each plot. The observations were taken one day prior to treatment imposition as well as 5, 10 and 15 days after treatment imposition. The data collected from three sprays were averaged and expressed on per leaf basis. The percent reduction of aphids, thrips and mites were also recorded. The natural enemy population per plant was also recorded after each spray. The yield data collected from each plot was extrapolated on hectare basis. The treatments were subjected to statistical analysis by single factor ANOVA.

Phytotoxicity

To study the phytotoxicity of Quinalphos 20 % EC & Deltamethrin 1% EC on chilli plants, a foliar application was given for all treatments at five different doses *viz* 600, 700, 800, 1600 and 3200 ml/ha along with standard chemicals. The extent of phytotoxicity was recorded on chilli plant only at an interval of 1, 3, 7, 10 and 15 days after application of all treatments. The Phytotoxicity parameters were recorded as A) Leaf injury, B) Yellowing, C) Stunting, D) Necrosis, E) Vein clearing, F) Wilting, G) Epinasty and H) Hyponasty.

Results & Discussion

Pretreatment count on number of whitefly, aphid and natural enemies were non-significant among the treatments, indicating the uniformity in the incidence of the sucking pests in the experiment plots.

Sucking pest population

Whitefly population

One day before spray, the whitefly population were found significant and ranged from 3.87-4.20 whitefly/3 leaves. Five days after the spray; whitefly population were lowest (0.73 whitefly/3 leaves) in the treatment Quinalphos 20% EC @ 3200 ml/ha); while it was at par with Deltamethrin 1% EC. The treatment T_3 Quinalphos 20% EC @ 800 ml/ha and T_8 Quinalphos 20% EC @1600 ml/ha *i.e.* had (0.80 whitefly/3 leaves) and remaining treatments ranged from 0.93-5.80 whitefly/3 leaves. Ten days after the spray significantly lowest population was recorded in the treatment T_9 *i.e.* 0.67 whitefly/3 leaves, while it was at par with T_8 and T_3 and remaining treatment ranged from 1.33-7.27 whitefly/3 leaves. 5.80 whitefly/3 leaves population was recorded in untreated plot.

Thrips Population

One day before of first spray, thrips population were found non-significant and ranged from 6.67 and 7.40 thrips/plant. Five days after spray, significantly lowest population of thrips were noticed in the treatment with T_9 (2.33 thrip/plant), which was at par with the treatments T_3, T_4, T_8 and T_2. Ten days after first spray, significantly lowest population was recorded in the treatment with T_9 (2.93 thrips/plant), which was at par with the treatments T_3, T_8, T_4, T_2 and T_1. Fifteen days after first spray T_9, T_8, T_4 and T_3 continued to be recorded lowest thrips population *i.e.* 3.33, 3.40, 3.40 and 3.47 thrips/plant, respectively. It was statistically at par with each other. Similar trend was observed in second spray also (Table 2). However, five days after third spray lowest population was recorded in the treatment T_9 (0.20 thrips/plant), which was at par with treatments T_8, T_4, T_3 and T_2. Similar trend was observed after ten and fifteen days after third spray (Table 2). Data computed on percent reduction of thrips population indicated that 34.15 to 85.78 percent population reduced after may be spraying of different insecticidal doses, however, T_9 (85.78%) was found most effective in reducing the thrips population, followed by T_8,T_4,and T_3. Similar trend was observed by Subhashree *et al.* (2019) [5] and Deole and Yadu (2018) [2].

Natural Enemies (Coccinellid beetle)

One day before treatment of coccinellid beetle was non-significant and ranged from 0.53 to 0.67 beetles/ plant. However, five days after first spray, beetle population was recorded significantly lowest in the treatment T_9 0.27 beetles /plant followed by treatment T_8, T_4, T_3 and T_2. Ten days after first spray, beetle population was significantly lowest in the treatment T_9 (0.33 beetle/plant), similarly treatments T_1, T_2, T_3, T_4 and T_8 were at par in beetle population ranged from 0.40-0.47 beetles/plant. While 1.07 beetles/ plant was recorded in untreated plot. Fifteen days after first spray T_9 maintained significantly lowest population *i.e.* (0.33 beetles/plant (Table 3). Similar trend was observed as second spray (Table 3). Five days after third spray Coccinellid population was significantly lowest in the treatment T_9 (0.20 beetles/plant), which was at par with treatment T_8. Remaining treatments recorded the beetle population ranged from 0.53 to 0.87 beetle/ plant. The population was ranged from 0.53 to 0.87 beetles/plant and lowest population was recorded in treatment T_9 (0.33 beetles/plant). Fifteen days after spray, the treatment T_9 maintained significantly lowest population (0.40 beetles /plant), followed by the treatment T_8 and T_4. T_9 and T_8 were proved to be most effective insecticide doses against coccinellid beetle on chilli. Similar trend was observed by Patil *et al.* (2018) [3].

Resistance of polyphagous Sucking pests

From the above observations, it was noticed that Quinalphos 20% EC and Deltamethrin 1% EC @ 800 ml is the effective dose of target pests and did not cause the resistance of sucking pests like whitefly, thrips and natural enemies during the field experiment compared to untreated control plot. Hence, we can conclude that Quinalphos 20% EC and Deltamethrin 1% EC has not buildup resistance of sucking pests like whitefly, thrips and natural enemies.

Green chilli fruits yield

Among the different treatments significantly highest yield was recorded in the treatment T_9 (Quinalphos 20% EC& Deltamethrin 1% EC @ 3200 ml/ha) *i.e.* 15.27 q/ha. Next best treatment was T_4, T_3 and T_8 (14.63, 14.50 and 14.43 q/ha respectively). Remaining treatments recorded the yield ranged from 10.23 to 13.23 q/ha (Table 4).

Phytotoxicity of Quinalphos 20% EC & Deltamethrin 1% EC on chilli and other harmful effects

There were no phytotoxic symptoms observed in any of the treatment with Quinalphos 20% EC and Deltamethrin 1% EC at the tested concentrations. None of the phytotoxicity symptoms like leaf injury, yellowing, stunting, necrosis, vein clearing, wilting, epinasty, and hyponasty were observed at the highest dose of Quinalphos 20 % EC & Deltamethrin 1% EC @ 3200 ml/ha (Table-5).

Phytotoxicity of Quinalphos 20% EC and Deltamethrin 1% EC (Krishi Rasayan sample) on chilli and other harmful effects observed

Phytotoxicity of Quinalphos 20% EC and Deltamethrin 1% EC (Krishi Rasayan sample) was evaluated at 1600 and 3200 ml/ha doses and other treatments on chilli crop. Observation on phytotoxicity symptoms were recorded on ten randomly selected plants from each plot at 1, 3, 7, 10 and 15 days after each application. The level of phytotoxicity was estimated by the following 0-10 phytotoxicity rating scale (PRS).

Parameters for assessment of phytotoxicity

1. Leaf injury
2. Yellowing
3. Stunting
4. Necrosis
5. Vein clearing
6. Wilting
7. Epinasty
8. Hyponasty

Phytotoxicity rating scale

Score	Phytotoxicity (%)
0	No phytotoxicity
1	1-10
2	11-20
3	21-30
4	31-40
5	41-50
6	51-60
7	61-70
8	71-80
9	81-90
10	91-100

Phytotoxicity

Observations on phytotoxicity symptoms like leaf injury, yellowing, stunting, necrosis, vein clearing, wilting, epinasty and hyponasty were recorded on ten randomly selected plants from each plot at 1, 3, 7, 10 and 15 days after each application. The level of phytotoxicity was estimated by the following phytotoxicity rating scale (PRS). No phytotoxicity was observed in all the treatments up to @ 3200 ml/ha. Hence krishi rasayan sample *i.e.* Quinalphos 20% EC and Deltamethrin 1% EC was non phytotic to chilli crop up to 3200 ml/ha level of application.

Conclusion

The field trial conducted during *Rabi* 2020 (First season) at College of Agriculture, RVSKVV, College of Agriculture, Gwalior (M.P.), indicated that Quinalphos 20% EC and Deltamethrin 1% EC @ 800ml/ha can effectively and economically control pest population on chilli crop. This dose was found significantly superior over other pesticides treatments. The tested product was safe to chilli crop as no phytotoxicity was observed up to the dosage @ 3200 ml/ha of pesticide.

Table 1: Bio-efficacy of insecticides against whitefly, *Bemisia tabaci* (Genn.) on chilli

Treatments	a.i./ha (ml/gm)	Dose/ha (ml/gm)	Number of whitefly population/3 leaves										Over all mean	Reduction (%)
			First spray				Second spray			Third spray				
			1 DBS	5 DAS	10 DAS	15 DAS	5 DAS	10 DAS	15 DAS	5 DAS	10 DAS	15 DAS		
Quinalphos 20 + Deltamethrin 1%EC @ 600 ml/ha	126	600	4.00 (2.12)	1.07 (1.25)	1.33 (1.35)	1.40 (1.38)	0.67 (1.08)	1.00 (1.22)	1.07 (1.25)	0.27 (0.86)	0.40 (0.93)	0.40 (0.93)	0.84	85.06
Quinalphos 20 + Deltamethrin 1%EC @ 700 ml/ha	147	700	3.93 (2.11)	1.00 (1.22)	1.33 (1.35)	1.47 (1.40)	0.73 (1.11)	1.07 (1.25)	1.13 (1.28)	0.13 (0.79)	0.47 (0.97)	0.27 (0.87)	0.84	85.06
Quinalphos 20 + Deltamethrin 1%EC @ 800 ml/ha	168	800	4.20 (2.17)	0.80 (1.14)	0.73 (1.11)	0.93 (1.19)	0.73 (1.11)	0.80 (1.14)	0.93 (1.19)	0.07 (0.75)	0.33 (0.90)	0.20 (0.83)	0.61	89.12
Quinalphos 25% EC @ 1500 ml/ha (Market sample)	375	1500	4.13 (2.15)	0.93 (1.19)	1.20 (1.30)	1.53 (1.43)	0.80 (1.14)	0.80 (1.14)	0.87 (1.16)	0.07 (0.75)	0.33 (0.91)	0.13 (0.79)	0.74	86.89
Deltamethrin 2.8%EC @ 500 ml/ha	12.5	500	4.07 (2.13)	2.13 (1.62)	2.47 (1.72)	2.00 (1.58)	1.33 (1.35)	1.20 (1.30)	2.93 (1.85)	0.80 (1.14)	0.93 (1.19)	0.87 (1.17)	1.63	71.17
Emamectin benzoate 5% SG @ 200 ml/ha	10	200	3.87 (2.09)	3.33 (1.96)	3.80 (2.07)	3.60 (2.02)	1.87 (1.54)	1.13 (1.28)	4.00 (2.12)	1.80 (1.52)	1.60 (1.45)	1.20 (1.30)	2.48	56.09
Untreated control	-	-	4.13 (2.15)	5.80 (2.51)	7.27 (2.79)	6.53 (2.65)	6.33 (2.61)	6.47 (2.64)	7.20 (2.77)	3.87 (2.09)	3.73 (2.05)	3.67 (2.04)	5.65	-
Quinalphos 20 + Deltamethrin 1%EC @ 1600 ml/ha	336	1600	3.93 (2.11)	0.80 (1.14)	0.73 (1.11)	0.80 (1.14)	0.67 (1.08)	0.80 (1.14)	0.87 (1.16)	0.07 (0.75)	0.27 (0.87)	0.40 (0.94)	0.60	89.38

Quinalphos 20 + Deltamethrin 1%EC @ 3200 ml/ha	672	3200	4.00 (2.12)	0.73 (1.11)	0.67 (1.08)	0.93 (1.19)	0.67 (1.07)	0.73 (1.11)	0.80 (1.14)	0.00 (0.71)	0.20 (0.83)	0.13 (0.79)	0.54	90.43
SEm ±			0.05	0.05	0.04	0.05	0.05	0.06	0.06	0.05	0.08	0.07		
CD at 5%			NS	0.15	0.12	0.14	0.15	0.17	0.18	0.16	0.25	0.20		

Figures in the parentheses are transformed (√n+0.5) values, NS= Non-significant

Table 2: Bio-efficacy of insecticides against thrips, *Scirtothrips dorsalis* on chilli

Treatments	a.i./ha (ml/gm)	Dose/ha (ml/gm)	Number of thrips population/plant										Over all mean	Reduction (%)
			First spray				Second spray			Third spray				
			1 DBS	5 DAS	10 DAS	15 DAS	5 DAS	10 DAS	15 DAS	5 DAS	10 DAS	15 DAS		
Quinalphos 20 + Deltamethrin 1%EC @ 600 ml/ha	126	600	6.67 (2.68)	2.47 (1.72)	3.13 (1.90)	3.67 (2.04)	0.53 (1.00)	0.60 (1.04)	1.20 (1.29)	0.47 (0.98)	0.60 (1.04)	0.33 (0.90)	1.44	82.88
Quinalphos 20 + Deltamethrin 1%EC @ 700 ml/ha	147	700	6.73 (2.69)	2.47 (1.72)	3.07 (1.89)	3.47 (1.99)	0.47 (0.98)	0.53 (1.01)	1.13 (1.28)	0.33 (0.90)	0.47 (0.98)	0.33 (0.91)	1.36	83.85
Quinalphos 20 + Deltamethrin 1%EC @ 800 ml/ha	168	800	7.20 (2.77)	2.40 (1.70)	3.00 (1.87)	3.47 (1.99)	0.40 (0.94)	0.47 (0.98)	1.00 (1.22)	0.27 (0.87)	0.33 (0.90)	0.20 (0.83)	1.28	84.81
Quinalphos 25%EC @ 1500 ml/ha (Market sample)	375	1500	7.13 (2.76)	2.33 (1.68)	3.40 (1.97)	3.40 (1.97)	0.40 (0.94)	0.40 (0.94)	1.00 (1.22)	0.20 (0.83)	0.33 (0.90)	0.13 (0.79)	1.29	84.72
Deltamethrin 2.8%EC@ 50 0ml/ha	12.5	500	7.40 (2.81)	5.67 (2.48)	4.07 (2.14)	4.40 (2.21)	2.00 (1.58)	1.87 (1.54)	2.60 (1.76)	1.60 (1.45)	1.40 (1.38)	0.87 (1.17)	2.72	67.78
Emamectin benzoate 5% SG@ 200 ml/ha	10	200	6.67 (2.68)	6.00 (2.55)	7.47 (2.82)	8.53 (3.00)	7.07 (2.75)	5.80 (2.51)	5.47 (2.44)	5.07 (2.36)	3.20 (1.92)	1.40 (1.38)	5.56	34.15
Untreated control	-	-	7.27 (2.78)	8.60 (3.01)	11.87 (3.52)	12.53 (3.61)	12.40 (3.59)	9.73 (3.20)	8.07 (2.93)	5.93 (2.54)	3.93 (2.11)	2.87 (1.83)	8.44	-
Quinalphos 20 + Deltamethrin 1%EC@ 1600 ml/ha	336	1600	6.73 (2.69)	2.40 (1.70)	3.00 (1.87)	3.40 (1.97)	0.40 (0.94)	0.47 (0.98)	1.00 (1.22)	0.27 (0.87)	0.33 (0.91)	0.13 (0.79)	1.27	84.99
Quinalphos 20 + Deltamethrin 1%EC@ 3200 ml/ha	672	3200	7.27 (2.79)	2.33 (1.68)	2.93 (1.85)	3.33 (1.96)	0.33 (0.91)	0.40 (0.94)	0.93 (1.20)	0.20 (0.83)	0.27 (0.87)	0.07 (0.75)	1.20	85.78
SEm ±			0.07	0.06	0.04	0.06	0.07	0.08	0.04	0.06	0.06	0.06		
CD at 5%			NS	0.19	0.13	0.18	0.21	0.23	0.13	0.15	0.19	0.18		

Figures in the parentheses are transformed (√n+0.5) values, NS= Non-significant

Table 3: Effect of insecticides on population of natural enemies (Lady Bird beetle), *Coccinella septumpunctata*

Treatments	a.i./ha (ml/gm)	Dose/ha (ml/gm)	Number of beetles population/plant										Over all mean	Reduction (%)
			First spray				Second spray			Third spray				
			1DBS	5DAS	10DAS	15DAS	5DAS	10DAS	15DAS	5DAS	10DAS	15DAS		
Quinalphos 20 + Deltamethrin 1%EC @ 600 ml/ha	126	600	0.60 (1.05)	0.33 (0.91)	0.47 (0.98)	0.53 (1.01)	0.53 (1.02)	0.47 (0.98)	0.53 (1.02)	0.87 (1.17)	0.73 (1.11)	0.93 (1.20)	0.60	34.68
Quinalphos 20 + Deltamethrin 1%EC @ 700 ml/ha	147	700	0.53 (1.02)	0.40 (0.95)	0.40 (0.94)	0.60 (1.05)	0.53 (1.02)	0.40 (0.94)	0.53 (1.01)	0.53 (1.02)	0.67 (1.08)	0.73 (1.11)	0.53	41.94
Quinalphos 20 + Deltamethrin 1%EC @ 800 ml/ha	168	800	0.60 (1.05)	0.33 (0.91)	0.47 (0.98)	0.53 (1.02)	0.47 (0.98)	0.40 (0.94)	0.67 (1.08)	0.53 (1.02)	0.73 (1.11)	0.73 (1.11)	0.54	41.13
Quinalphos 25%EC @ 1500 ml/ha (Market sample)	375	1500	0.53 (1.01)	0.40 (0.94)	0.40 (0.95)	0.67 (1.08)	0.40 (0.94)	0.33 (0.91)	0.53 (1.02)	0.47 (0.98)	0.53 (1.02)	0.53 (1.02)	0.47	48.39
Deltamethrin 2.8%EC @ 500 ml/ha	12.5	500	0.67 (1.08)	0.33 (0.91)	0.53 (1.01)	0.60 (1.05)	0.53 (1.01)	0.40 (0.94)	0.60 (1.05)	0.73 (1.11)	0.73 (1.11)	0.73 (1.11)	0.58	37.10
Emamectin benzoate 5% SG @ 200 ml/ha	10	200	0.67 (1.08)	0.33 (0.91)	0.60 (1.05)	0.53 (1.02)	0.67 (1.07)	0.53 (1.02)	0.60 (1.05)	0.80 (1.14)	0.87 (1.16)	0.93 (1.20)	0.65	29.03
Untreated control	-	-	0.53 (1.02)	0.47 (0.98)	1.07 (1.25)	1.00 (1.22)	0.93 (1.20)	0.73 (1.11)	1.00 (1.22)	1.00 (1.22)	1.13 (1.28)	0.93 (1.20)	0.92	-
Quinalphos 20 + Deltamethrin 1%EC @ 1600 ml/ha	336	1600	0.60 (1.05)	0.33 (0.91)	0.47 (0.98)	0.47 (0.98)	0.33 (0.91)	0.33 (0.91)	0.20 (0.83)	0.33 (0.91)	0.53 (1.02)	0.60 (1.05)	0.40	56.45
Quinalphos 20 + Deltamethrin 1%EC @ 3200 ml/ha	672	3200	0.53 (1.01)	0.27 (0.87)	0.33 (0.91)	0.33 (0.91)	0.33 (0.91)	0.27 (0.87)	0.13 (0.79)	0.20 (0.84)	0.33 (0.91)	0.40 (0.95)	0.29	68.55
SEm ±			0.05	0.04	0.05	0.04	0.05	0.04	0.04	0.03	0.04	0.03		
CD at 5%			NS	0.11	0.15	0.12	0.15	0.12	0.12	0.09	0.12	0.09		

Figures in the parentheses are transformed (√n+0.5) values, NS= Non-significant

Table 4: Effect of different Pesticides on yield of chilli at harvest (q/ha)

Treatments	a.i./ha (ml/gm)	Dose/ha (ml/gm)	Yield (t/ha)
Quinalphos 20 + Deltamethrin 1%EC @ 600 ml/ha	126	600	11.40
Quinalphos 20 + Deltamethrin 1%EC @ 700 ml/ha	147	700	12.47
Quinalphos 20 + Deltamethrin 1%EC @ 800 ml/ha	168	800	14.50
Quinalphos 25%EC @ 1500 ml/ha (Market sample)	375	1500	14.63
Deltamethrin 2.8%EC @ 500 ml/ha	12.5	500	12.27
Emamectin benzoate 5% SG @ 200ml/ha	10	200	13.23
Untreated control	-	-	10.23
Quinalphos 20 + Deltamethrin 1%EC @1600 ml/ha	336	1600	14.43
Quinalphos 20 + Deltamethrin 1%EC @ 3200 ml/ha	672	3200	15.27
SEm ±			0.57
CD at 5%			1.70

Figures in the parentheses are mean values

Table 5: Phytotoxicity parameters observed* (mean data recorded at 1, 3,7, 10 and 15 days after each spray)

Treatments	Leaf injury	Yellowing	Stunting	Necrosis	Vein clearing	Wilting	Epinasty	Hyponasty
Quinalphos 20 + Deltamethrin 1%EC @ 600 ml/ha	0	0	0	0	0	0	0	0
Quinalphos 20 + Deltamethrin 1%EC @ 700 ml/ha	0	0	0	0	0	0	0	0
Quinalphos 20 + Deltamethrin 1%EC @ 800 ml/ha	0	0	0	0	0	0	0	0
Quinalphos 25%EC @ 1500 ml/ha (Market sample)	0	0	0	0	0	0	0	0
Deltamethrin 2.8%EC @ 500 ml/ha	0	0	0	0	0	0	0	0
Emamectin benzoate 5% SG @ 200 ml/ha	0	0	0	0	0	0	0	0
Untreated control	0	0	0	0	0	0	0	0
Quinalphos 20 + Deltamethrin 1%EC @ 1600 ml/ha	0	0	0	0	0	0	0	0
Quinalphos 20 + Deltamethrin 1%EC @ 3200 ml/ha	0	0	0	0	0	0	0	0

Based on 0-10 scale where 0=0%, 1=1-10%, 2=11-20%, 3= 21-30%, 4=31-40%, 5=41-50%, 6=51-60%, 7=61-70%, 8=71-80%, 9=81-90%, 10=91-100%

Table 6: Economics of different insecticides for the control

Treatments	Dose /ha	Yield (t/ha)	Additional yield over control (t/ha)	Additional profit (Rs/ha)	Cost of treatments (Rs/ha)	Net profit (Rs/ha)	C:Bratio
Quinalphos 20 + Deltamethrin 1%EC @ 600 ml/ha	600	11.40	1.17	58333	3240	55093	1:17.00
Quinalphos 20 + Deltamethrin 1%EC @ 700 ml/ha	700	12.47	2.23	111667	3480	108187	1:31.09
Quinalphos 20 + Deltamethrin 1%EC @ 800 ml/ha	800	14.50	4.27	213333	3720	209613	1:56.35
Quinalphos 25%EC @ 1500 ml/ha (Market sample)	1500	14.63	4.40	220000	9000	211000	1:23.44
Deltamethrin 2.8%EC @ 500 ml/ha	500	12.27	2.03	101667	3180	98487	1:30.97
Emamectin benzoate 5% SG @ 200 ml/ha	200	13.23	3.00	150000	5526	144474	1:26.14
Untreated control	-	10.23	-	-	-	-	-
Quinalphos 20 + Deltamethrin 1%EC @ 1600 ml/ha	1600	14.43	4.20	210000	5640	204360	1:36.23
Quinalphos 20 + Deltamethrin 1%EC @ 3200ml/ha	3200	15.27	5.03	251667	9480	242187	1:25.55

Cost of cultivation of Chilli is 46000 Rs/ha

Note:

Selling rate of chilli fruit (Rs/t): 50,000:

Labour charge for sprays (Rs): 600 per spray:

Deltamethrin 2.8% EC:

Rate of insecticides Rs/litre or kg.

Quinalphos 20% + Deltamethrin 1% EC : 2700

Quinalphos 25% EC : 1600

920 Emamectin benzoate 5% SG : 6210

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