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Evaluation of different spray schedules of insecticides against sucking pest infesting chilli (C*apsicum annum* L.)

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Abstract
The present investigations on evaluation of different spray schedules of insecticides against sucking pest infesting chilli (*Capsicum annum* L.)" was conducted during *kharif* 2016-17 at Horticulture Instructional Farm, C.P. College of Agriculture, S. D. Agricultural University, Sardarkrushinagar. The spray schedule S_4 (clothianidin 50WP @ 20g/ 10 lit., thiamethoxam 25WG @ 3g/ 10 lit., propergite 57EC @ 10ml/ 10 lit., chlorantraniliprole 18.5SC @ 4 ml/ 10 lit.) was effective management of chilli sucking pest in chilli.

Keywords: Chilli, sprsy schedule, mite, thrips

Introduction
Chilli is an important vegetable and condiment crop in India. The two cultivated species (*Capsicum annum* L. and *Capsicum frutescens* L.; family Solanaceae) are raised in the tropics and sub-tropics with a temperature range of 20-25 °C considered as ideal. The medicinal value of chilli is much realized because of its vitamin 'C' and capsaicin (C_{18} H_{27} O_3 N). It is widely used throughout the tropics as major ingredient of curry powder in the culinary production. Besides essential alkaloid, red colouring matter, which is non-pungent. India is the largest consumer and exporter of chilli in the world with a production of 3292 MT from an area of 238 thousand ha and productivity 10 MT per ha during 2016 (NHB 2016). The major chilli growing states are Andhra Pradesh, Maharashtra, Karnataka, Tamil Nadu and Rajasthan. In Gujarat, it is cultivated in an area of 6500 ha with the production of 6600 MT (Anonymous 2013) [1]. The major chilli growing districts of Gujarat include Anand, Banaskantha, Kheda, Vadodara, Navsari, Patan, Mehsana and Surat. A number of factors responsible for low yield include adverse climate, poor quality seeds, diseases, insect and mites significantly affect both the quality as well as production of chilli. The yield losses range between 50 to 90 per cent due to insect pests of chilli (Nelson and Natrajan 1994, Kumar, 1995) [11, 7]. Thrips (*Scirthothrips dorsalis* Hood), whiteflies (*Bemisia tabaci* Genn), aphids (*Aphis gossypii* Glover) and yellow mites (*Polyphagotarsonemus latus* Banks) are the important sucking pests which contributed to reduce the crop yield (Hosmani, 1993) [2, 3]. The damage due to mites and thrips together had been estimated to the tune of 50 per cent (Kandasamy *et al*. 1990) [6].

Materials and Methods
A field experiment was conducted during *kharif* 2016-17 at Horticulture Instructional Farm of Chamanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University Sardarkrushinagar. The experiment was consisted of five spray schedules which replicated fourth in Randomized Block Design (RBD). Gross plot size 3.60m X 6.00m and net plot size 2.40m X 2.80m, Seedling of chilli vatiety GCh 1 was used and transplanted during second week of july 2016, with spacing 60 cm X 60cm. The spray schedules consisted the following: S_1 (diafenthiuron 50WP @ 10g/ 10 lit., imidacloprid 17.8SL @ 5ml / 10 lit., propergite 57 EC @ 10 ml/ 10 lit., profenophos 50 EC @ 10 ml/ 10 lit.,), S_2 (triazophos 40EC @ 20 ml/ 10 lit., acetamiprid 20SP @ 2g/ 10 lit., imidacloprid 17.8SL @ 5 ml / 10 lit., novaluron 10 EC @ 10 ml/ 10 lit.,), S_3 (acetamiprid 20SP @ 2 g/ 10 lit., thiamethoxam 25WP @ 3g/ 10 lit., thiacloprid 21.7SC @ 6 ml/ 10 lit., emamectin benzoate 5SG @ 5 g/ 10 litre), S_4 (clothianidin 50WP @ 20 g/ 10 lit., thiamethoxam 25WP @ 3g/ 10 lit., propergite 57EC @ 10 ml/ 10 lit., chlorantraniliprole 18.5SC @ 4 ml / 10 litre) and spray schedule S_5 (untreated control) were studied under present investigation.

Foliar application of respective insecticides was given as per schedule using a manually operated knapsack sprayer. The first spray was made at 1 thrips / leaf and subsequent sprays were at an interval of ten days.

Observations

Five plants were selected randomly in each plot. Number of sucking pests *viz*., thrips, whitefly and yellow mite population were counted from three leaves (top, middle and bottom) of each selected plant prior to each spray and after 3 days and 7 days of spray. Finally, mean population of thrips, whitefly and yellow mite per three leaves were worked out at three and seven days after spray.

Results and Discussion

Thrips (*Scirtothrips dorsalis* Hood)

Thrips population recorded at third days after all sprays indicated that the minimum population (Table 1) was recorded in S_4 (0.85 thrips/ 3 leaves), which was at par with the S_3 (0.95 thrips/ 3 leaves). It was followed by the S_2 (1.68 thrips/ 3 leaves) and S_1 (1.73 thrips/ 3 leaves). Similar trend was also observed at seven days after all sprays the minimum population was recorded in S_4 (0.75 thrips/ 3 leaves), which was at par with the S_3 (0.79 thrips/ 3 leaves). It was followed by the S_2 (1.50 thrips/ 3 leaves) and S_1 (1.65 thrips/ 3 leaves) respectively.

The similar results were recorded by Prajapati and Agalodiya (2011) [12] evaluated spray schedule S_1 (comprising triazophos 40EC @ 25ml/10 lit., wettable sulphur 50 WP @40g/10lit., imidacloprid 17.8 SL @ 5ml/10lit., wettable sulphur 50 WP @ 40g/10lit and acephate 75 SP @ 15g/ 10lit.of water) registered the lowest population of thrips and similar resul was recorded by Nagaraj *et al.* (2007) [9].

Table 1: Evaluation of different spray schedules of insecticides against thrips on chilli

S. No	Treatments	No. of thrips/ 3 leaves									Pooled	
		First spray			Second spray		Third spray		Fourth spray			
		Before spray	3 DAS	7 DAS	3 DAS	7 DAS	3 DAS	7 DAS	3 DAS	7 DAS	3 DAS	7 DAS
1.	S_1	2.19 (4.30)	1.32^{bc} (1.24)	1.29^{bc} (1.17)	1.54^{b} (1.88)	1.52^{b} (1.81)	1.56^{b} (1.92)	1.51^{b} (1.80)	1.55^{b} (1.90)	1.53^{b} (1.84)	1.49^{b} (1.73)	1.47^{b} (1.65)
2.	S_2	2.20 (4.32)	1.63^{b} (2.14)	1.56^{b} (1.92)	1.47^{b} (1.66)	1.33^{b} (1.27)	1.29^{bc} (1.17)	1.27^{bc} (1.11)	1.51^{b} (1.79)	1.50^{b} (1.74)	1.48^{b} (1.68)	1.42^{bc} (1.50)
3.	S_3	2.13 (4.03)	1.54^{b} (1.88)	1.37^{b} (1.38)	1.06^{c} (0.63)	0.99^{c} (0.48)	1.03^{c} (0.55)	0.95^{c} (0.41)	1.18^{c} (0.90)	1.15^{c} (0.82)	1.20^{c} (0.95)	1.14^{cd} (0.79)
4.	S_4	2.16 (4.17)	1.04^{c} (0.59)	1.02^{c} (0.54)	0.97^{c} (0.44)	0.94^{c} (0.39)	1.41^{b} (1.49)	1.38^{b} (1.41)	1.23^{c} (1.02)	1.17^{c} (0.86)	1.16^{c} (0.85)	1.12^{d} (0.75)
5.	S_5	2.20 (4.32)	2.28^{a} (4.69)	2.32^{a} (4.86)	2.58^{a} (6.15)	2.61^{a} (6.30)	3.08^{a} (8.97)	3.13^{a} (9.28)	2.94^{a} (8.13)	2.93^{a} (8.09)	2.72^{a} (6.90)	2.75^{a} (7.05)
S.Em.±		NS	0.10	0.09	0.08	0.08	0.11	0.11	0.09	0.08	0.10	0.09
C.V. %		10.33	13.05	11.84	10.97	11.44	12.75	13.40	10.87	9.35	11.98	11.82

*Figures in parentheses are retransformed values, while those outside $\sqrt{X+0.5}$ transformed values

Table 2: Evaluation of different spray schedule of insecticides against whitefly on chilli

S. No	Treatments	No. of whitefly/ 3 leaves									Pooled	
		First spray			Second spray		Third spray		Fourth spray			
		Before spray	3 DAS	7 DAS	3 DAS	7 DAS	3 DAS	7 DAS	3 DAS	7 DAS	3 DAS	7 DAS
1.	S_1	2.08 (3.82)	1.02^{c} (0.54)	0.99^{c} (0.49)	1.41^{b} (1.48)	1.34^{b} (1.29)	1.36^{b} (1.30)	1.28^{b} (1.14)	1.44^{b} (1.59)	1.39^{b} (1.42)	1.31^{b} (1.20)	1.25^{b} (1.06)
2.	S_2	2.10 (3.91)	1.14^{c} (0.80)	1.02^{c} (0.54)	1.26^{b} (1.10)	1.17^{b} (0.87)	1.05^{bc} (0.59)	1.00^{c} (0.49)	1.02^{c} (0.54)	0.97^{cd} (0.44)	1.12^{bc} (0.75)	1.04^{bc} (0.58)
3.	S_3	2.08 (3.82)	1.48^{b} (1.69)	1.41^{b} (1.49)	0.86^{c} (0.24)	0.82^{c} (0.17)	0.89^{c} (0.29)	0.84^{c} (0.20)	0.80^{d} (0.15)	0.77^{d} (0.10)	1.01^{c} (0.52)	0.96^{c} (0.42)
4.	S_4	2.12 (4.01)	1.50^{b} (1.74)	1.48^{b} (1.69)	0.94^{c} (0.39)	0.86^{c} (0.25)	1.32^{b} (1.23)	1.26^{b} (1.08)	1.33^{b} (1.28)	1.25^{bc} (1.07)	1.27^{b} (1.12)	1.20^{b} (0.98)
5.	S_5	2.09 (3.87)	2.11^{a} (3.95)	2.13^{a} (4.06)	2.56^{a} (6.07)	2.69^{a} (6.74)	2.73^{a} (6.94)	2.74^{a} (7.02)	2.70^{a} (6.77)	2.64^{a} (6.45)	2.52^{a} (5.88)	2.55^{a} (6.00)
S.Em.±		0.08	0.08	0.07	0.07	0.08	0.09	0.07	0.07	0.10	0.08	0.07
C.V. %		7.33	10.80	10.44	9.88	11.65	12.04	10.12	9.16	14.06	10.67	10.08

*Figures in parentheses are retransformed values, while those outside $\sqrt{X+0.5}$ transformed values

Table 3: Evaluation of different spray schedules of insecticides against yellow mite on chilli

S. no	Treatments	No. of yellow mite/ 3 leaves									Pooled	
		First spray			Second spray		Third spray		Fourth spray			
		Before spray	3 DAS	7 DAS	3 DAS	7 DAS	3 DAS	7 DAS	3 DAS	7 DAS	3 DAS	7 DAS
1.	S_1	2.13 (4.05)	2.00^{a} (3.49)	1.96^{a} (3.33)	1.89^{b} (3.07)	1.85^{b} (2.94)	1.25^{cd} (1.06)	1.13^{cd} (0.79)	1.41^{b} (1.49)	1.35^{bc} (1.34)	1.64^{b} (2.18)	1.57^{b} (1.97)
2.	S_2	2.12 (4.00)	2.06^{a} (3.72)	2.03^{a} (3.64)	1.73^{bc} (2.50)	1.70^{b} (2.40)	1.56^{b} (1.93)	1.51^{b} (1.80)	1.60^{b} (2.07)	1.59^{b} (2.02)	1.74^{b} (2.52)	1.71^{b} (2.42)
3.	S_3	2.14 (4.09)	1.44^{b} (1.58)	1.39^{b} (1.43)	1.38^{cd} (1.44)	1.36^{c} (1.34)	1.37^{bc} (1.38)	1.33^{bc} (1.27)	1.44^{b} (1.59)	1.41^{b} (1.48)	1.41^{bc} (1.49)	1.37^{bc} (1.38)
4.	S_4	2.10 (3.92)	1.41^{b} (1.48)	1.36^{b} (1.34)	1.35^{d} (1.32)	1.33^{d} (1.28)	1.09^{d} (0.69)	1.00^{d} (0.49)	1.18^{c} (0.89)	1.11^{c} (0.74)	1.26^{c} (1.09)	1.20^{c} (0.94)
5.	S_5	2.08 (3.84)	2.15^{a} (4.12)	2.19^{a} (4.28)	2.27^{a} (4.67)	2.30^{a} (4.80)	2.39^{a} (5.22)	2.49^{a} (5.68	2.64^{a} (6.49)	2.56^{a} (6.06)	2.36^{a} (5.08)	2.39^{a} (5.94)
S.Em.±		0.11	0.08	0.09	0.11	0.10	0.08	0.07	0.07	0.08	0.11	0.11
C.V. %		10.65	8.98	10.26	12.52	11.88	10.46	9.44	8.31	10.13	12.65	13.18

*Figures in parentheses are retransformed values, while those outside $\sqrt{X+0.5}$ transformed values

Whitefly (*Bemisia tabcai* Genn.)

The results showed that the population of whitefly was recorded minimum at third and seven days after which spray significant differed among spray schedules with minimum under S_3 (0.52 whitefly/ 3 leaves), (0.42 whitefly/ 3 leaves) respectively, with was at par with S_2 (0.75 whitefly/ 3 leaves), (0.58 whitefly/ 3 leaves) after third and seven days respectively. It was followed by S_4 and S_1 (Table 2).The results of present investigation are in agreement with the results of Mhaske and Mote (2005) [8] who observed imidacloprid 17.5 SL, thiomethoxam 25 WG, azadirachtin 1 per cent, triazophos 40 EC and profenophos 50EC at different concentration against thrips, jassid, and whitefly and shoot and fruit borer infesting brinjal crop. The similar results was recorded by Jayewar *et al.*, (2003) [8], and jakhar (2015) [4].

Yellow mite (*Polyphagotarsonemus latus* Banks)

The results showed that the population of yellow mite was recorded minimum at third and seven days after spray found significant the lowest population of yellow mite under S_4 (1.09 yellow mite/ 3 leaves), (0.94 yellow mite/ 3 leaves) respectively, which was at par with S_3 (1.49 yellow mite/ 3 leaves), (1.38 yellow mite/ 3 leaves) after third and seven days respectively. It was followed by S_1 and S_2 (Table 3).

The results are agreement with the findings of Singh and Singh (2013) [13] reported that the maximum reduction in mite population with abamectin (77.28%), propergite (72.66%) and dicofol (66.91%), moderate reduction with thiamethoxam (66.16%), imidacloprid 70 WP (50.54%), sulphur (49.26%). Azadiractin (42.25%), imidacloprid (41.72%) and neem oil based formulation (38.41%) found less effective in yellow mite population and conform result was found Prajapati and Agalodiya (2011) [12].

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