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Bio-efficacy and Residue Studies of Methomyl (Lannate 40 sp) against Pest Complex of Chilli (*Capsicum frutescens* L.) and Pigeon Pea (*Cajanus cajan* L. Millsp.)

Savitri Chakraborty[1]*, AK Somchoudhury[2] and Ashim Chowdhury[3]

[1]*Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalya, India*

[2]*Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalya, India*

[3]*Department of Agricultural Chemistry & Soil Science, University of Calcutta, India*

***Corresponding Author:** Savitri Chakraborty, Savi Agrotech Consultant, Pittsburgh, USA.

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Abstract

Field trials were conducted at University Experimental Farm at Kalyani, West Bengal, India to test the effectiveness of Methomyl (Lannate 40 SP) at various doses solely and in combination with synthetic pyrethroids against thrips *Scirtothrips dorsalis* Hood and *Helicoverpa armigera* (Hub.) infesting chilli and pod borer larvae *Helicoverpa armigera* (Hub.), pigeon pea pod fly *Melanagromyza obtusa* Mall and Apion spp. infesting pigeon pea *Cajanu scajan* (L.) Mill sp. Quinalphos 25 EC @ 250g a.i. ha^{-1} and Cypermethrin 10 EC @ 60g a.i. ha^{-1} was incorporated as a standard pesticide in this trial. The rate of breakdown of Methomyl 40 SP in chilli fruits and pigeon pea seeds was studied following its bio-efficacy study. The combination of Methomyl 40SP + Cypermethrin 10EC @ 150 + 60g a.i. ha^{-1} was found to be compatible and had performed the best in respect to pest control for both crops. The residues of Methomyl had reached BDL (below detectable limit) on the fourth and fifth day of spray on chilli and on fifth and seventh day of spray on pigeon pea. The half-life value was 0.58 to 0.66 days for chilli and 0.84 to 1.20 days for pigeon pea. The T_{MRL} values were calculated as 4.07 and 5.31 days for Methomyl spray @ 300 and 450g a.i. ha^{-1}, respectively on pigeon pea.

Keywords: *Bio- efficacy; Methomyl; Chilli; Pigeon pea; Breakdown rate*

Introduction

Chilli (*Capsicum frutescens* L.) belonging to family Solanaceae is an important vegetable and commercially grown condiment indispensable for every Indian home. Nair (1981) had reported 23 pests on chilli and among them Thrips, *Scirtothrips dorsalis* Hood is a key pest of chilli in India [1]. Butani. (1976) had recorded that thrips caused yield loss of 20-25% in addition to transmitting leaf curl virus of chilli [2]. Jagmohan., *et al*. (1980) studied the insecticides for control of pests of sweet pepper [3]. Pulses are an important component of Indian diet. Among pulses pigeon pea (*Cajanus cajan* L. Mill sp.) belongs to the family *Fabaceae*, and is widely cultivated in the tropics. Pigeon pea occupies the second most important position in respect of acreage and production in India. Nair (1981) recorded the incidence of about twenty major insect pests on pigeon pea [1]. Among them Panwar. (1998) had recorded that *Helicoverpa armigera* (Hub.) was a serious concern to Indian farmers owing to its growing resistance to different groups of insecticides [4]. Mohasin., *et al*. (1999) reported peak incidence of this pest on pigeon pea during the first fortnight of February [5]. Among the pod borers *Melanagromyza obtusa* (Mall) caused 60-65% damage to pods of pigeon pea as observed by Panwar (1998) [4].

During the present investigation, field trials were conducted to test the effectiveness of Methomyl, S- methyl N-[methyl carbomoyloxy] thioacetimidate (Lannate 40 SP) supplied by Du Pont Far East Inc against pest complex of chilli and pigeon pea. Earlier the liquid formulation of Methomyl (Lannate 12.5L) was used to combat pest of crops. It was later observed that though this formulation had proved effective in reducing the pest population, the main drawback was its high inhalation toxicity compared to other conventional insecticides.

Hence it became imperative to develop such a formulation which would be safe to mammals and still retain its efficacy against pest. Keeping this in mind the T_{MRL} value of Methomyl 40 SP on chilli fruits and pigeon pea seeds were determined after its bio-efficacy study. The T_{MRL} value of Methomyl was found to be 0.2 mg kg^{-1} on vegetables.

Materials and Methods

The experiment was conducted at University Experimental Farm at Kalyani (West Bengal), India situated at 23°N, 89°E, 9.75m from mean sea level. Pusa Jwala variety of chilli was sown during March to July (first season) and July to October (second season) and B-517 variety of pigeon pea was sown during July to February (first season) and September to April (second season), respectively by following Randomized Blocks Design with three replications. Plot size for both the crop was 4m x 5m each. The weeding, manuring, fertilization & irrigation were carried out at regular intervals to raise the crop. Treatments included in bio-efficacy study of Methomyl 40SP are enlisted below:

T1 = Methomyl 40SP @ 150g a.i. ha^{-1}

T2 = Methomyl 40SP @ 300g a.i. ha^{-1}

T3 = Methomyl 40SP @ 450g a.i. ha^{-1}

T4 = Methomyl 40SP @ + Cypermethrin 10 EC @ 150 + 60g a.i. ha^{-1}

T5 = Cypermethrin 10EC @ 60g a.i. ha^{-1}

T6 = Quinalphos 25EC @ 250g a.i. ha^{-1}

To = Control

Pesticides were sprayed with Knapsack sprayer, pressure 24 bar at appearance of pests and thereafter two sprays at ten days interval for chilli and at the pod formation stage of pigeon pea and ETL (Economic Threshold Level) of the pests. The ETL was standardized as 2 caterpillars per plant or 1 egg mass/sq.m for lepidopteran larvae as quoted in Plant Protection Schedule for West Bengal, by the research conducted at B.C.K.V. & Govt. of West Bengal India.

Observation on Pest Incidence

To record the incidence of thrips on chilli, the numbers of nymphs of thrips on three apical twigs from five randomly selected plants were recorded. The percentage of fruits infested by borer was recorded at each picking. The incidence of *Helicoverpa armigera* (Hub.) larvae population on pigeon pea was worked out by counting the number of larvae on five randomly, selected plants/plot on first, third, seventh and tenth day after spray. Total number of bored pod was recorded at each picking and cumulative mean percent of pod bored was worked out for different treatments. This gave an idea of the percentage of pod bored by pod borer complex of pigeon pea.

Statistical Methods

The data on pest incidence and yield of chilli and pigeon pea were subjected to analysis of variance (ANOVA) after making necessary transformation.

Residue analysis

Fruit samples of chilli and pigeon pea pods were picked from different randomly tagged plants one hour after spraying and on day 1,3,5, 7 and 10 days after final (third) spray of pesticides at the above mentioned dosage and residue studies was done by following the method given below. 50g (representative sample) of chilli and pigeon pea seeds were soaked in 150 mL ethyl-acetate and then blended for 30 min and re-extracted with 2 x 100 ml ethyl acetate. The combined filtrate was mixed with 50 mL distilled water and evaporated in rotary evaporator. The residue was re-dissolved in 100 ml water and acidified with 5 mL 1 (N) H_2SO_4 and partitioned with 3 x 50 mL Hexane. Hexane layer was discarded and aqueous part was re-extracted with 3 x 50 ml chloroform. The combined organic layer was dried over anhydrous Na_2SO_4 and evaporated under vacuum at 50°C.The final volume was reconstituted by distilled methanol for HPLC analysis.

Estimation of Methomyl was made by HPLC (Hewlett Packard Model 1050) coupled with UV/VIS detector, attached with an integrator HP 3392 A. A reverse phase C18 bondapak 2 mm x 25 cm column was used and the analysis was performed by maintaining mobile phase Methanol: H_20 (7: 3 v/v), Flow rate of 0.5 mL min-1 at wave length of 240 nm. Limit of detection for this particular study is 0.005 ppm. The Retention time was 3.17 and the sensitivity of the instrument and detector is 0.001 ppm.

Recovery studies were carried out to establish the reliability of the analytical methods and to know the efficiency of extraction, portioning and cleanup steps. The chilli fruits or pigeonPea pods sample were fortified separately with analytical grade Methomyl at the level of 2,1 and 0.5 ppm, respectively. Residue analysis was carried out by following the above described method.

Results and Discussion

Efficacy of Methomyl 40sp on Chilli pest and Pigeon Pea Pest

Significantly more pest damage was observed in control than in insecticide treated plots in chilli (Tables 1 and 2). Methomyl 40SP + Cypermethrin 10 EC were the most effective insecticide compared to other insecticide tested. The efficacy of Methomyl 40SP @ 450g a.i. ha^{-1} and Methomyl 40 SP + Cypermethrin 10 EC was surprisingly similar. There was no significant difference between their treatment means ($P > 0.05$) but they were significantly different from control.

S.NO	Treatment	Dose (g a.i ha^{-1})	Mean No. of thrips/twigs before pray	% Reduction/ increase (+) of thrips population days after spray				Percentage Fruit Infested by borer	Yield (Kg ha^{-1})
				1st	3rd	7th	10th		
1.	Methomyl-40SP	150	1.66	73.41 (58.89)	77.04 (61.37)	75.00 (59.82)	69.36 (56.30)	3.96 (11.37)	1280
2.	Methomyl-40SP	300	2.33	99.9 (89.86)	100.00 (90.00)	97.91 (81.83)	92.71 (74.36)	0.78 (5.86)	1545
3.	Methomyl-40SP	450	2.66	100.00 (90.00)	100.00 (90.00)	99.17 (84.71)	95.53 (77.81)	0.01 (0.18)	1699
4.	Methomyl-40SP + Cypermethrin-10EC	150 + 60	1.33	100.00 (90.00)	100.00 (90.00)	99.99 (89.16)	98.59 (82.17)	0.35 (3.39)	1683
5.	Cypermethrin-10EC	60	2.33	100.00 (90.00)	99.95 (88.23)	97.87 (81.70)	96.14 (78.66)	0.90 (5.47)	1493
6.	Quinalphos-25EC	250	2.66	99.22 (84.85)	98.81 (83.63)	95.32 (77.50)	89.40 (71.00)	1.77 (7.52)	1388
7.	Untreated control (water spray)	-	2.33	+15.75 (23.74)	+18.49 (25.51)	+23.75 (20.17)	+30.11 (33.39)	10.66 (19.13)	1026
	CD at 5%		NS	1.70	2.43	1.54	2.88	1.46	1.04

NB: Figure in parentheses are angular transformed values; NS –Not significant.

Table 1: *Effect of different treatment schedules of Methomyl 40-SP in control of pest of chilli and on yield during March-July, at BCKV, Kalyani, W.B. (mean of three sprayings) (First season).*

S.NO	Treatment	Dose (g a.i ha^{-1})	Mean No. of thrips/twigs before pray	% Reduction/ increase (+) of thrips population days after spray				Percentage Fruit infested by borer	Yield (Kg ha^{-1})
				1st	3rd	7th	10th		
1.	Methomyl-40SP	150	3.66	70.98 (52.25)	72.44 (58.36)	69.92 (56.75)	65.38 (53.84)	5.20 (13.01)	1544
2.	Methomyl-40SP	300	3.33	96.80 (79.73)	97.60 (81.27)	93.48 (75.19)	90.16 (71.68)	0.96 (5.59)	1738

3.	Methomyl-40SP	450	2.66	98.33 (82.71)	99.15 (84.79)	95.12 (77.33)	92.97 (74.59)	0.19 (2.31)	1894
4.	Methomyl-40SP + Cypermethrin-10EC	150 + 60	3.66	99.07 (84.53)	100.00 (90.00)	96.91 (79.98)	95.91 (77.28)	0.57 (4.21)	1878
5.	Cypermethrin-10EC	60	3.33	98.20 (82.29)	98.97 (83.81)	92.73 (75.90)	87.55 (75.91)	1.08 (5.88)	1829
6.	Quinalphos-25EC	250	2.66	97.14 (80.23)	97.85 (81.55)	92.73 (74.34)	87.55 (69.32)	2.17 (8.48)	1715
7.	Untreated control (water spray)	-	3.33	+27.46 (31.60)	+32.09 (34.49)	+41.14 (39.85)	+51.90 (46.09)	14.38 (22.32)	1236
	CD at 5%		NS	1.98	2.58	1.87	1.80	1.17	1.14

NB: Figure in parentheses are angular transformed values; NS –Not significant.

Table 2: *Effect of different treatment schedules of Methomyl 40-SP in control of pest of chilli and on yield during July-October, at BCKV, Kalyani, W.B. (mean of three sprayings) (second season).*

The reduction in pest population due to insecticidal treatment was reflected in the yield parameters as well. A Higher yield is observed in treated plots compared to control. Even the low dose of Methomyl @ 150g a.i. ha^{-1} had given sufficient reduction of thrips population after spray at various days. The performance of Quinalphos @ 250g a.i. ha^{-1}, Cypermethrin @ 60g a.i. ha^{-1} and Methomyl @ 300g a.i. ha^{-1} were statistically at par to pest control and yield. A higher reduction in percentage of fruits infested by borer was observed in the treatments with Methomyl 40 SP @ 450g a.i. ha^{-1}.

S.no	Treatment	Dose (g a.i ha^{-1})	Pre-application count of population of *Helicoverpa* larvae/plant	% Reduction/ increase (+) *Helicoverpa* larvae population days after spray				Percentage Fruit infested by borer	Yield (Kg ha^{-1})
				1st	3rd	7th	10th		
1.	Methomyl-40SP	150	1.66	78.90 (62.67)	83.66 (66.17)	76.51 (61.05)	73.09 (58.73)	9.11 (17.69)	1876
2.	Methomyl-40SP	300	3.33	99.99 (89.73)	100.00 (90.00)	97.39 (80.71)	95.70 (78.09)	1.17 (6.24)	2290
3.	Methomyl-40SP	450	3.00	100.00 (90.00)	100.00 (90.00)	99.99 (89.95)	98.95 (84.20)	0.53 (4.07)	2397
4.	Methomyl-40SP + Cypermethrin-10EC	150 + 60	2.33	100.00 (90.00)	100.00 (90.00)	99.95 (89.07)	99.05 (84.51)	0.98 (5.51)	2209
5.	Cypermethrin-10EC	60	1.33	98.03 (81.94)	97.21 (80.27)	91.98 (73.42)	87.16 (68.01)	1.67 (7.41)	2172
6.	Quinalphos-25EC	250	2.33	95.77 (78.10)	89.13 (70.73)	85.97 (67.91)	80.30 (63.59)	4.22 (11.95)	2005
7.	Untreated control (water spray)	-	2.66	+31.42 (34.09)	+33.75 (35.59)	+41.66 (40.27)	+47.04 (43.33)	23.57 (29.02)	1607
	CD at 5%		NS	2.39	2.06	1.97	2.19	1.20	1.02

NB: Figure in parentheses are angular transformed values; NS –Not significant.

Table 3: *Effect of different treatment schedules of Methomyl 40-SP in control of Helicoverpaarmigera (Hub.) larvae and pod borer complex of pigeon pea and on yield during July–February at BCKV, Kalyani, W.B. (mean of three sprayings) (First season).*

S.NO	Treatment	Dose (g a.i ha^{-1})	Pre-application count of population of *Helicoverpa* larvae/plant	% Reduction/ increase (+) *Helicoverpa* larvae population days after spray				Percentage Fruit infested by borer	Yield (Kg ha^{-1})
				1st	3rd	7th	10th		
1.	Methomyl-40SP	150	2.66	79.04 (62.69)	81.86 (64.77)	75.33 (60.19)	71.97 (57.94)	12.05 (20.33)	1477
2.	Methomyl-40SP	300	3.33	98.77 (83.68)	99.83 (87.98)	96.40 (79.14)	95.09 (77.18)	2.55 (9.17)	1870
3.	Methomyl-40SP	450	3.33	99.99 (89.61)	100.00 (90.00)	99.51 (89.30)	98.07 (82.01)	1.17 (6.19)	1999
4.	Methomyl-40SP + Cypermethrin-10EC	150 + 60	3.66	99.90 (89.59)	99.99 (89.61)	99.14 (89.07)	98.56 (83.08)	1.46 (6.92)	1886
5.	Cypermethrin-10EC	60	2.66	97.36 (80.67)	95.99 (78.38)	90.10 (71.70)	85.39 (67.51)	3.00 (9.98)	1754
6.	Quinalphos-25EC	250	2.33	95.02 (77.13)	87.81 (69.58)	84.75 (66.94)	78.66 (62.42)	7.26 (15.66)	1632
7.	Untreated control (water spray)	-	3.00	+37.93 (38.01)	+40.28 (39.47)	+47.90 (43.86)	+59.98 (50.75)	31.89 (36.42)	1132
	CD at 5%			1.78	2.22	1.95	2.58	1.07	1.13

NB: Figure in parentheses are angular transformed values; NS –Not significant.

Table 4: *Effect of different treatment schedules of Methomyl 40-SP in control of Helicoverpaarmigera (Hub.) larvae and pod borer complex of pigeon pea and on yield during Sept. - April at BCKV, Kalyani, W.B. (mean of three sprayings) (Second season).*

From Tables 3 and 4, it is evident that the highest dosage of Methomyl had provided almost total reduction of pest population in pigeon pea a day after spray. The performance of highest as well as medium dosage was much superior to those of conventional pesticides like Cypermethrin and Quinalphos when applied at their recommended dosage. Methomyl was found to be chemically compatible with Cypermethrin @ 150 + 60g a.i. ha^{-1} and had given excellent control of pod borer and Helicoverpa armigera (Hub.) larvae population. The yield of pigeon pea recorded was 2209 kg a.i. ha^{-1} in this treatment compared to 1607 kg a.i. ha^{-1} in control plot (27% increase).

Residue and Dissipation of Methomyl 40 Sp in Chilli Fruits and Pigeon Pea Pods

The validity of the method was determined by recovery studies. The average percentage of recoveries from chilli fruits were 96.2%, 86.2% and 95.1% and from pigeon pea seeds was found to be 87.5%, 86.4% and 88.6% for Methomyl spiked at 2 ppm, 1 ppm and 0.5 ppm, respectively. Since all recovery values were found to be above 85%, hence the method described could be recommended for estimation of Methomyl from chilli fruits as well as pigeon pea pods.

The residue data and percent dissipation along with regression equation and half-life values of Methomyl are presented in table 5 and 6 for chilli and table 7 and 8 for pigeon pea. It is evident that for chilli (Table 5 and 6) the residues had declined progressively with time. The initial deposit had declined to the extent of 56-64% within 24 hour of application. For treatments @ 450g a.i. ha^{-1} about 95% of initial deposit had dissipated within three days of spray. The residues were below detectable level on third and 5th day of last application @ 300g a.i. ha^{-1}. The dissipation of Methomyl 40 SP on Chilli followed first order kinetics with the half-life values of ~ 0.58 days to ~ 0.66 days (Figure 1). The T_{MRL} value was found to range between 2.71-4.00 days for spray @ 300 and 450g a.i. ha^{-1}. The dissipation of Methomyl in pigeon pea seeds (Tables 7 and 8) followed similar pattern as chilli. The residues were found to reach BDL (Below detectable limit) on fifth and seventh day of spray @ 300 and 450g a.i. ha^{-1} respectively, for both the seasons. About 80-90% of initial deposit of Methomyl had dissipated on the third day of application @ 450g a.i. ha^{-1}. From Figure 2 it is evident that the dissipation of Methomyl

40SP in pigeon pea seeds had also followed first order reaction kinetics. About 90% of initial deposit had dissipated on the fifth day of last application at the higher dose. The T_{MRL} values were found to be 4.07 and 5.19 days for sprays @ 300 and 450g a.i. ha^{-1}, respectively.

Days after treatment	Dose 300 g a.i. ha^{-1} (T2) Mean Residue in ppm ± SD (% Dissipation)	Dose 450 g a.i. ha^{-1} (T3) Mean Residue in ppm ± SD (% Dissipation)
0	3.45 ± 0.06	5.10 ± 0.13
1	1.25 ± 0.05 (63.8)	2.27 ± 0.11 (56.9)
3	0.11 ± 0.07 (96.8)	0.23 ± 0.02 (95.5)
5	ND	ND
7	ND	ND
10	ND	ND
	Y= 3.55-0.50X $T_{1/2}$ = 0.60 Days T_{MRL} = 2.71 Days	Y = 3.75-0.45X $T_{1/2}$ = 0.66 Days T_{MRL} = 4.04 Days

Table 5: *Residue of Methomyl 40SP in/on Chilli (First season).*

Days after treatment	Dose 300 g a.i. ha^{-1} (T2) Mean Residue in ppm ± SD (% Dissipation)	Dose 450 g a.i. ha^{-1} (T3) Mean Residue in ppm ± SD (% Dissipation)
0	3.26 ± 0.04	4.90 ± 0.11
1	1.35 ± 0.04 (58.6)	2.01 ± 0.06 (59.0)
3	0.09 ± 0.06 (97.2)	0.20 ± 0.03 (95.9)
5	ND	ND
7	ND	ND
10	ND	ND
	Y = 3.57-0.53X $T_{1/2}$ = 0.58 Days T_{MRL} = 2.69 Days	Y = 3.73-0.47X $T_{1/2}$ = 0.64 Days T_{MRL}= 4.00 Days

Table 6: *Residue of Methomyl 40SP in/on Chilli (Second season).*

Days after treatment	Dose 300 g a.i. ha^{-1} (T2) Mean Residue in ppm ± SD (% Dissipation)	Dose 450 g a.i. ha^{-1} (T3) Mean Residue in ppm ± SD (% Dissipation)
0	3.51 ± 0.28	6.03 ± 0.07
1	1.38 ± 0.06 (60.6)	1.84 ± 0.06 (69.5)
3	0.28 ± 0.03 (92.2)	0.54 ± 0.04 (91.0)
5	ND	0.32 ± 0.02 (94.1)
7	ND	ND
10	ND	ND
	Y= 3.53–0.36X $T_{1/2}$ = 0.84 Days T_{MRL} = 5.19 Days	Y = 3.62–0.25X $T_{1/2}$ = 1.2 Days T_{MRL}= 5.19 Days

Table 7: *Residue of Methomyl 40SP in/on Pigeon pea (First season).*

Days after treatment	Dose 300 g a.i. ha^{-1} (T2) Mean Residue in ppm ± SD (% Dissipation)	Dose 450 g a.i. ha^{-1} (T3) Mean Residue in ppm ± SD (% Dissipation)
0	3.90 ± 0.08	6.89 ± 0.07
1	1.39 ± 0.05 (64.4)	2.45 ± 0.03 (64.4)
3	0.45 ± 0.04 (88.5)	0.65 ± 0.02 (90.0)
5	ND	0.35 ± 0.02 (94.9)
7	ND	ND
10	ND	ND
	Y= 3.53–0.30X $T_{1/2}$ = 1.01 Days T_{MRL} = 4.07 Days	Y = 3.72–0.26X $T_{1/2}$ = 1.16 Days T_{MRL} = 5.31 Days

Table 8: *Residue of Methomyl 40SP in/on Pigeon Pea (Second season).*

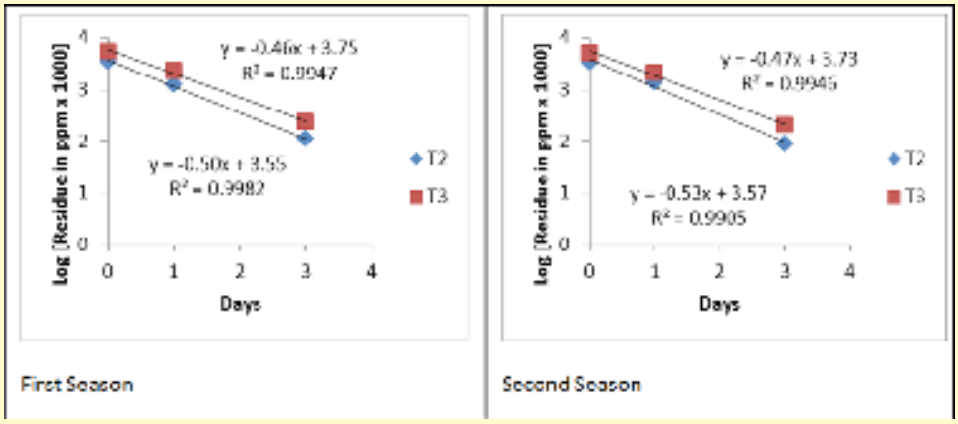

Figure 1: *Dissipation rate kinetics of Methomyl 40 SP in/on Chilli fruits.*

It is evident from Tables 1-4 that all pesticidal treatment had proved superior and significantly different to control (untreated) plot in respect to pest control and yield of chilli and pigeon pea. For both the seasons the trend of pest control following Methomyl spray was found to be similar. Methomyl @ 450g a.i. ha^{-1} was found to be the most effective treatment in respect to pest control and yield. An increase in dosage of Methomyl spray from 150g a.i. ha^{-1} to 450g a.i. ha^{-1} had resulted in increase in percentage reduction of pest population and yield of chilli and pigeon pea as well. The combination of Methomyl and Cypermethrin @ 150 + 60g a.i. ha^{-1} was found to be compatible for both the seasons and it had performed excellently against Helicoverpa larvae population and pod borers of pigeon pea than those of sole treatment of pesticides. The results of present investigation lends further support to earlier reports by Armstrong (1991) who had evaluated Methomyl @ 0.56 kg a.i. ha^{-1} against Heliothis armigera infesting pigeon pea and had found lower percentage of infestation and lower damaged pods in treated plots [6]. Felland., *et al*. (1995) studied the distribution and management of thrips on nectarine in mid Atlantic region [7]. It was observed that Methomyl spray had reduced silvering injury by Frankliniella occidentalis and had provided a longer period of protection as well. Sanap and Pawar . (1996) had conducted experiment to test efficacy of Methomyl 40 SP @ 100, 300 and 400g a.i. ha^{-1} in combination with Cypermethrin against Helicoverpa armigera Hub. And Exclastis atomosa infesting Cajanuscajan (L.) [8]. Kulkarni., *et al*. (2012) had reported that Methomyl 40SP @ 400g a.i. ha^{-1} was significantly superior over lower doses of Methomyl 40SP @ 300g a.i. ha^{-1} in reducing mealy bug colonies in grapes [9]. Satpathy., *et al*. (2006) studied the

efficacy of Methomyl against chillithrips and reported that Methomyl 40SP @ 300 g a.i. ha^{-1} was found to be most effective compared to Dimethoate 30 EC @ 300g a.i. ha^{-1} [10].

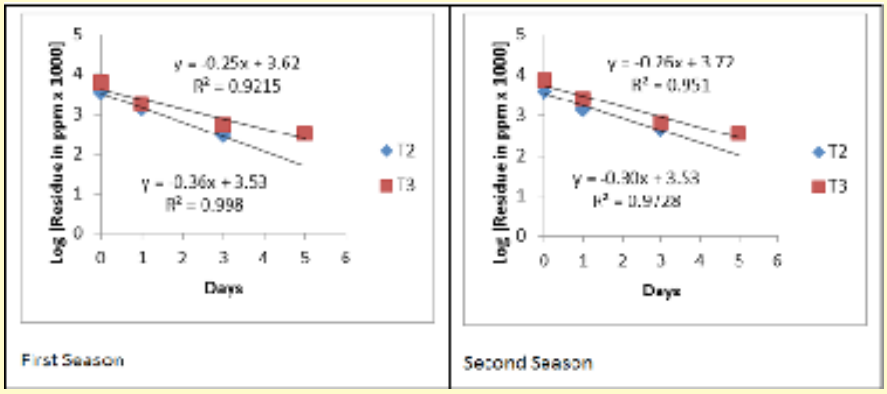

Figure 2: *Dissipation rate kinetics of Methomyl 40 SP in/on Pegion pea pods.*

Study of dissipation pattern of Methomyl on chilli and pigeon pea reveals that irrespective of dosage the residues had declined progressively with time. The rate of breakdown of Methomyl 40 SP had followed first order reaction for both the dosage on chilli and pigeon pea. The residues were below detectable level on fifth and seventh day of last application of Methomyl @ 300g a.i. ha^{-1} and 450g a.i. ha^{-1}, respectively.

A waiting period of 4.07 to 5.31 days was recommended for the lower and higher dosage of application respectively. The residues of Methomyl 40 SP in pigeon pea seeds and chilli had reached below tolerance level within 2.75-5.46 days as designed by EPA, USA. No residues were detected after the waiting period had elapsed. Hence Methomyl could be safely recommended for use in combating pests of pigeon pea.

The results of present investigation are in good agreement to earlier reports by Das (1992) who while studying breakdown rate of Methomyl 12.5 L in okra fruits applied @ 500 (T_1) and 1000 (T_2) g a.i. ha^{-1} found that the residues had completely dissipated within 10 days for T1 and 15 days for T_2 [11]. The $T_{1/2}$ and TMRL values for the two doses in fruits were in the range of 1.44 to 1.56 days and 5.2 to 5.4 days [11]. The rate of disappearance of Methomyl from foliage of straw berries, tomato and cucumber was studied and the residues had reached levels of 0.5, 0.2 and 0.6 ppm in seven days after Methomyl application to strawberries, tomatoes and cucumber, respectively [12]. Methomyl (Lannate 40 SP) @ 500, 750 and 1000g a.i.ha^{-1} was evaluated against shoot and fruit borer of brinjal. Methomyl @ 500-750g a.i. ha^{-1} was effective in minimizing the incidence of pest. The yield recorded was also higher in treated plots compared to untreated control [13]. Methomyl (Lannate 40 SP) @ 450g a.i.ha^{-1} had proved to be highly effective against *Sylepta derogata* and *Earias-vitella* infesting okra, the residues had also declined within fifth day of last application as recommended by EPA, USA. [14].

Conclusions

1. Methomyl 40SP @ 450g a.i. ha^{-1} was found to be more effective treatment in respect of mean percent reduction of chilli thrips Scirtothrips dorsalis.
2. Methomyl 40SP found to be compatible with Cypermethrin @ 150 + 60g a.i. ha^{-1} and gave excellent control of Helicoverpa armigera larvae of pigeon pea.
3. The dissipation of Methomyl 40SP followed first order kinetics for doses 300 and 450g a.i. ha^{-1} on chilli and pigeon pea.

4. The residue had declined to BDL (below detectable limit) after 3rd and 5th day of spray of Methomyl @ 300 and 450g a.i. ha^{-1}, respectively on chilli.
5. On pigeon pea seeds the residue of Methomyl 40SP had declined to BDL after 5th day of spray @ 300g a.i. ha^{-1} and @ 450g a.i. ha^{-1} it had declined to BDL after 7th day of spray.
6. The residue of Methomyl 40SP in chilli and pigeon pea reached below tolerance level within 2.75-5.46 days as designed by EPA, USA.

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Volume 2 Issue 6 December 2015