



Bioefficacy evaluation of phosmet 50 WP against rice leaffolder, *Cnaphalocrocis medinalis* (Guenee) (Pyralidae: Lepidoptera)

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Abstract

Field experiments were conducted to evaluate the bioefficacy of phosmet 50 WP against *C. medinalis* on rice. The first experiment was conducted during October 2017 to February 2018 using the variety BPT 1024 at Sivapuri village (79°42'48.3"E) near Chidambaram and the second experiment was conducted during October 2018 to February 2019 using the variety BPT 1024 at Nanjamathuvalkai village (11°23'53.49"N and 79°41'43.29"E) near Chidambaram. Five doses of phosmet 50 WP @ 400, 500, 600, 700, 1000 g a.i/ha and the standard check Cartap hydrochloride 50% SP @ 500 g a.i/ha was tested against leaffolder infesting rice. The leaffolder incidence was reduced to an extent of 64.11- 88.24 per cent in phosmet 50 WP during first season. The effectiveness of phosmet 50 WP against leaffolder during second season was reduced to an extent of 58.70- 86.50 per cent. Phosmet 50 WP @ 600 g a.i ha⁻¹ was highly effective in reducing the per cent damage of leaffolder as the per cent reduction over control on 7 and 14 DAT respectively.

Keywords: BPT 1024, rice, efficacy, phosmet 50 WP, rice leaf folder

1. Introduction

Rice (*Oryza sativa* L.) is the staple food for over half the world population and cultivated in more than 114 countries, mostly in developing countries. Approximately 162.9 million hectares of land are globally under rice cultivation with the production of 496.4 million tonnes. It provides 27 per cent of dietary energy and 20 percent of dietary protein in the developing world. It is the primary source of income and employment for more than 100 million households in Asia and Africa [1].

India is the world second largest rice producer with 16.352 million hectares of land under cultivation and production of 168.5 million tonnes [5].

In many Asian countries including India, China, Pakistan, Japan, Korea, Malaysia, Sri Lanka and Vietnam the outbreaks of rice leaffolder have been reported. Globally, 16.5 to 21.0 per cent loss of attainable yield in rice was estimated due to insect pests. In India, the attainable yield of rice reduced up to 70 per cent due to severe infestation of leaffolder [9].

Among the major pests that infests rice, rice leaffolder *C. medinalis* (Pyralidae: Lepidoptera) is an insect with migratory characteristics that poses a major threat to rice production. In Tamil Nadu, the yield loss due to leaffolder ranged between 30 and 80 per cent in epidemic situation. Leaffolder damage resulted in 57% reduction in chlorophyll content, 23% reduction in photosynthetic II activity and 23% reduction in relative water content. Cumulative effect on loss of chlorophyll reduced photosynthetic availability and altered water relations caused by the leaffolder injury lead to significant yield loss in rice [7]. In rice ecosystems,

yield and grain production loss due to rice leaffolder infestation was upto 6.4% and 278 kg/ha respectively [6].

Wettable powder pesticide formulation contains active ingredient in a finely ground state which are designed to be applied as a dilute suspension through liquid spraying equipment. Phosmet 50 WP is a systemic and broad-spectrum organophosphate insecticide used on both plant and animal eco-system.

Phosmet 50 WP being used on a wide range of fruit crops, ornamentals and vines for the control of aphids, mites and fruit flies [3]. Since new insecticides are introduced from time to time, it becomes necessary to evaluate the same to find out the effective dosage before giving final recommendations to the cultivar. Keeping this in view, studies were carried out on newer formulation of phosmet 50 WP against rice leaffolder by evaluating the bio-efficacy, Phytotoxicity of phosmet 50 WP against *C. medinalis* in rice.

2. Materials and Methods

Two field experiments were conducted to evaluate the bioefficacy of phosmet 50 WP against *C. medinalis* on rice. The first experiment was conducted during October 2017 to February 2018 using the variety BPT 1024 at Sivapuri village (79°42'48.3"E) near Chidambaram and the second experiment was conducted during October 2018 to February 2019 using the variety BPT 1024 at Nanjamathuvalkai village (11°23'53.49"N and 79°41'43.29"E) near Chidambaram.

The experiments were laid out in a randomized block

design. The plot size was 50 m² with the spacing of 20×10 cm during both the seasons. Each treatment was replicated three times.

The evaluation of insecticides was done in a randomized block design, with three replications. First application was given at 45 days after transplanting and second application was given 14 days after first application. Observations on the pest population/damage were recorded on randomly selected 10 hills per plot before and 1,3,5,7 and 10 days after each application.

Five doses of Phosmet 50 WP 400, 500, 600, 700, 1000 g a.i. ha was tested on BPT 1024 variety in rice during 2017 to 2019 crop season. Cartap hydrochloride 50 SP @ 500 g a.i. ha was used and kept as standard check. An untreated control was also kept for comparison purpose.

For assessing leaffolder damage, the leaf was considered to be damaged by the leaffolder if, at least one-third of its area was showing leaf damage symptoms. Leaf damage was recorded from 10 hills, selected at random in a replication from each plot. For this, total number of leaves per hill and damaged leaves were recorded and percent damage was worked out. The yield was also recorded on whole plot basis [1].

3. Statistical Analysis

The percent damage of leaffolder and population of spiders and coccinellids were transformed using arc sine and square root transformation ($\sqrt{x + 0.5}$) respectively for the statistical analysis. Randomised block design was followed and analysis was done following Panse and Sukkatme [8] (1957). The mean values were compared using Duncan's Multiple Range Test (DMRT).

The corrected percent reduction in field population was worked out by using the formula of Henderson and Tilton (1955) [4] as follows

$$\text{Corrected percent reduction} = 1 - \left[\frac{T_a \times C_b}{T_b \times C_a} \right] \times 100$$

Where,

T_a-Number of insects in the treatment after spraying

T_b-Number of insects in the treatment before spraying

C_a-Number of insects in the untreated check after spraying

C_b-Number of insects in the untreated check before spraying

4. Result and Discussion

Efficacy of *C. medinalis* on rice during first season

The leaffolder incidence and the effect of phosmet 50 WP on leaffolder was observed during the first season (January 2017 to April 2017) and second season (October 2018 to January 2019). The effect of chemical treatment on rice leaffolder, *C. medinalis* revealed that the efficacy of different concentrations of phosmet 50 WP was superior over Cartap hydrochloride 50 SP @ 500 g a.i ha⁻¹ and untreated control after first application.

The effect of chemical treatment on rice leaffolder, *C. medinalis* (Table 1) revealed that the efficacy of different concentrations of phosmet 50 WP was superior over cartap hydrochloride 50 SP @ 500 g a.i ha⁻¹ and untreated control after first application.

Seven and 14 days after first application, phosmet 50 WP @ 1000 g a.i ha⁻¹ recorded the highest per cent damage of 7.32 and 6.05 respectively, which was statistically on par with phosmet 50 WP @ 700 g a.i ha⁻¹ (8.13 and 6.34) and 600 g a.i ha⁻¹ (8.29 and 7.98) with the per cent damage during 7 and 14 days respectively and untreated check record 13.91

and 14.13 per cent respectively. The standard check Cartap hydrochloride 50 SP @ 500 g a.i ha⁻¹ recorded per cent damage of 9.32 and 8.63 respectively. (Table 1)

Phosmet 50 WP @ 1000 g a.i ha⁻¹ was highly effective in reducing the per cent damage of leaffolder as the per cent reduction over control was 47.38 and 57.18 on 7 and 14 DAT respectively, which was comparable with phosmet 50 WP @ 700 a.i ha⁻¹ (41.55 and 55.13) and 600 g a.i ha⁻¹ (40.40 and 43.52) with per cent reduction over control of respectively and the standard check cartap hydrochloride 50 SP @ 500g a.iha⁻¹ recorded per cent reduction of 33.00 and 38.92 respectively.

After second application, phosmet 50 WP @ 1000 g a.i ha⁻¹ recorded lowest per cent damage of 2.82 and 1.90 after 21 and 28 days of application respectively which was comparable with the phosmet 50 WP @ 700 g a.i. ha⁻¹ which recorded 6.46 and 1.93 respectively and Phosmet 50 WP @ 600 g a.i ha⁻¹ which recorded 3.84 and 2.89 at 21 and 28 days after treatment (Table 2). Highest per cent reduction over control for phosmet 50 WP @ 1000 g a.i ha⁻¹ recorded 82.20 and 88.24 at 21 and 28 days after treatment which was comparable with phosmet 50 WP @ 700 g a.i ha⁻¹ which recorded 59.22 and 88.06 and phosmet 50 WP @ 600 g a.i ha⁻¹ which recorded 75.76 and 83.78 respectively.

The standard check cartap hydrochloride 50 SP @ 500 g a.i ha⁻¹ recorded per cent reduction of 56.69 and 63.37 respectively.

Efficacy of phosmet 50 WP against *C. medinalis* – II season

The result on the effect of chemical treatment on rice leaffolder,

C. medinalis (Table 3) revealed the efficacy of different concentrations of phosmet 50 WP with cartap hydrochloride 50 SP @ 500 g a.i ha⁻¹ and untreated control after first application.

Seven and 14 days after first application, phosmet 50 WP @ 1000 g a.i ha⁻¹ recorded the highest per cent damage of 20.32 and 20.16 respectively, which was comparable with phosmet 50 WP @ 600 g a.i ha⁻¹ with the per cent damage of 21.99 and 21.16 during 7 and 14 days respectively and untreated check record 44.89 and 45.02 per cent respectively (Table 3). The standard check Cartap hydrochloride 50 SP @ 500 g a.i ha⁻¹ recorded the per cent damage of 24.89 and 26.83 per cent respectively.

Phosmet 50 WP @ 1000 g a.i ha⁻¹ was highly effective in reducing the per cent damage of leaffolder as the per cent reduction over control was 54.73 and 55.22 on 7 and 14 DAT respectively, which was comparable with phosmet 50 WP @ 600 a.i ha⁻¹ with per cent reduction over control of 51.01 and 52.99 respectively and the standard check cartap hydrochloride 50 SP @ 500 g a.iha⁻¹ recorded per cent reduction of 44.55 and 40.40 respectively.

After second application, phosmet 50 WP @ 600 g a.i ha⁻¹ recorded lowest per cent damage of 19.18 and 10.17 after 21 and 28 days of application respectively which was on par with the phosmet 50 WP @ 1000 g a.i. ha⁻¹ which recorded 16.89 and 6.51 respectively at 21 and 28 days after treatment (Table 4) and the standard check cartap hydrochloride 50 SP @ 500 g a.i ha⁻¹ recorded per cent damage of 25.70 and 19.20 respectively (Table 4).

Highest per cent reduction over control for phosmet 50 WP @ 1000 g a.i ha⁻¹ recorded 63.83 and 86.50 at 21 and 28 days after treatment which was on par with phosmet 50 WP

@ 700 g a.i ha⁻¹ which recorded 63.83 and 86.48 respectively. Phosmet 50 WP @ 600 g a.i ha⁻¹ recorded 58.93 and 78.88 at 21 and 28 days after treatment respectively. The standard check cartap hydrochloride 50 SP @ 500 g a.i ha⁻¹ recorded per cent reduction of 44.97 and 60.13 respectively.

Table 1: Efficacy of phosmet 50 WP against *C. medinalis* – I Season (First application)

Tr. No	Treatments	Per cent leaffolder damage*			Mean	Per cent reduction over control	
		PTC	7 DAT	14 DAT		7 DAT	14 DAT
T ₁	Phosmet 50 WP 400 g a.i ha ⁻¹	10.47 (18.87)	9.42 (17.87)	8.87 (17.33)	9.15	32.28	37.23
T ₂	Phosmet 50 WP 500 g a.i ha ⁻¹	11.89 (20.17)	8.64 (17.09)	8.70 (17.16)	8.67	37.89	38.43
T ₃	Phosmet 50 WP 600 g a.i ha ⁻¹	12.36 (20.58)	8.29 (16.73)	7.98 (16.41)	8.13	40.40	43.52
T ₄	Phosmet 50 WP 700 g a.i ha ⁻¹	10.43 (18.84)	8.13 (16.56)	6.34 (14.58)	7.24	41.55	55.13
T ₅	Phosmet 50 WP 1000 g a.i ha ⁻¹	12.44 (20.65)	7.32 (15.69)	6.05 (14.24)	6.69	47.38	57.18
T ₆	Cartap hydrochloride 50% SP 500 g a.i ha ⁻¹	12.82 (19.39)	9.32 (17.77)	8.63 (17.08)	8.98	33	38.92
T ₇	Control	14.44	13.91	14.13	14.02	—	—
	S. Ed	0.20	0.19	0.17	—	—	—
	CD (P=0.05)	0.43	0.40	0.37	—	—	—

*Mean of three replications; DAT – Days after Treatment; PTC-Pre Treatment Count.

Values enclosed in the parentheses are arc sine transformed values

Table 2: Efficacy of phosmet 50 WP against *C. medinalis* – I Season (Second application)

Tr. No	Treatments	Percent leaffolder damage*		Mean	Per cent reduction over control	
		21 DAT	28 DAT		21 DAT	28 DAT
T ₁	Phosmet 50 WP 400 g a.i ha ⁻¹	4.92 (12.82)	5.80 (13.94)	5.36	68.94	64.11
T ₂	Phosmet 50 WP 500 g a.i ha ⁻¹	4.83 (12.70)	2.89 (9.79)	3.86	69.51	82.12
T ₃	Phosmet 50 WP 600 g a.i ha ⁻¹	3.84 (11.30)	2.89 (9.79)	3.37	75.76	83.78
T ₄	Phosmet 50 WP 700 g a.i ha ⁻¹	6.46 (14.72)	1.93 (7.99)	4.20	59.22	88.06
T ₅	Phosmet 50 WP 1000 g a.i ha ⁻¹	2.82 (9.67)	1.90 (7.92)	2.36	82.20	88.24
T ₇	Cartap hydrochloride 50 SP 500 g a.i ha ⁻¹	6.86 (15.18)	5.92 (14.08)	6.39	56.69	63.37
T ₈	Control	15.84 (23.14)	16.16 (23.70)	16	—	—
	S. Ed	0.17	0.15	—	—	—
	CD (P=0.05)	0.36	0.31	—	—	—

*Mean of three replications; DAT – Days after Treatment; PTC-Pre Treatment Count.

Values enclosed in the parentheses are arc sine transformed values

Table 3: Efficacy of phosmet 50 WP against *C. medinalis*– II Season (First application)

Tr.no	Treatments	Per cent leaffolder damage*			Mean	Per cent reduction over control	
		PTC	7 DAT	14 DAT		7 DAT	14DAT
T ₁	Phosmet 50 WP 400 g a.i ha ⁻¹	32.45 (34.71)	32.73 (34.88)	25.16 (30.09)	28.95	27.09	44.11
T ₂	Phosmet 50 WP 500 g a.i ha ⁻¹	26.83 (31.18)	26.41 (30.91)	24.2 (29.46)	25.31	41.17	46.25
T ₃	Phosmet 50 WP 600 g a.i ha ⁻¹	42.90 (40.90)	21.99 (27.95)	21.16 (27.38)	21.58	51.01	52.99
T ₄	Phosmet 50 WP 700 g a.i ha ⁻¹	40.96 (39.77)	21.79 (33.13)	21.06 (27.18)	27.46	51.42	53.30
T ₅	Phosmet 50 WP 1000 g a.i ha ⁻¹	34.45 (35.93)	20.32 (26.78)	20.16 (26.67)	20.24	54.73	55.22
T ₇	Cartap hydrochloride 50 SP 500 g a.i ha ⁻¹	35.32 (36.44)	24.89 (29.91)	26.83 (31.18)	25.86	44.55	40.40
T ₈	Control	46.45	44.89	45.02	44.96	—	—
	S. Ed	0.44	0.37	0.36	—	—	—
	CD (P=0.05)	0.95	0.81	0.79	—	—	—

*Mean of three replications; DAT – Days after Treatment; PTC-Pre Treatment Count

Values enclosed in the parentheses are arc sine transformed values

Table 4: Efficacy of phosmet 50 WP against *C. medinalis*– II Season (Second application)

Tr.no	Treatments	Per cent leaffolder damage*		Mean	Per cent reduction over control	
		21 DAT	28 DAT		21 DAT	28 DAT
T ₁	Phosmet 50 WP 400 g a.i ha ⁻¹	26.10 (30.71)	19.89 (26.48)	23.00	44.11	58.70
T ₂	Phosmet 50 WP 500 g a.i ha ⁻¹	19.81 (26.41)	12.39 (20.60)	16.1	57.58	74.27
T ₃	Phosmet 50 WP 600 g a.i ha ⁻¹	19.18 (25.96)	10.17 (18.59)	14.68	58.93	78.88
T ₄	Phosmet 50 WP 700 g a.i ha ⁻¹	16.89 (24.25)	6.50 (14.76)	11.7	63.83	86.48
T ₅	Phosmet 50 WP 1000 g a.i ha ⁻¹	16.89 (24.26)	6.51 (14.77)	23.4	63.83	86.50
T ₇	Cartap hydrochloride 50% SP 500 g a.i ha ⁻¹	25.70 (30.44)	19.2 (25.97)	22.45	44.97	60.13
T ₈	Control	46.7	48.16	47.43	—	—
	S. Ed	0.33	0.64	—	—	—
	CD (P=0.05)	0.71	0.29	—	—	—

*Mean of three replications; DAT – Days after Treatment; PTC-Pre Treatment Count

Values enclosed in the parentheses are arc sine transformed values

5. Conclusion

Based on the results, it is concluded that phosmet 50 WP @ 600 and 700 g/ha effectively managed leaf folder in rice ecosystem with increased yield. However, phosmet 50 WP @ 600ga.ih⁻¹ was equally effective as compared to higher

doses against pests. It was found safer to natural enemies and did not exhibit any phytotoxicity. Hence phosmet 50 WP @ 600ga.i ha⁻¹ may be recommended for the management of stem borer and leaf folder in rice ecosystem.

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