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Evaluation of thiamethoxam 25 per cent WG against major insect pests of rice (*Oryza sativa* L.)

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ABSTRACT

An experiment was conducted at Regional Agriculture Research Station, College of Agriculture, Waraseoni, Bagalaght, Madhya Pradesh during the 2014-15 to study on the evaluation of Thiamethoxam 25 per cent WG for the management of stem borer (*Scirpophaga incertulas* Walker), leaf folder (*Cnaphalocrocis medinalis* Guenee), gall midge (*Orseolia oryzae* Wood Mason), leaf hoppers *viz.*, green leaf hopper (*Nephotettix virescens* Distant), brown plant hopper (*Nilaparvata lugens* Stal), in rice crop. Thiamethoxam 25 per cent WG used in the experiment was different doses *i.e.* @ 20 g a.i. /ha, 25 g a.i. /ha, 30 g a.i. /ha, 50 g a.i. /ha, and 100 g a.i. /ha, with insecticidal check Imidacloprid 17.8 SL @ 30 ml a.i./ha. Two sprays of insecticides were applied at fifteen days interval. The most effective dose of thiomethoxam 25 per cent WG in controlling the rice insect pests was 50 g. a.i./ha followed by 30 g a.i. /ha and 25 g a.i. /ha. Per cent reduction of insect pests over untreated plot after final sprays was followed this order of efficacy: Thiamethoxam 25 per cent WG @ 20 g a.i. /ha> 100 g a.i. /ha, > Imidacloprid 17.8 SL @ 30 ml a.i./ha.. Highest cost benefit ratio (1:21.69) was observed in thiamethoxam 50 per cent WG @ 20 g a.i. /ha.

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INTRODUCTION

Rice (*Oryza sativa* L.) is the most important and staple food crop for more than two thirds of the population of India and more than 65 per cent of the world population (Mathur *et al.*, 1999). The crop plays a vital role in our national food security and is a means of livelihood for millions of rural households. In India, rice is grown over an area of 43.76 m ha with production of 99.43 m tonnes (2012-13). Among various constraints of rice production, damage due to insect pests is substantial and needs regular attention. Large-scale cultivation of high yielding varieties, monocropping, close planting, water regime, excessive use of nitrogenous fertilizers and misuse of agrochemicals have further aggravated the pest incidence. Over 1400 insect species attack standing and stored rice in the world (Grist and Lever, 1969). According to Pathak and Dhaliwal (1981) these pests account for losses of 24 per cent while

Cramer (1967) reported it to be 35 per cent. However, about 20 insect pests have major significance in different rice growing regions of India. Among these, yellow stem borer (*Scirpophaga incertulas* Walker), brown plant hopper (*Nilaparvata lugens* Stal), white backed plant hopper (*Sogatella furcifera* Hovarth), gallmidge (*Orseolia oryzae* Wood Mason), leaf folder (*Cnaphalocrocis medinalis* Guenee), case worm (*Propayax stagnalis* Guenee) and Gundhi bug (*Leptocorisa acuta* Thunb.) found to cause substantial damage to crop across the country. Incidence of yellow stem borer on rice was reported throughout the country with a varied level of severity and the reported yield losses ranged from 3 to 65 per cent and the yield loss caused by leaf folder reported to the extent of 5 to 25 per cent (Ghose *et al.*, 1960). Among the insect pests, yellow stem borer (*Scirpophaga incertulas* Walker), leaf folder (*Cnaphalocrocis medinalis* Guenee), brown plant hopper (*Nilaparvata lugens* Stal) and gallmidge (*Orseolia oryzae* Wood Mason) are predominant in Balaghat district of Madhya Pradesh. These pests infest the crop at different stages of plant growth and cause a variety of damage such as tissue boring, leaf scrapping and juice sucking from ear head. The primary mode of managing these insects is by the application of insecticides. From time to time several insecticides have been tried and recommended for management of stem borer and leaf folder.

MATERIAL AND METHODS

The field experiment was conducted at the College of Agriculture farm, Waraseoni, Balaghat, Madhya Pradesh during *Kharif* season of 2014. The soil of the experimental site was sandy loam in texture with high per cent of sand and low per cent of clay and dry sub-humid and subtropical climate. Attempts were made to evaluate the effect of five different doses of thiamethoxam *viz*., @ 20 g a.i. /ha, 25 g a.i. /ha, 30 g a.i. /ha, 50 g a.i. /ha and 100 g a.i. /ha, with one insecticidal check imidacloprid 17.8 SL @ 30 ml a.i./ha and untreated control against yellow stem borer (*Scirpophaga incertulas* Walker), brown plant hopper (*Nilaparvata lugens* Stal), white backed plant hopper (*Sogatella furcifera* Hovarth), gallmidge (*Orseolia oryzae* Wood Mason) and leaf folder (*Cnaphalocrocis medinalis* Guenee). The experiment was laid out in Randomized Block Design (RBD) with seven treatments including control and each treatment was replicated three times. The control plot was sprayed with water. The experimental plot was 5 m x 4 m size and the crop was grown on a row spacing of 20 x 15 cm. The spraying on crop for testing efficacy of different pesticide formulations was started with the incidence of pest. All the sprayings were done using knapsack sprayer at an interval of 15 days. Three plants of each row out of selected five rows were randomly selected and tagged. The population of insect pests were recorded before and 5, 10 and 15 days after each spray. Statistical analysis of all the recorded data were subjected to analysis of variance in Randomized Block Design.

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under the following heads Table 1 to 5.

Stem borer:

The thiamethoxam exhibited varying degree of yellow ytem borer (YSB) infestation (% DH/WEH). All the treatments showed significant effect to reduce YSB infestations at 5, 10 and 15 days after spray (DAS) and increased the grain yield over control. Among the different doses of thiamethoxam 25 per cent WG, 50 g a.i./ha was significantly minimized the per cent DH infestation after the spraying. The mean per cent DH under plot treated with thiamethoxam 25 per cent WG 50 g a.i./ha was obtained as 4.06, 5.18 and 5.58 followed by thiamethoxam 25 per cent WG 30 g a.i./ha and thiamethoxam 25 per cent WG, 25 g a.i./ha as against untreated control which showed 5.77, 8.70 and 9.61 per cent DH infestations. The mean per cent white ear head at 15 DAS in thiamethoxam 25 per cent WG 50 g a.i./ha treated plot were observed as 7.15 followed by thiamethoxam 25 per cent WG 30 g a.i./ha, thiamethoxam 25 per cent WG, 25 g a.i./ha and thiamethoxam 25 per cent WG 100 g a.i./ha with the 7.87, 8.03 and 8.99 per cent WEH infestation, respectively.

Leaf folder:

Leaf damage per cent by leaf folder ranged from 7.05 to 8.30, one day before the spray. All the treatments showed significant difference compared to control. Observation recorded after insecticidal treatment

revealed that thiamethoxam 25 per cent WG 100 g a.i./ ha proved to be most effective insecticide showing minimum per cent leaf damage. The thiamethoxam 25 per cent WG 50 g a.i./ha recorded similar damage per cent.

Gall midge:

Minimum damage per cent and silver shoot per cent caused by gall midge in rice was recorded in plot treated with thiamethoxam 25 per cent WG @ 50 g. a.i./ ha as compared to other insecticidal treatments. Whereas, maximum damage per cent and silver shoot per cent recorded with untreated control.

Leaf hoppers:

The results presented in Table 3 revealed that infestation in all the plots recorded 24 hrs before the insecticidal application was almost similar. After application of insecticide, the results revealed that thiamethoxam 25 per cent WG 30 g a.i./ha was most effective dose in controlling of leaf hopper *i.e.* green leaf hopper (GLH) and brown plant hopper (BPH) among all doses of thiamethoxam and Imidaclorprid 17.8 SL followed by thiamethoxam 25 per cent WG 25 and 50 g a.i./ha.

Bio-efficacy of thiamethoxam 25 WG in reducing sucking pests in other crops was reported by earlier workers. Efficacy of thiamethoxam in reducing thrips (Nali *et al*., 2004 and Sreekanth *et al.*, 2004) jassids (Patel *et al*., 2003) and in reducing colorado beetle (Surkus, 2003) was reported in various crops.

Natural enemies:

The natural enemies such as dragon and damsel

Table 1 : Efficacy of different dose of thiomethoxam 25 per cent WG against yellow stem borer in rice crop

Treatments	Dosage a.i./ha	Dead heart (%)				White ears (%) at 15 DAS	Grain yield (q/ha)
		ADBS	5 DAS	10 DAS	15 DAS		
T_1 - Thiamethoxam 25% WG	20 g	3.76a	5.04bc	7.86de	8.66e	11.87d	41.23d
T_2 - Thiamethoxam 25% WG	25 g	3.09a	4.22ab	5.37ab	5.71bc	8.03bc	45.24cd
T_3 - Thiamethoxam 25% WG	30 g	3.97a	4.09ab	5.30ab	5.70bc	7.87bc	47.64bc
T_4 - Thiamethoxam 25% WG	50 g	3.17a	4.06ab	5.18ab	5.58bc	7.15abc	48.15bc
T_5 –Thiamethoxam 25% WG	100 g	4.00a	4.70abc	6.21bc	6.81c	8.99c	44.79cd
T_6 - Imidacloprid 17.8 SL	30 ml	4.07a	4.77abc	6.40bcd	7.00cd	9.55c	42.67d
T_7 - Control	-	4.13a	5.77c	8.70e	9.61e	17.15d	36.60e
CV			15.61	15.17	14.27	14.45	5.60
S.E. ±			0.40	0.51	0.53	0.75	1.50
C.D. (P=0.05)		NS	1.18	1.51	1.56	2.22	4.41

Means followed by the same letter in a column are not significantly different (P=0.05) by DMRT
ADBS: A day before spray, DAS: Days after spray NS=Non-significant

Table 2 : Efficacy of different dose of thiomethoxam 25 per cent WG against leaf folder in rice crop

Treatments	Dosage a.i./ha	Leaf damage (%)				Grain yield (q/ha)
		ADBS	5 DAS	10 DAS	15 DAS	
T_1 - Thiamethoxam 25% WG	20 g	8.12a	6.13ab	7.44bc	8.19bc	41.23d
T_2 - Thiamethoxam 25% WG	25 g	7.05a	5.47a	6.28b	6.77b	45.24cd
T_3 - Thiamethoxam 25% WG	30 g	7.89a	5.29a	6.10b	6.61b	47.64bc
T_4 - Thiamethoxam 25% WG	50 g	7.70a	4.71a	5.22a	5.43a	48.15bc
T_5 –Thiamethoxam 25% WG	100 g	7.96a	4.66a	5.18a	5.39a	44.79cd
T_6 - Imidacloprid 17.8 SL	30 ml	8.06a	6.05ab	7.36bc	8.16bc	42.67d
T_7 - Control	-	8.30a	7.32b	9.80c	10.85c	36.60e
CV			15.07	15.53	16.47	5.60
S.E. ±			0.48	0.58	0.67	1.50
C.D. (P=0.05)		NS	1.41	1.72	1.97	4.41

Means followed by the same letter in a column are not significantly different (P=0.05) by DMRT
ADBS: A day before spray, DAS: Days after spray NS=Non-significant

flies, coccinellids, carabids and spiders were observed during both the phase of the crop. However, their population was almost similar both in vegetative and reproductive phase of the crop. All the recorded natural enemies are predators and their population is known to be directly related to their prey population. Tiwari *et al.* (2001) reported the occurrence of spider, dragonfly (*Crocothemis* sp.), damselfly (*Agriocnemis* sp.), and predatory cricket, rove beetle (*Paederus fuscipes*), ground beetle (*Ophionea indica* [*Casnoidea indica*]), predatory grasshopper (*Conocephalus* sp.) and brown bug (*Andrallus* sp.) as the natural enemies of paddy ecosystem in Jabalpur, Madhya Pradesh, India which supports the present findings.

Grain yield:

The thiamethoxam 25 per cent WG @ 50 g a.i./ha harvested highest grain yield (48.15 q/ha), at par with thiamethoxam 25 per cent WG @ 30 g a.i./ha (47.65 q/ha), thiamethoxam 25 per cent WG @ 25 g a.i./ha (45.24 q/ha) and thiamethoxam 25 per cent WG @ 100 g a.i./ha (44.79 q/ha). The untreated check recorded lowest yield (36.60 q/ha). The thiamethoxam 25 per cent WG @ 20 g a.i./ha and imidacloprid 17.8 SL @ 30 ml a.i./ha recorded lower yields and were at par. Earlier Tej Kumar (2001) reported also reported higher grain yield in cartap

Table 3: Efficacy of different dose of thiomethoxam 25 per cent WG against Gall midge and hoppers in rice crop

Treatments	Dosage a.i./ha	Gall midge		GLH/hill				BPH/hill				Grain yield (q/ha)
		Damage %	Silver shoot %	ADBS	5 DAS	10 DAS	15 DAS	ADBS	5 DAS	10 DAS	15 DAS	
T_1 - Thiamethoxam 25% WG	20 g	1.25	3.05	4.71	1.21	2.13	2.09	5.56	2.19	2.03	3.12	41.23d
T_2 - Thiamethoxam 25% WG	25 g	1.56	2.56	2.12	0.09	0.89	1.03	4.22	0.28	0.96	1.38	45.24cd
T_3 - Thiamethoxam 25% WG	30 g	0.80	0.86	4.33	0.00	0.10	0.68	5.01	0.00	0.21	1.06	47.64bc
T_4 - Thiamethoxam 25% WG	50 g	2.65	4.42	3.86	0.68	1.02	1.71	6.82	1.03	1.56	2.65	48.15bc
T_5 –Thiamethoxam 25% WG	100 g	2.23	5.86	2.98	3.12	4.12	3.89	4.99	2.99	4.18	5.48	44.79cd
T_6 - Imidacloprid 17.8 SL	30 ml	1.98	3.01	4.01	2.11	2.67	3.01	3.58	2.88	2.91	4.19	42.67d
T_7 - Control	-	3.89	7.11	3.09	4.39	6.70	5.10	4.25	6.31	6.87	9.15	36.60e
CV												5.60
S.E. ±												1.50
C.D. (P=0.05)												4.41

Means followed by the same letter in a column are not significantly different (P=0.05) by DMRT
ADBS: A day before spray, DAS: Days after spray, GLH= Green leaf hopper, BPH= Brown plant hopper

Table 4 : Natural enemies population on rice crop

Natural enemies	Crop stage	
	Vegetative stage	Reproductive stage
Dragon flies or Damsel flies/sq. mt.	1.74	1.70
Coccinellids/hill	0.50	0.49
Carabids/hill	0.32	0.37
Spiders/hill	1.19	1.21

Table 5: Economics of different dose of thiomethoxam 25 per cent WG against insect pests of rice crop

Treatments	Yield (q/ha)	Gross income (Rs./ha)	Cost of cultivation (Rs./ha)	Net profit. (Rs./ha)	Net gain over control (Rs./ha)	BCR
T_1 - Thiamethoxam 25% WG @ 20 g a.i./ha	41.23	37107	17575	19532	3417	2.11
T_2 - Thiamethoxam 25% WG @ 25 g a.i./ha	45.24	40716	19201	21515	5400	2.12
T_3 - Thiamethoxam 25% WG @ 30 g a.i./ha	47.64	42876	19155	23721	7606	2.23
T_4 - Thiamethoxam 25% WG @ 50 g a.i./ha	48.15	43335	18425	24910	8795	2.35
T_5 –Thiamethoxam 25% WG @ 100 g a.i./ha	44.79	40311	17191	23120	7005	2.34
T_6 - Imidacloprid 17.8 SL @ 30 ml a.i./ha	42.67	38403	17425	20978	4863	2.20
T_7 - Control	36.60	32940	16825	16115	-	1.95

*Cost of cultivation – Rs. 16825/ha Price of paddy Rs. 900/q

hydrochloride treatment (Anuradha, 2012).

Cost economics:

The calculated net returns and also benefits vs cost ratio was highest (2.35) in thiamethoxam 25 per cent WG @ 50 g a.i./ha treatment, followed by thiamethoxam 25 per cent WG @ 100 g a.i./ha. Remaining treatments in the order of magnitude of net profit are thiamethoxam 25 per cent WG @ 30 g a.i./ha, imidacloprid 17.8 SL @ 30 ml a.i./ha, thiamethoxam 25 per cent WG @ 25 g a.i./ha and thiamethoxam 25 per cent WG @ 20 g a.i./ha and untreated check. Pathak and Tiwari (2005) reported higher cost benefit ratio and net benefit in furadan, followed by pradhan and padan.

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