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Efficacy of insecticides against rice yellow stem borer, *Scirpophaga incertulas* (Wlk.) on Basmati rice

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ABSTRACT

Field experiments were carried out during wet seasons of 2007 and 2008 to test the efficacy of various insecticides along with check against yellow stem borer, Scirpophaga incertulas (Wlk.) with rice variety Pusa Basmati-1 at Crop Research Station, Masodha, Faizabad. Out of seven insecticides tested, fipronil 5SC @ 50g a.i.ha^{-1} superior to over other insecticides, which results the lowest incidence of yellow stem borer with highest grains yield followed by cartap hydrochloride 50SP @ 300g a.i.ha^{-1} and cartap hydrochloride 4G @ 750g a.i.ha^{-1}. However remaining insecticides were also found significantly superior over the control (check). Based on economics of the insecticides, cartap hydrochloride 50SP proved most economical than others with highest cost: benefit ratio (1:8.97) followed by fipronil 5SC (1:6.22) and cartap hydrochloride 4G (1:5.54) against lowest in indoxacarb 14.5 SC @ 75g a.i.ha^{-1} (1:2.89).

Key words: rice, yellow stem borer, insecticides, efficacy

The yellow stem borer (YSB), *Scirpophaga incertulas* (Wlk.) is the major damaging stem borer species and considered as serious pest of aromatic and lowland rice. It is a major constraint, responsible for low production of rice yield in almost the rice ecosystems, which caused 3-95% yield losses in India (Senapati and Panda, 1999). Due to an increase in environmental awareness, resurgence problems and health hazards, it is necessary to identify the effective as well as economical and eco-friendly chemical insecticides. Keeping these facts in view the field trials were carried out to test the efficacy of various newer insecticides against the yellow stem borer.

MATERIALS AND METHODS

Field trials were conducted at the Crop Research Station, Masodha of Narendra Deva University of Agriculture and Technology, Kumarganj; Faizabad (U.P.) during wet seasons of 2007 and 2008. The experiments were laid out in randomized block design with three replications. Twenty-one days old seedlings of rice variety Pusa Basmati-1 was transplanted in 5m x 4m plot sized with spacing of 15cm x 20cm. Recommended fertilizers dose and others agronomical practices were adopted to raise a good crop. To study the impacts of six insecticides *viz.*, cartap hydrochloride 4G @ 750g a.i.ha^{-1}, carbosulfan 25EC @ 250g a.i.ha^{-1}, fipronil 5SC @ 50g a.i.ha^{-1}, indoxacarb 14.5SC @75g a.i.ha^{-1}, methomyl 40SP @ 400g a.i.ha^{-1}, and cartap hydrochloride 50SP @ 300g a.i.ha^{-1} alongwith untreated control against YSB were evaluated. Five insecticides were applied as foliar spray by using knapsack sprayer, whereas cartap hydrochloride 4G was provided in standing water by broadcasting when the insect population reached economic threshold levels.

For observations, total numbers of tiller alongwith infested tillers (dead heart/white ear head) were counted at one day before and 7, 14, 21 days after the application of insecticides in 20 randomly selected hills from each plot. The crop was harvested at maturity and plot-wise grain yield recorded by leaving two border rows around the plot. The data on YSB incidence (% DH/WEH) was transformed by using appropriate transformation and also subjected to statistical analysis. The cost: benefit (C:B) ratio was also calculated to find out the economics of the each treatment.

Table 1. Efficacy of newer insecticides against rice stem borer during wet season 2007

Treatments	Dose (a.i. ha^{-1})	Mean per cent damage							Yield (t ha^{-1})
		Pre treatment (DH)	First application (DH)			Second application (WE)			
			7 DAS	14 DAS	21 DAS	7 DAS	14 DAS	21 DAS	
Cartap hydrochloride 4G	750g	5.30 (13.03)	2.35 (8.82)	1.81 (7.74)	4.29 (11.95)	0.88 (5.37)	1.76 (7.62)	3.98 (11.50)	3.77
Carbosulfan 25EC	250g	5.09 (13.03)	3.75 (11.16)	3.98 (11.50)	5.86 (14.00)	1.36 (6.68)	3.48 (10.74)	5.56 (13.66)	3.55
Fipronil 5SC	50g	5.40 (13.43)	1.62 (7.32)	1.55 (7.16)	3.86 (11.33)	0.65 (4.53)	1.36 (6.66)	2.44 (8.98)	3.98
Indoxacarb 14.5SC	75g	4.90 (12.79)	2.72 (9.49)	2.44 (8.98)	5.39 (13.42)	1.07 (5.85)	2.00 (8.14)	4.19 (11.81)	3.60
Methomyl 40 SP	400g	5.12 (13.07)	3.67 (11.02)	4.06 (11.62)	6.34 (14.58)	1.55 (7.13)	3.75 (11.16)	6.12 (14.30)	3.47
Cartap hydrochloride 50SP	300g	5.21 (13.17)	1.85 (7.82)	1.57 (7.19)	3.99 (11.52)	0.72 (4.72)	1.67 (7.42)	2.72 (9.48)	3.93
Untreated control	_	5.24 (13.22)	6.81 (15.12)	9.86 (18.29)	10.93 (19.25)	3.41 (10.62)	6.71 (15.00)	9.04 (17.50)	2.80
SEm+		0.35	0.48	0.30	0.59	0.45	0.35	0.31	1.41
CD (P=0.05)		NS	1.49	0.91	1.84	1.39	1.07	0.96	0.42

Values within parentheses are arc sine transformation, Sin-^{1} , DAS: Days after spraying

RESULTS AND DISCUSSION

The tested insecticides exhibited varying degree of YSB infestations (%DH/WEH)(Table 1). All the treatments showed significant effect to reduced YSB at 7, 14 and 21 days after application of treatments and increased the grain yield over control. Among the treatments, fipronil 5SC proved best performance with least YSB infested tillers (DH) with 1.62, 1.55 and 3.86 per cent in 2007 and 2.62, 1.86 and 3.53 per cent in 2008 after the first application, whereas 0.65, 1.36 and 2.44 %

Table 2. Efficacy of newer insecticides against rice stem borer during wet season 2008

Treatments	Dose (a.i. ha^{-1})	Mean per cent damage							Yield (t ha^{-1})
		Pre treatment (DH)	First application (DH)			Second application (WE)			
			7 DAS	14 DAS	21 DAS	7 DAS	14 DAS	21 DAS	
Cartap hydrochloride 4G	750g	5.27 (13.25)	3.24 (10.37)	2.62 (9.30)	4.19 (11.81)	0.91 (5.45)	1.71 (7.50)	3.74 (11.15)	3.72
Carbosulfan 25EC	250g	5.14 (13.11)	3.95 (11.46)	3.93 (11.28)	5.75 (13.86)	1.62 (7.30)	3.26 (10.38)	5.71 (13.97)	3.49
Fipronil 5SC	50g	5.21 (13.18)	2.62 (9.27)	1.86 (7.82)	3.53 (10.80)	0.58 (4.36)	1.41 (6.82)	3.17 (10.25)	3.90
Indoxacarb 14.5SC	75g	5.32 (13.33)	3.45 (10.70)	3.49 (10.76)	5.30 (13.30)	1.24 (6.37)	2.01 (8.15)	4.29 (11.96)	3.62
Methomyl 40 SP	400g	4.97 (12.88)	4.06 (11.62)	4.19 (11.81)	6.07 (14.26)	1.88 (7.94)	3.34 (10.52)	6.15 (14.65)	3.40
Cartap hydrochloride 50SP	300g	5.33 (13.36)	2.72 (9.54)	2.01 (8.15)	3.78 (11.19)	0.79 (5.06)	1.50 (7.04)	3.25 (10.36)	3.88
Untreated control	_	4.89 (12.76)	7.67 (16.07)	9.77 (18.21)	12.00 (20.27)	3.18 (10.27)	6.90 (15.21)	10.37 (18.77)	2.74
SEm+		0.32	0.35	0.31	0.39	0.31	0.36	0.36	1.26
CD (P=0.05)		NS	1.08	0.96	1.21	0.96	1.10	1.11	0.38

Values within parentheses are arc sine transformation, Sin-$^{1}\sqrt{x/100}$, DAS: Days after spraying

WEH in 2007 and 0.58, 1.41 and 3.17 % WEH in 2008 after the second application of insecticides at 7, 14 and 21 days, respectively and at par with the cartap hydrochloride 50SP and cartap hydrochloride 4G. The result of the superiority of fipronil 5SC was in agreement with the observations of Panda *et al.* (2004). Cartap hydrochloride 50SP and cartap hydrochloride 4G was ranked secondand third best insecticides, respectively in the present investigation is with inconformity of the results of Sanithi and Mishra (2006), Nayak and Rath (2007) and Singh *et al.* (2008).

Based on grain yield of the paddy, the highest yield was also obtained from the plots treated with fipronil 5SC @ 50g a.i.ha^{-1} with 3.98 and 3.90 tha^{-1}, which was at par with cartap hydrochloride 50SP (3.93 and 3.88 tha^{-1}), cartap hydrochloride 4G (3.77 and 3.72 tha^{-1}) during 2007 and 2008, respectively. The maximum increased yield was recorded in fipronil treated plot (42.32%) followed by cartap hydrochloride 50 SP (41.05%) and cartap hydrochloride 4G (35.35%) over untreated control (Table 3). Based on pooled mean, cartap hydrochloride 50SP (1:8.79) had shown highest C:B ratio with ₹13144.00 ha^{-1} net income followed by fipronil (1:6.22), carbosulfan (1:5.90), cartap hydrochloride 4G (1:5.54), while minimum C/B ratio was observed in indoxacarb (1:2.89). However, the highest monetary return (₹ 51285.00 ha^{-1}) was found with fipronil followed by cartap hydrochloride 50 SP (₹ 50943.00).

Table3. Economics of treatments based on pooled mean of wet season 2007 and 2008

Treatments	Dose (a.i. ha^{-1})	Quantity treatment^{-1} ha^{-1}	Cost of insecticides (₹)	Cost of treatment (₹ ha^{-1})	Yield (t ha^{-1})	Yield increased over control (%)	Gross income (₹ ha^{-1})	Value of saved yield (₹ ha^{-1})	Net income over control (₹ ha^{-1})	Cost : Benefit ratio
Cartap hydrochloride 4 G	750g	18.75 kg	56 kg^{-1}	2300.00	3.75	35.35	48776.0	12740.0	10440.0	1:5.54
Carbosulfan 25EC	250g	1.00 lit.	600 li^{-1}	1650.00	3.52	27.02	45773.0	9737.0	8087.0	1:5.90
Fipronil 5SC	50g	1.00 lit.	1000 li^{-1}	2450.00	3.94	42.32	51285.0	15249.0	12799.0	1:6.22
Indoxacarb 14.5SC	75g	00.52 lit.	3200 li^{-1}	3778.00	3.61	30.27	46943.0	10907.0	7129.0	1:2.89
Methomyl 40SP	400g	1.00 kg	1200 kg^{-1}	2850.00	3.44	24.10	44720.0	8684.0	5834.0	1:3.05
Cartap hydrochloride 50SP	300g	00.60 kg	1000 kg^{-1}	1650.00	3.91	41.05	50830.0	14794.0	13144.0	1:8.97
Untreated control	_	_	_	_	2.77	_	36036.0	_	_	_

* Labour charge = ₹ 100 per day (labour required 2 ha^{-1} for spraying and 1 ha^{-1} for broad casting)
* Sprayer rent = ₹ 25 per day * Price of grain yield = ₹ 1300 q^{-1}

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