Research Paper :

Evaluation of New Chemical Molecules for the Managaement of *Scirpophaga incertulas* Walker, in Aerobic rice

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International Journal of Plant Protection, Vol. 2 No. 2 : 205-208 (October, 2009 to March, 2010)

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SUMMARY

Field experiment carried out at University of Agricultural Sciences, Bangalore. College of Agriculture Navile Shimoga, during *kharif* 2006 showed superiority of fipronil 0.3G @ 7.5 g a.i./ha followed by carbosulfan 6G @ 1000 g a.i./ha and carbofuran 3G @ 750 g a.i./ha which were moderately effective and cartap hydrochloride 4G @ 1000 g a.i./ha was least effective among the granular formulations. Among the spray formulations beta-cyfluthrin 2.5EC @ 12.5 g a.i ./ha was highly effective followed by monocrotophos 36 SL @ 500 g a.i./ha and flubendiamide 500 SC @ 24 g a.i./ha. The next best was indoxacarb 14.5 SC @ 30 g a.i./ha but imidacloprid 17.8 SL @ g a.i./ha and seed treatment of imidacloprid 70 WS @ 5ml/kg seed and lambda cyhalothrin 2.5 EC @ 12.5 g a.i./ha were less effective against rice yellow stem borer (YSB).

Key words : *Scirpophaga incertulas,* Fipronil, Carbosulfan, Beta-cyfluthrin, Flubendiamide, Lambda cyhalothrin.

Accepted : August, 2009

It is time to initiate movements like "More crop per drop" which has been quite successful in Israel. Aerobic rice is one such option to minimize water requirement for rice crop. Growing rice with aeration or under non-flooded condition is termed as aerobic rice. Traditionally rice is grown in uplands with low or no inputs is also referred as aerobic rice (Mishra, 2005). The rice stem borers, which infest the rice from seedling to maturity act as a major constraints for rice production (Dale, 1994; Pathak, 1975 and Anonyomus, 1969). The larvae of *Scirpophaga incertulas* cause dead hearts during vegetative stage and white ear heads during reproductive stage. Even though rice plant can compensate if dead heart infestation does not exceed 10 per cent, it cannot compensate for white ear loss. However, application of insecticides is the most commonly used measure for reducing pest population. Thus, it is imperative that alternative insecticides be explored for managing rice pests. The new insecticides should be effective in reducing the pest damage, cost effective, biodegradable, safer to natural enemies and other non-target organisms.

MATERIALS AND METHODS

A field experiment was conducted at University of Agricultural Sciences, Bangalore. College of Agriculture Navile Shimoga, to evaluate new chemical molecules of insecticides against YSB in rice variety Rasi, comprising of 12 treatments in a randomized block design during *kharif*, 2006. The new chemical molecules used were monocrotophos 36 SL @ 500 g a.i. /ha, imidacloprid 17.8 SL @ 20 g a.i. /ha, lamda cyhalothrin 2.5 EC @ 12.5 g a.i. /ha, beta-cyfluthrin 25 EC @ 12.5 g a.i. / ha, imidacloprid 70 WS @ 5 ml/kg of seeds, flubendiamide 500 SC @ 24 g a.i. /ha, indoxacarb 14.5 SC @ 30 g a.i. /ha, carbofuran 3G @ 750 g a.i. /ha (Standard check), carbosulfan 6G @ 1000 g a.i. /ha, cartap-Hydrochloride 4 G @ 1000 g a.i. /ha, and fipronil 0.3G @ 7.5 g a.i. /ha along with untreated check.

All agronomic practices were followed as per the recommendations, except for YSB control. The granular and spray formulations were applied thrice at 30, 60 and 80 days after sowing (DAS), a single chemical was used for all the three applications and their efficacy was evaluated. To avoid intermixing of treatments, about 20 to 30 cm thick were prepared all around plots having the treatments of granular insecticides. Using knapsack sprayer with hollow cone nozzle spray applications was made @ 300-600 litres spray fluid per hectare depending on crop growth stages. Drifting from one plot to another was avoided by using plastic sheet at the time of spraying. For seed treatment, sprouted seeds were soaked in imidacloprid 70 WS (5 ml per kg seed) solution for three hours, dried in shade and sown in the plots. The seeds sown were covered by a thin layer of paddy straw to prevent feeding by birds and to facilitate higher germination. Observations on the incidence of dead heart at 50 and 75 DAS and white earheads (WH) at crop maturity prior to harvesting were recorded from 20 hills in each plot. The per cent incidence of stem borer was assessed by counting the total number of tillers and tillers affected by stem borer.

Grain and fodder yields were recorded separately from net plot area of each treatment after harvesting the crop. Economics of insecticide applications was computed on the basis of economic returns from grain and fodder yields and cost of insecticidal treatments. The cost benefit ratios (C.B.R.) thus calculated were used for judging the economics of treatments.

RESULTS AND DISCUSSION

It could be seen from Table 1 that, at 50 days after sowing (DAS), fipronil 0.3 G @ 7.5 g ai /ha was significantly superior chemical compound than other chemical compounds with least per cent dead hearts (DH) damage of 3.40. The next best chemical was, beta-cyfluthrin 2.5 EC @ 12.5 g ai/ha which recorded 4.40 per cent dead heart and followed by monocrotophos 36 SL @ 500 g ai/ha against stem borer with 4.42 per cent DH. While, the carbosulfan 6G @ 1000 g ai /ha (5.49 % DH) was at par with carbofuran 3G @ 750 g ai/ha (5.81 % DH). Flubendiamide 500 SC @ 24 g ai/ha, cartap hydrochloride 4G @ 1000 g ai/ha and indoxacarb 14.5 SC @ 30 g ai/ha were at par with each other with per cent DH of 6.46, 6.50 and 6.57, respectively. Imidacloprid 200 SL @ 20 g ai/ha (7.36 % DH) was superior to lamda cyhalothrin 5 EC @ 2.5 g ai/ha (8.36 % DH) and imidacloprid 75 WS seed treatment (5 ml / kg seed) (8.40 % DH), but were less effective against YSB. However, the highest dead heart (15.2 %) was recorded in control.

At 75 DAS, among the granular insecticides, fipronil 0.3G @ 7.5 g a.i./ha was significantly superior with lowest per cent DH of 2.43 and the carbosulfan 6 G @ 1000 g ai/ha (3.93 % DH) was at par with carbofuran 3 G @ 750 g ai/ha (4.03% DH). These findings are in agreement with Dash and Mukerjee (2003) who reported that fipronil @ 0.075 kg /ha controlled the stem borer most effectively than lamdacyhalothrin. Sontakke and Dash (2000) concluded that the application of carbofuran and fipronil at 50 DAT afforded effective control of stem borer causing white heads whereas, cartap hydrochloride was ineffective in reducing insect pest incidence and increasing grain yield. Cartap hydrochloride 4 G @ 1000 g ai/ha was less effective (4.6 % DH) than other granular insecticides. Karthikeyan and Purushothaman (2000) reported that application of carbofuran although proves effective, its use causes resurgence of leaf folder. However, they obtained the maximum grain yield by carbosulfan over check insecticide carbofuran. Among spray insecticides, Beta-cyfluthrin 25 EC @ 12.5 g ai/ha was superior with 3.27 per cent DH and numerically next best was monocrotophos 36 SL @ 500 g a.i/ha (3.92 % DH) but flubendiamide 500 SC @ 24 g a.i/ha was at par with monocrotophos showing per cent DH of 4.23. Next in the order of decreasing efficacy was indoxacarb 14.5 SC.

Table 1: Efficacy of new insecticide chemical molecules against YSB in aerobic paddy during *kharif* season 2005-06

Treatment	Dosage	Per cent dead heart per hill		White earhead (%)	Yield (q/ha)
		50 DAS	75 DAS		
Monocrotophos 36 SL	500 g a.i/ha	4.42 (12.13)[f]	3.92 (11.31)[de]	5.93 (14.08)[e]	38.40[bc]
Imidachloprid 17.8 SL	20 g a.i/ha	7.36 (15.75)[c]	6.80 (15.11)[bc]	8.20(16.63)[c]	29.00[f]
Lamda cyhaluthrin 2.5 EC	12.5 g a.i/ha	8.38 (16.77)[b]	7.13 (15.49)[b]	10.44 (18.84)[b]	23.90[g]
Beta cyfluthrin 2.5 EC	12.5 g a.i/ha	4.40 (12.10)[f]	3.27 (10.40)[e]	4.90 (12.77)[f]	38.67[b]
Imidachloprid 70 WS	5 ml/Kg seed	8.40 (16.83)[b]	7.37 (15.75)[b]	10.99 (19.36)[b]	21.30[h]
Flubendamide 500 SC	24 g a.i/ha	6.46 (14.72)[d]	4.23 (11.84)[b]	6.43 (14.68)[de]	32.70[e]
Indoxacarb 14.5 SC	30 g a.i/ha	6.57 (14.85)[d]	5.75 (13.85)[c]	7.42 (15.8)[cd]	29.50[f]
Carbofuran 3 G	750 g a.i/ha	5.81 (13.94)[e]	4.03 (11.58)[de]	6.35 (14.59)[de]	35.27[d]
Carbosulfon 6 G	1000 g a.i/ha	5.49 (13.55)[e]	3.93 (11.41)[de]	6.14 (14.35)[e]	37.40[c]
Cartap hydrochloride 4 G	1000 g a.i/ha	6.50 (14.76)[d]	4.60 (12.37)[d]	6.50 (14.77)[de]	32.00[e]
Fipronil 0.3 G	7.5 g a.i/ha	3.40 (10.62)[g]	2.43 (8.89)[f]	2.59 (19.19)[g]	42.97[a]
Untreated check		15.20 (22.94)[a]	12.31 (20.53)[a]	12.67 (20.84)[a]	17.17[i]
S.E±		0.25	0.47	0.43	0.81
C.D. (5 %)		0.74	1.37	1.27	2.38
C.V (%)		5.30	6.13	5.86	7.1

DAS- Days after sowing. Figures in parentheses are arc sin transformed values

Table 2: Effect of new insecticide chemical molecules on yield of aerobic paddy and its economics during *kharif* season 2005-06

Chemicals	Dosage	Yield (kg/ha)		Gross income (Rs./ha)	Cost of treatment (Rs./ha)	Net gain (Rs./ha)	Net profit over control (Rs./ha)	CBR
		Grain	Straw					
Monocrotophos 36 SL	500 g a.i/ha	38.40	57.26	25853.0	1070.00	24783.0	12542.5	1:11.72
Imidachloprid 17.8 SL	20 g a.i/ha	29.00	47.58	19779.0	660.60	19118.4	6877.9	1:10.41
Lamda cyhaluthrin 2.5 EC	12.5 g a.i/ha	23.90	42.66	16473.0	332.00	16141.0	3900.5	1:11.75
Beta cyfluthrin 2.5 EC	12.5 g a.i/ha	38.67	57.85	26094.5	647.55	25447.0	13206.5	1:20.39
Imidachloprid 70 WS	5 ml/Kg seed	21.30	40.15	14787.5	199.92	14587.58	2347.08	1:11.74
Flubendamide 500 SC*	24 g a.i/ha	32.70	50.76	22158.0	-	-	-	-
Indoxacarb 14.5 SC	30 g a.i/ha	29.50	48.25	20112.5	1568.30	18544.2	6303.7	1:4.02
Carbofuran 3 G	750 g a.i/ha	35.27	52.54	23789.0	2800.00	20989.0	8748.5	1:3.12
Carbosulfon 6 G	1000 g a.i/ha	37.40	55.68	25224.0	2324.00	22900.0	10659.5	1:4.59
Cartap hydrochloride 4G	1000 g a.i/ha	32.00	50.69	21734.5	2175.00	19559.5	7319.0	1:3.37
Fipronil 0.3 G	7.5 g a.i/ha	42.97	61.25	28844.5	1875.00	26969.5	14729.0	1:7.86
Untreated check	-	17.17	38.77	12240.5	-	12240.5	-	-

Price: Grain: Rs. 600/Qtl   Fodder: Rs. 50/Qtl   * Free sample

Means showing similar alphabet in the columns are at par @ 30 g ai /ha (5.75 % DH) which was at par with imidacloprid at 20 g ai/ha showing 6.80 per cent DH. Lamda cyhalothrin 5 EC @ 12.5 g ai/ha and imidacloprid 75 WS seed treatment (5 ml / kg seed), were at par and less effective with 7.13 and 7.37 per cent DH, respectively. Ramesh Babu *et al.* (2000) reported that foliar application of imidachloprid at 25 g ai/ha 5 days before planting was effective against stem borer in main field upto 45 DAT but higher doses favoured the incidence of stem borer. Panda *et al*. (2004) reported that from the point of effective insect control, safety to spiders and increased grain yield, Fipronil @ 0.075 and 0.05 kg ai/ha was found better than carbofuran and phorate.

White ear head of 2.59 per cent was least in fipronil 0.3 G @ 7.5 g ai/ha treated plot followed by spray insecticides of beta-cyfluthrin 25 EC @ 12.5 g ai/ha which was effective than other insecticides with 4.9 per cent WH, and next was monocrotophos 36 SL @ 500 g ai/ha (5.93 % WH) carbosulfan 6 G @ 1000 g ai/ha (6.14 % WH) was at par with monocrotophos 36 SL @ 500 g ai/ha. Carbofuran 3 G @ 750 g ai/ha, flubendiamide 500 SC @ 24 g ai/ha, cartap hydrochloride 4 G @ 1000 g ai/ha and indoxacarb 14.5 SC @ 30 g ai/ha were at par with 6.35, 6.43, 6.5 and 7.42 per cent WH, respectively and imidacloprid 200 SL @ 20 g ai/ha (8.2 % WH) was at par with indoxacarb. Lamda cyhalothrin 5 EC @ 12.5 g ai/ha and imidacloprid 75 WS seed treatment (5 ml / kg seed), were at par and less effective with 10.44 and 10.99 per cent DH, respectively.

The cost benefit ratio was maximum in case of beta cyfluthrin (1:20.39) followed by lamda cyhalothrin (1:11.75), imidacloprid seed treatment (1:11.74), monocrotophos (1:11.72), imidacloprid spray (1:10.41), fiprorill (1:7.86), carbosulfan (1:4.59), indoxacarb (1:4.02), cartap hydrochloride (1:3.37) and carbofuran (1:3.12) (Table 2). Korat *et al*. (1999) reported that inspite of high yields obtained in the case of carbofuran, it showed the lowest (1 : 2.60) C.B.R. value due to its high cost.

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