

Yield Performance of Different Insecticides against Rice Yellow Stem Borer, *Scirpophaga incertulas* WLK

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Abstract

The yield data of different insecticides against paddy yellow stem borer, *Scirpophaga incertulas* WLK showed significant findings. The average highest yield (59.04 q/ha) was obtained in fipronil 0.3 G (T2), followed by spinosad 45 SC (T3) (57.21 q/ha) and they were at par with each other. The other treatments viz., profenophos 50 EC (T1) and cartap hydrochloride (T4) recorded 51.71 and 50.33 q/ha yield, which found at par with each other and also showed significantly higher yield over control (43.79 q/ha).

Keywords: Yellow stem borer; *Scirpophaga incertulas* WLK; Insecticide; Yield

Introduction

Rice (*Oryza sativa* L.) is the world's second most important cereal crop. At global level, it is a staple food crop of paramount importance to more than half of the population with regard to food value and is consumed by more than 60% of the world population. It provides 27% of dietary energy and 20% of dietary protein in the developing world [1].

In India, paddy is grown in 44.06 million ha constituting 34.4% of the total cultivable area. About 70% of our farmers are cultivating paddy and the production is about 105.31 million tonnes and productivity being 2178 kg/ha. The productivity of rice has increased from 1984 kg/hectare in 2004-2005 to 2393 kg/hectare in 2011-2012 [2]. Gujarat occupies about 2% of area among rice growing states. It is grown on 8.36 lakh ha area, which comprises nearly 90% of Kharif and 10% of Summer season rice with a total production of 17.90 lakh tonnes and the productivity of 2141 kg/ha [2], but it is lower than the country's productivity.

Rice is facing the various pest problems starting from seedling to maturity stage. It is infested by more than 800 insect species [3]. Out of which, 20 are of major economic significance. Together, they infest all parts of the plant at all growth stages and a few transmit virus disease [4]. A list of major, minor and sporadic pests attacking paddy crop in Gujarat is reported by Korat and Pathak [5].

Yellow stem borer, *Scirpophaga incertulas* WLK is one of the widely distributed, dominant and monophagous pest of paddy in the Indian subcontinent. It is damaging crop in nursery as well as in transplanted crop causing drying of central shoot known as 'dead heart' in young plants, boring at heading stage usually occurs at the peduncle node and 'white earhead' formed [6]. Hence, present investigation is carried out on effectiveness of insecticides against rice yellow stem borer, *Scirpophaga incertulas* WLK on yield of paddy.

Material and Methods

Experimental details:

1	Location	Wheat Research Station farm, Navsari Agricultural University, Bardoli (Gujarat)
2	Duration	4 months
3	Season and year	Kharif 2012 and Kharif 2013
4	Variety	GR-11
5	Design	Randomized Block Design (RBD)
6	No. of treatments	5
7	Replication	6
8	Plot size	Gross Plot size (6 × 4.2 m ²)
		Net plot size (5.6 × 3.9 m ²)

9	Spacing	20 cm × 15 cm
10	Method of sowing	Transplanting
11	Fertilizer application	100-30-00 :: N:P:K kg/ha

Table 1: Experimental details; location, cropping season, treatments and design.

Details of treatment

Sr. No.	Name of insecticide	Formulation	Concentration (%)
1	Profenophos	50 EC	0.08%
2	Fipronil	0.3 G	0.01%
3	Spinosad	45 SC	0.01%
4	Cartap hydrochloride	4 G	0.20%
5	Control (water)	--	--

Table 2: Treatment details; formulation and applied concentration.

Time and method of insecticide application

The insecticide formulations were used as a foliar spray by using “knapsack sprayer” at the time of peak post population.

Method of observations

The observations on number of tillers damaged by yellow stem borer, *Scirpophaga incertulas* WLK (Dead Heart (DH)/White Earhead) were recorded before and 3, 7 and 10 days after application of each treatment. For this purpose, twenty hills were selected randomly from each plot. The percentage of dead hearts were worked out by using following formula.

$$\text{Per cent DH} = (\text{Number of DH} / \text{Total number of tillers}) \times 100$$

Yield

The grain yield per hectare was recorded for each treatment and data were subjected to appropriate statistical analysis for interpretation.

Results and Discussion

First spray

Pre-treatment: The performance of different insecticides against yellow stem borer, *Scirpophaga incertulas* WLK management at first spray before spraying showed non-significant results indicating there were no differences among treatments (Table 1 and Figure 1). The interaction effect between treatments and year was non-significant.

At 3 DAS: The data on per cent dead hearts due to yellow stem borer, *Scirpophaga incertulas* WLK at 3 DAS on first spray (Table 1 and Figure 1) revealed significant results and fipronil 0.3 G (T2) with 3.05% dead hearts found superior among all insecticides, but was at par with spinosad 45 SC (T3) (3.39%). The next best treatment was profenophos 50 EC (T1) which recorded 4.10% dead heart and found at par with cartap hydrochloride (T4) (4.26%). The highest dead hearts

damage of 5.55% was observed in control plot (T5). The interaction effect between treatments and year was non-significant, which revealed consistent performance of insecticides during the period of both years.

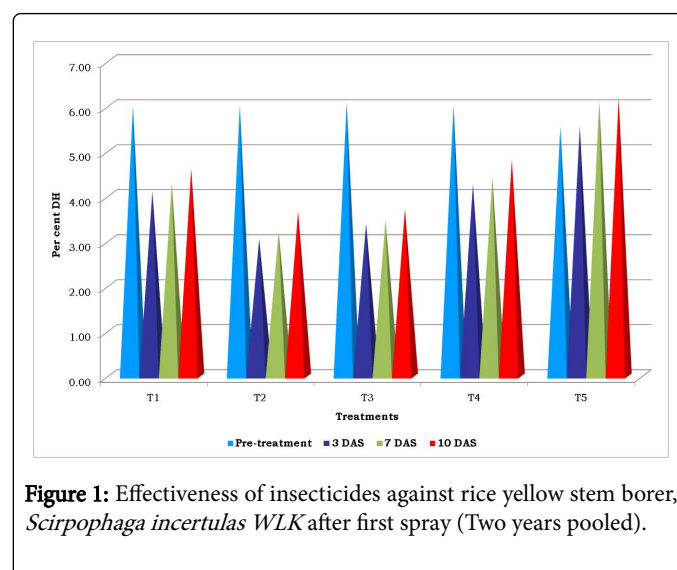


Figure 1: Effectiveness of insecticides against rice yellow stem borer, *Scirpophaga incertulas* WLK after first spray (Two years pooled).

At 7 DAS: The parallel trend on performance of insecticides against yellow stem borer, *Scirpophaga incertulas* WLK was recorded at 7 DAS on first spray (Table 1 and Figure 1) and showed significant results. The lowest dead hearts were found in plots of fipronil 0.3 G (T2) (3.21%), followed by spinosad 45 SC (T3) (3.46%) and they were at par with each other. The next best treatments were profenophos 50 EC (T1) (4.28%) and cartap hydrochloride (T4) (4.41%) and found at par with each other. The highest dead heart damage of 6.12% was observed in control plot (T5). The interaction effect between treatments and year was non-significant.

At 10 DAS: At 10 DAS on first spray, the similar trend insecticides efficacy against yellow stem borer, *Scirpophaga incertulas* WLK was found with significant findings (Table 1 and Figure 1). The minimum damage was recorded in treatment fipronil 0.3 G (T2) (3.66%), followed by spinosad 45 SC (T3) (3.70%) and they were at par with each other. The other treatments viz., profenophos 50 EC (T1) (4.61%) and cartap hydrochloride (T4) (4.81%) also showed significantly lower damage over control (6.17%), but previous two were found at par with each other. The interaction effect between treatments and year was non-significant, which revealed consistent performance of insecticides during the period of both years.

Second spray

At 3 DAS: The per cent dead hearts due to yellow stem borer, *Scirpophaga incertulas* WLK at 3 DAS on second spray (Table 1 and Figure 2) revealed significant results and fipronil 0.3 G (T2) with 2.40% dead hearts found superior among all insecticides, but was at par with

spinosad 45 SC (T3) (2.69%). The next best treatment was profenophos 50 EC (T1), which recorded 3.27% dead hearts and showed at par results with cartap hydrochloride (T4) (3.39%). The highest dead heart

damage of 6.02% cent was observed in control plot (T5). The interaction effect between treatments and year was non-significant.

Sr. No.	Treatments	Before spray	DH (%) after first spray			DH (%) after second spray		
			3 DAS	7 DAS	10 DAS	3 DAS	7 DAS	10 DAS
1	Profenophos 50 EC	14.13 (6.01)	11.66 (4.10)	11.91 (4.28)	12.37 (4.61)	10.4 (3.27)	10.6 (3.40)	10.85 (3.56)
2	Fipronil 0.3 G	14.1 (6.02)	10.03 (3.05)	10.28 (3.21)	11 (3.66)	8.85 (2.4)	9.2 (2.57)	9.21 (2.59)
3	Spinosad 45 SC	14.2 (6.08)	10.59 (3.39)	10.67 (3.46)	11.06 (3.7)	9.41 (2.69)	9.64 (2.81)	9.67 (2.84)
4	Cartap hydrochloride 4 G	14.16 (6.01)	11.91 (4.26)	12.09 (4.41)	12.64 (4.81)	10.59 (3.39)	10.79 (3.53)	11.04 (3.68)
5	Control (water)	13.57 (5.54)	13.59 (5.55)	14.31 (6.12)	14.34 (6.17)	14.41 (6.2)	14.54 (6.31)	14.54 (6.32)
SE (m) + (T)		0.4	0.23	0.27	0.27	0.22	0.21	0.22
SE (m) + (T × Y)		0.57	0.32	0.4	0.4	0.32	0.31	0.33
CD at 5% (T)		NS	0.64	0.77	0.78	0.62	0.6	0.64
CD at 5% (T × Y)		NS	NS	NS	NS	NS	NS	NS
CV		10.01	6.77	8.23	7.95	7.24	6.89	7.21

*Values in outside the parentheses are arc sine transformed values and inside are original values

Table 1: Effectiveness of insecticides against rice yellow stem borer, *Scirpophaga incertulas* WLK (Two years pooled).

At 7 DAS: The similar type of trend on performance of insecticides against yellow stem borer, *Scirpophaga incertulas* WLK was recorded at 7 DAS on second spray and showed significant findings (Table 1 and Figure 2). The lowest dead heart count was found fipronil 0.3 G (T2) (2.57%), followed by spinosad 45 SC (T3) (2.81%) and showed at par results with each other. The next best treatments were profenophos 50 EC (T1) (3.40%) and cartap hydrochloride (T4) (3.53%) and found at par with each other. The highest dead heart damage of 6.31% was observed in control plot (T5). The interaction effect between treatments and year was non-significant indicating consistent show of insecticides during the period of both years.

At 10 DAS: At 10 DAS, the similar trend of insecticides performance against yellow stem borer, *Scirpophaga incertulas* WLK was observed with significant data (Table 1 and Figure 2). The minimum damage was recorded fipronil 0.3 G (T2) (2.59%), followed by spinosad 45 SC (T3) (2.84%) and they were at par with each other. The other treatments viz., profenophos 50 EC (T1) (3.56%) and cartap hydrochloride (T4) (3.68%) were at par with each other and also showed significantly lower damage over control (6.32%). The interaction effect between treatments and year was non-significant, which revealed consistent performance of insecticides during the period of both years.

Fipronil 5 SC reported as the most effective insecticide by Sontake and Dash and others [7-13] which was also found superior in present investigation and therefore these findings match with the current study match with earlier findings.

Some other worker like Singh et al. [14] revealed that cartap hydrochloride 4G and fipronil 0.3 were comparatively more effective, while Kumar and Sachan [15] tested five newer and among biopesticide, a new molecule spinosad @ 200 ml a.i./ha was found more effective. Similarly, in the investigation of Karthikeyan et al. [16], who showed that spinosad @ 54 g a.i./ha caused higher reduction in dead hearts and white ears. These above studies strongly support the present experimental results.

Yield

The data on yield of paddy obtained during Kharif 2012 and Kharif 2013 under influence of various insecticidal treatments are analysed and presented in Table 2 and depicted graphically in Figure 3.

First Year (Kharif 2012): The yield data collected after management of yellow stem borer, *Scirpophaga incertulas* WLK by using different insecticides recorded significant results (Table 2 and Figure 3). The highest yield of 59.42 q/ha was recorded in treatment of fipronil 0.3 G

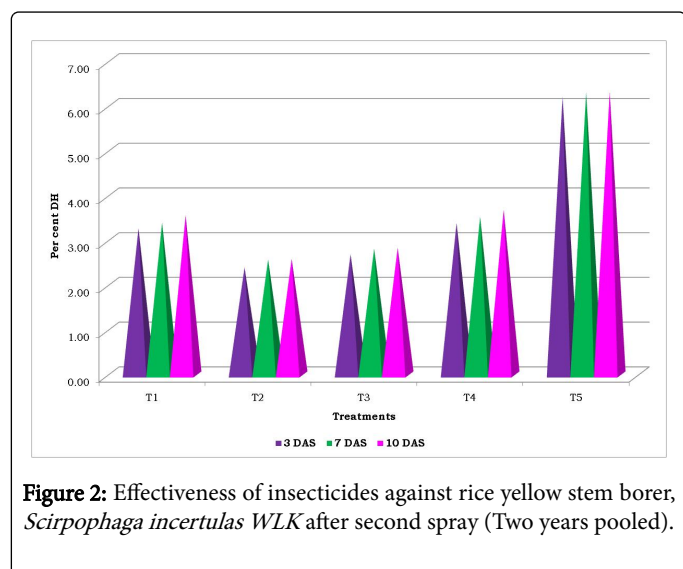


Figure 2: Effectiveness of insecticides against rice yellow stem borer, *Scirpophaga incertulas* WLK after second spray (Two years pooled).

(T2), followed by spinosad 45 SC (T3) with 57.75 q/ha yield and they were at par with each other. The other treatments viz., profenophos 50 EC (T1) and cartap hydrochloride (T4) recorded 52.42 and 51.58 q/ha yield, which were found at par with each other and also showed significantly higher yield over control (44.67 q/ha).

Second Year (Kharif 2013): The yield data collected after management of yellow stem borer, *Scirpophaga incertulas* WLK by using different insecticides recorded significant results (Table 2 and Figure 3). The highest yield of 58.67 q/ha was observed in treatment of fipronil 0.3 G (T2), followed by spinosad 45 SC (T3) with 56.67 q/ha yield and they were at par with each other. The other treatments viz., profenophos 50 EC (T1) and cartap hydrochloride (T4) recorded 51.00 and 49.08 q/ha yield, which were found at par with each other and also showed significantly higher yield over control (42.92 q/ha).

Sr. No.	Treatments	Yield (q/ha)		
		Kharif 2012	Kharif 2013	Pooled
1	Profenophos 50 EC	52.42	51	51.71
2	Fipronil 0.3 G	59.42	58.67	59.04
3	Spinosad 45 SC	57.75	56.67	57.21
4	Cartap hydrochloride 4G	51.58	49.08	50.33
5	Control (water)	44.67	42.92	43.79
SE (m) + (T)		1.75	1.82	1.21
SE (m)+ (T x Y)		--	--	1.78
CD at 5% (T)		5.17	5.36	3.44
CD at 5% (T x Y)		--	--	NS
CV		8.07	8.61	8.34

Table 2: Effectiveness of insecticides on yield (q/ha) of rice during Kharif 2012, Kharif 2013 and pooled.

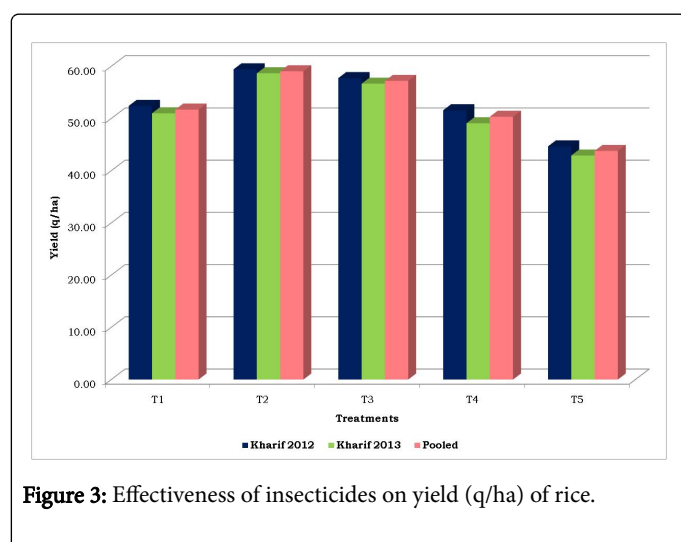


Figure 3: Effectiveness of insecticides on yield (q/ha) of rice.

Pooled data: The pooled data on yield obtained after management of yellow stem borer, *Scirpophaga incertulas* WLK by using different insecticides showed significant findings (Table 2 and Figure 3). The

highest yield of 59.04 q/ha was obtained in treatment fipronil 0.3 G (T2), followed by spinosad 45 SC (T3) with 57.21 q/ha yield and they were at par with each other. The other treatments viz., profenophos 50 EC (T1) and cartap hydrochloride (T4) recorded 51.71 and 50.33 q/ha yield, which were found at par with each other and also showed significantly higher yield over control (43.79 q/ha). The interaction effect between treatments and year was non-significant indicating consistent show of insecticides during both the years.

Earlier, the higher paddy yield was recorded by the application of cartap hydrochloride [17] and fipronil [9,11]. In the present investigation, more or less similar trend was also observed. However, no information is available on rest of the insecticides evaluated in the present investigation and hence, results could not be compared with the work done in past.

Summary and Conclusion

The average data on per cent dead hearts due to yellow stem borer, *Scirpophaga incertulas* WLK was recorded at 3,7 and 10 days after first and second spray and revealed significant results. On first spray, the minimum damage was recorded in treatment fipronil 0.3 G (T2), followed by spinosad 45 SC (T3) and they were at par with each other. Profenophos 50 EC (T1) and Cartap hydrochloride (T4) and were found at par with each other, but showed significantly lower damage over control.

After second spray, the similar trend of insecticides performance against yellow stem borer, *Scirpophaga incertulas* WLK was observed with significant data. The minimum damage was recorded fipronil 0.3 G (T2), followed by spinosad 45 SC (T3) and they were at par with each other. Profenophos 50 EC (T1) and cartap hydrochloride (T4) were found at par with each other and also showed significantly lower damage than control. The yield data of paddy obtained under influence of various insecticidal treatments showed significant findings. The average highest yield of 59.04 q/ha was obtained in treatment fipronil 0.3 G (T2), followed by spinosad 45 SC (T3) with 57.21 q/ha yield and they were at par with each other. Profenophos 50 EC (T1) and cartap hydrochloride (T4) recorded 51.71 and 50.33 q/ha yield, which were found at par with each other and also showed significantly higher yield over control (43.79 q/ha).

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