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ASSESSMENT OF IPM PRACTICES AGAINST YELLOW STEM BORER *SCIRPHOPHAGA INCERTULAS* (WALKER)

M Shankar[1*], V Ravinder Naik[2] and Rvt Balazzii Naaiik[3]

[1]Krishi Vigyan Kendra, Kampasagar, PJTSAU, Nalgonda 508207, Telangana, India
[2]Department of Extension, College of Agriculture, PJTSAU, Rajendranagar, Hyderabad 500030, Telangana, India
[3]AICRP on Forage Crops, PJTSAU, Rajendranagar, Hyderabad 500030, Telangana, India
*Email: shankar.ento2007@gmail.com (corresponding author): ORCID ID 0000-0002-5953-0407

ABSTRACT

An on-farm trial on the assessment of IPM practices against rice yellow stem borer *Scirphophaga incertulas* (Walker) in rice was carried out at five locations at randomly selected farmers' fields of KVK adopted villages of *Scirphophaga incertulas* (Walker) Nalgonda District, Telangana during rabi 2015-16, 2016-17 and 2017-18. The IPM practice consisted of seed treatment, nursery management, clipping off leaf tips before transplanting, application of recommended dosages of fertilizers, application of chlorantraniliprole granules @ 10 kg/ ha, the release of biocontrol agent *Trichogramma japanicum* @ 1,25,000/ ha at five releases from 20 DAT at an interval of 20 days, installation of pheromone traps @ 10/ ha, spraying of cartap hydrochloride 50SP @ 2.0 g/ l at the vegetative stage and chlorantraniliprole 18.5SC @ 0.3 ml/ l at the panicle initiation stage. The results on pest incidence like mean deadhearts were significantly lower in IPM demonstration plots (9.9%) than in farmers' practice (17.7%) and the white earheads incidence was *Scirphophaga incertulas* (Walker) (9.0%) *Scirphophaga incertulas* (Walker) in IPM demonstration plots compared to 19.3% in farmers' practice. The grain yield was higher in demonstration plots 6588.3 kg/ ha, with a increase of 12.0% over the farmers' practice of 5913.3 kg/ ha. The gross returns, net returns, and benefit-cost were obtained more in IPM demonstrations as compared to farmers' practices.

Key words: Rice, IPM, Yellow stem borer, Dead hearts, White ear heads, Yield, Gross returns, Net returns, Cost of cultivation, B: C ratio

Rice (*Oryza sativa* L.) is one of the most important cereal crop and a staple food for more than half of the world's population (Liu et al., 2014). In India, more than 100 insect pest species attack rice (Matteson, 2000), and twenty insect species are identified as major pests. These cause yield losses of about 10 -60% (Bhogadhi and Bentur, 2015; Jena et al., 2018). Among these, the yellow stem borer, *Scirpophaga incertulas* (Walker) (Crambidae: Lepidoptera), is the most damaging, causing annual yield losses of 27-34% (Prasad et al., 2007). The stem borer causes deadhearts at the vegetative stage and white earheads at the reproductive phase (Sulagitti et al., 2018); and yield losses vary from 17 to 51% (Muralidharan and Pasalu, 2006; Singh et al., 2018; Singh and Triveni, 2019). Stem borer incidence is recorded in early sown and late sown crop to an extent of 20.0% and 80.0%, respectively (Singh et al., 2018). The deadhearts incidence ranged from 11.2-40.1%, and white earheads from 27.6-71.7% (Krishnaiah and Varma, 2010). The IPM provides farmers with a variety of options for managing pests, diseases, and weeds. The IPM technology demonstrated are location specific and have cost effectiveness on farmers' fields as compared to conventional farmers' practice. Thus, location-specific IPM models are more adoptive to farmers (Gururaj Katti et al., 2021). There is a need to popularize and disseminate the improved IPM technologies. Therefore, the present study to assess the IPM technologies against yellow stem borer in rice in Nalgonda District, Telangana.

MATERIALS AND METHODS

Field experiments were carried out by the Krishi Vigyan Kendra, Kampasagar at farmers' fields in adopted villages of Duggaepally and Babusaipet villages of Tripuraram (M), Nandhiphad, Bhalunaik Thanda, and Nanya Thanda villages of Miryalaguda Mandal, and Somararam (V) Naeruducharla (M) (NL 16°51'48", EL 79°25'57") of Nalgonda District, Telangana during rabi 2015-16, 2016-17, and 2017-18. The demonstrations were conducted in five locations every year, covering selected adopted villages in the Nalgonda District. An on-farm trial of IPM with rice variety MTU 1010 included cultural, biological,

mechanical and chemical methods. These comprised carbendizum seed treatment @1g/ kg seed, application of carbofuran granules 1 kg/ 5 cents nursery before 5 days of pulling of nursery; cultural practices followed include: clipping off leaf tips before transplanting, application of recommended dosages of fertilizers 120-60-60 NPK/ ha, installation of pheromone traps @10 ha for monitoring collection and destruction of egg masses, application of chlorantraniliprole granules 0.4%G @ 10 kg/ ha at 20 days after transplanting, release of *Trichogramma japonicum* @1,25,000/ ha with five releases at 20 DAT, spraying of cartap hydrochloride 50SP @ 2g/ l at vegetative stage and chlorantraniliprole 18.5SC @ 0.3ml/ l at panicle initiation stage. Whereas in farmers' practices with rice variety MTU 1010, no seed treatment, application of cartap hydrochloride granules @ 1 kg/ 5 cents at 15 days after sowing, indiscriminate use of fertilizers, no pheromone traps, application of carbofuran 3G granules @ 15 kg/ ha at 15-20 days after transplanting, no release of biocontrol agents, spraying of lambda cyhalothrin @ 2ml/ l at vegetative stage, and bifenthrin @ 2ml/ l at panicle initiation stage were practised. The demonstrations were laid out in an area of 0.1 ha and an adjacent 0.1 ha was treated as a farmers' practice.

Observations were recorded on the incidence of deadhearts, white earheads, yield, and economics. Incidence of deadhearts (DH%) was recorded randomly on five hills/ m^2 from 30 days after transplanting (DAT) to 60 DAT at a 15 days interval, and the white earheads (WEH%) recorded on five randomly selected hills/ m^2 from 75 DAT to before harvesting of the crop at 15 days interval. The yield data was recorded by the random crop cutting method and increase in yield over the farmers' practices was analyzed as per standard statistical procedures through t-test. The gross returns, net returns, cost of cultivation, and benefit-cost ratio computed was calculated and computed, as per standard procedures.

RESULTS AND DISCUSSION

The data showed that the % incidence of deadhearts was 10.6, 9.8, and 9.4 in the IPM demonstration plots as compared to farmers' practice 18.6, 16.4, and 18.2% during rabi 2015-16, 2016-17, and 2017-18, respectively (Table 1). The deadhearts were significantly lower in IPM demonstration plots (9.9%). The white earheads were 10.2, 8.8, and 8.0% in IPM demonstration plots during *rabi* 2015-16, 2016-17 and 2017-18, respectively. In farmers' practice, the pest incidence was higher due to the non-adoption of IPM practices and non-recommended and higher dosages of pesticides. These results clearly indicated that demonstrations through IPM practices had a given positive impact. Similar findings were reported by Ramulamma et al. (2022); Sandeep et al. (2020); Banerjee et al. (2015); Kumar et al. (2018); Sudharani et al. (2021); Nayak et al. (2019) who reported that deadhearts and white earheads were lower in IPM plots.

The grain yield was recorded 6240.0, 7260.0, and 6215.0 kg/ ha in IPM demonstration plots as compared to 5665.0, 6825.0, and 5230.0 kg/ ha during rabi 2015-16, 2016-17, and 2017-18, respectively (Table 2) was observed. Thus, a mean grain yield of 6588.3 kg/ ha in IPM recommended practices. The increase yield over the farmers' practice was about 12.0% in IPM demonstrations. These results coincide with Ramulamma et al. (2022) that adopting IPM practices gave higher yield. Sandeep et al. (2020) assessed that IPM demonstration plots recorded more yield. Banerjee et al. (2015); Kumar et al. (2018) obtained higher yields in demonstration plots as compared to farmers' practice and Kumar et al. (2018). The IPM practices led to higher gross returns, net returns and

Table 1. Incidence of *S. incertulas* in rice (rabi 2015-16 to 2017-18 KVK, Kampasagar, Nalgonda District, Telangana)

Year	Deadhearts (%)		White earheads (%)	
	Demonstrations practice	Farmers practice	Demonstrations practice	Farmers practice
2015-16	10.6#	18.6#	10.2#	19.8#
2016-17	9.8#	16.4#	8.8#	18.2#
2017-18	9.4#	18.2#	8.0#	19.8#
Mean	9.9	17.7	9.0	19.3
t-value	-10.2		-12.2	
p-value	0.002*		0.0001*	

*Significant at $p<0.05$; #Mean of five farmers

Table 2. Yield and economics of rice against yellow stem borer of demonstration vs farmers practice during rabi from 2015-16 to 2017-18 at KVK, Kampasagar, Nalgonda District, Telangana

Year	Yield (kg/ ha)		±%	Gross returns (Rs./ ha)		Cost of cultivation (Rs./ ha)		Net returns (Rs./ ha)		B:C ratio	
	Demonstration practice	Farmers practice	Yield	Demonstration practice	Farmers practice	Demonstration practice	Farmers practice	Demonstration practice	Farmers practice	Demonstration practice	Farmers practice
2015-16	6240.0#	5665.0#	10.2	91355.0#	80897.5#	48354.0#	50790.0#	43001.0#	30107.5#	1.9#	1.6#
2016-17	7260.0#	6825.0#	6.4	118123.0#	107019.5#	64870.0#	67325.0#	64868.2#	67323.4#	1.8#	1.6#
2017-18	6265.0#	5250.0#	19.3	105927.5#	92260.0#	50700.0#	53512.5#	55227.5#	38747.5#	2.1#	1.7#
Average	6588.3	5913.3	12.0	105135.2	93392.3	54641.3	57209.2	54365.6	45392.8	1.9	1.6
t-value	1.16										
p-value	0.15**										

**Non significant at $p<0.05$; #Mean of five farmers

benefit-cost ratio were Rs. 1,05,135.2/ ha, Rs. 54,365.6/ ha and 1.9 as compared to farmers' practice. The input expenditure is lower in the IPM demonstration plots of Rs. 54,641.3/ ha over the farmers' practice Rs. 57,209.2/ ha (Table 2). Similar results were observed by Ramulamma et al. (2022). Chakraborthy (2012) reported that IPM plots' recorded better net returns and benefit-cost ratio.

From the above findings, it is clearly indicated that the IPM practices comprising seed treatment with carbendizum, nursery management, clipping off leaf tips before transplanting, application of recommended dosages of fertilizers, application of chlorantraniliprole granules, the release of *Trichogramma japanicum*, installation of pheromone traps, and spraying of chlorantraniliprole 18.5SC @0.3 ml/ l minimized the rice yellow stem borer incidence, obtained higher grain yield, gross returns, net returns, and benefit-cost ratio in IPM demonstration plots. Hence, the adoption of IPM practices proved to be economical, ecofriendly, and sustainable in the rice production system.

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AUTHOR CONTRIBUTION STATEMENT

All authors read, reviewed, agree and approved the final manuscript.

CONFLICT OF INTEREST

No conflict of interest.

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