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Front Line Demonstration of IPM Approaches Against Yellow Stem Borer in *Rabi* Rice in Telangana

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ABSTRACT: Front line demonstration of IPM approaches against Yellow stem borer in Rice was conducted by Krishi Vigyan Kendra, Malyal, during *Rabi* season of three years from 2017-18 to 2019-20 in Mahabubabad district, Telangana. Increased reliance on pesticides for pest control is found to be unsustainable and cost-ineffective. So, Integrated Pest Management (IPM) has been introduced as the best alternative for pest management in rice. for efficient use of Integrated Management Practices for minimizing the pest load and reducing the load of chemical pesticides in order to get higher yields and income, with the intention of popularizing integrated approaches against yellow stem borer in rice, front line demonstration was conducted. The Demonstration comprised of IPM approaches like application of carbofuran granules in nursery @ 160g/cent at 20DAS and in main field @ 25kg/ha at 15DAT, collection and destruction of egg masses, installation of pheromone traps with 5 mg lure @ 20 traps/ha against yellow stem borer for monitoring and need-based spraying of cartap hydrochloride @ 2gm/l against yellow stem borer of rice found effective against Farmers' practice. In all the three years of study, adoption of IPM approaches resulted in lesser incidence *i.e.*, 61.59%, 64.74% mean reduction of dead hearts and white ears than farmers' practice. Mean higher yield of 7750 kg/ha was recorded in Demonstration as against 6750kg/h kg/ha in farmers' practice showing 21.49% increase. This has resulted in higher mean net returns of Rs. 81,667/ha with Benefit Cost ratio (BCR) of 1.66 in Demonstration as against Rs. 71,867/ha in farmers' practice with BCR of 1.42. Lower technology index showed the feasibility of the evolved technology at farmer's fields. Extension gap (10.01) is higher compared to technology gap (2.43) and technology index (3.87), which shows that the technology may be popularized on large scale to lessen the extension gap.

Keywords: Front line demonstration, grain yield, IPM, rice, stem borer.

INTRODUCTION

Rice (*Oryza sativa* L.) is the most widely grown tropical cereal on the earth and over 400 million tons of processed rice is delivered every year. India is one of the world's biggest makers of white rice and brown rice and is filled in a space of 44.1m ha with a creation of 106.70 million tons and usefulness of 2.42 tons ha^{-1}. In Telangana, rice is the essential food crop developed all through the state and is developed in a space of around 1.91 m. ha with a yearly creation of 6.26 million tons and usefulness of 3.19 tons ha^{-1} (Statistical year book, 2018).

In practically all rice producing countries of the world, insect pests and crop diseases are viewed as the major factors that contribute to decrease in rice production. These pest problems increased with the intensification of irrigated rice production, which further expanded plant protection costs and consequently cost of development (Akhtar *et al.,* 2010). The insect pests of rice viz., yellow stem borer (*Scirpophaga incertulas* (Walker)) and rice leaf folder (*Cnaphalocrocis medinalis* (Guenee)) cause annual losses in the order of ten million tonnes. Complete crop failure due to these pests are rare, at the same time, infrequent flare-ups can obliterate somewhere in the range of 60 and 95 % of the yield. Yellow stem borer, *Scirpophaga incertulas (*Walker) is a monophagous pest of rice attacking the crop at both vegetative and reproductive stages of the crop. The larvae of yellow stem borer tunnel into stem and feed on the inner tissue of the stem and growing point causing dead hearts. Yellow stemborer damage can prompt around 20% yield loss in early established rice crops, and 80% in late-established crops and reported a yield loss of 18 to 40% because of the infestation of yellow stem borer (Singh *et al*., 2018). At

late infection, plants develop white ears. Yellow stem borer Infestation flowering stage causes extreme yield loss and cannot be achieved the full potential of the variety.

For the control of yellow stem borer, many methods have been taken on however insecticides are playing a key role for its control. Non judicial and rehashed use of insecticide sprays at inappropriate dosages frequently created issues like decrease in natural enemy populations, secondary pest outbreak, pest resurgence, development of insecticide resistance and environmental pollution. This required the utilization of substitute strategies which can actually control the insect pest population and furthermore upgrade the rice production without harming the ecological niche. Integrated Pest Management practices offer huge scope to keep pest population below economic injury level through ecofriendly measures. Front line demonstration is one of the most effective extension tool to demonstrate and disseminate the new technology among stake holders. With the intention of popularizing integrated approaches against yellow stem borer in rice, front line demonstration was conducted during Rabi season of 2017-18, 2018-19 and 2019-20.

MATERIALS AND METHODS

The present study of Front line demonstration of IPM approaches for containing Yellow stem borer in Rice in was directed by Krishi Vigyan Kendra, Malyal in villages namely Seethanagaram of Gudur mandal, Kommulavancha of Narsihmulapeta mandal, Gouraram and Vengampeta of Bayyaram mandal, Mahabubabad didtrict of Telangana state during the Rabi season of 2017-18, 2018-19 and 2019-20, respectively. Each year, the demonstration was conducted in 10 locations covering these four villages. In general, Farming situation under study was loam or sandy loam with low to medium fertility status of soils and well irrigated. Conducted baseline survey before taking up the demonstration and issues related with rice production were recognized. Socio economic status of adopted farmers was also studied. Majority of the farmers of study areas are marginal and resource poor. The major crop is rice and around 1500ha of district is under rice cultivation in these four villages. In view of prevailing weather conditions that cause rainfall as well as drop in least and most extreme temperatures in current years rice stem borer out breaks occurred around here and the farmers were following poor pest management practices realizing low yields.

The demonstration on Integrated Pest Management of Yellow stem borer in Rice comprised cultural, mechanical and chemical methods (Table 1). At each location, demonstration was laid out in an area of 0.4 ha and adjacent 0.4 ha was considered as control (Farmers' practice) for comparison studies and the demonstration was conducted in 10 locations for three consecutive years. Apart from showcasing the viability of pest management components, farmers were also sensitized on the relevance of these technologies by organizing awareness programmes, focused group discussions, conducting method demonstrations, training programmes and sending timely messages through AKPS, SMS portal, Innovative farmers network and *Whats app* groups. The FLD was led to concentrate on the potential yield decrease factors that are fundamentally because of the pests and yield difference between the farmers' practice and demonstration. Per cent dead hearts during vegetative stage and per cent white ears before harvest were recorded. Collected the yield data by random crop cutting method from both the demonstration and farmers' practice and used simple statistical tools for analyzing the data. The per cent increase in yield, other data parameters like cost of cultivation, gross returns, net returns and benefit cost ratio were recorded.

The per cent increase yield, technology gap, extension gap and technology index (Samui *et al.,* 2000) were calculated by using formulae as given below.

$$\text{Per cent increase in yield} = \frac{\text{Yield in demonstration} - \text{Yield in Farmers' practice}}{\text{Yield in Farmers' practice}} \times 100 \quad (1)$$

$$\text{Technology gap} = \text{Potential yield} - \text{Yield in demonstration} \quad (2)$$

$$\text{Extension gap} = \text{Yield in demonstration} - \text{Yield under existing practices.} \quad (3)$$

$$\text{Technology index} = \frac{\text{Potential yield} - \text{Yield in demonstration}}{\text{Potential yield}} \times 100 \quad (4)$$

Table 1: Details of treatments in Demonstration and Farmers' Practice.

Treatments	Components
Farmers' Practice (T_1)	• Sole dependence on insecticide application. • 3 sprays during the crop period
Technology Demonstrated (T_2)	• Application of carbofuran granules @ 160 g/cent nursery at one week before transplanting and 25 kg/ha at 15 DAT in main field • Collection and destruction of egg masses • Installation of Pheromone traps @ 10/ha for monitoring the pest. • ETL based insecticide application and application of cartap hydrochloride @ 2g/lt at panicle initiation stage.

RESULTS AND DISCUSSION

A. Per cent of pest damage

Observed lower incidence of dead hearts (2.7%) and white ears (1.96%) in demonstrated fields, 60-65% less incidence found over Farmers' practice. The data on impact of pheromone traps on the monitoring of pest incidence (Table 2) in rice showed the necessity of chemical control on time basis, hence it can be concluded that physical control reduces chemical load and also it decides the time of spraying for reducing the pest population

B. Grain Yield

The data presented in (Table 5) revealed yield differences among potential, demonstration and farmers' practice. The per cent increase in yield in demonstration over farmers' practice ranged from 12.18 to 21.49 with highest being recorded during *Rabi,* 2017-18. There was an average yield increase of 14.97 per cent which clearly indicated that adoption of IPM technology against stem borer in *Rabi* season had profound influence on stem borer incidence and yield.

Satpathi *et al.* (2005) reported from the southern part of Bengal have substantial increase of Grain production following the adoption of rice-IPM protocol. Thus cultivation of rice by IPM module is found economically prudent to suppress *S. incertulas* incidence and accordingly to boost up the production (Chakraborty, 2012).

C. Economics

The data showed that the per cent reduction in cost of plant protection was Rs. 2400/ha (Table 2). The additional income due to increased yield and saving on plant protection chemical in demonstration (T2) was Rupees 9800/- per ha (Table 5). The data clearly revealed that, the net returns from the demonstration is substantially higher than farmers' practice, *i.e.*, the average net returns from the demonstration is Rs. 81,667/ha as compared to Rs. 71,867/ha in control. The cumulative effect of demonstration over three years, recorded an average benefit cost of ratio 1.66, 17% higher than farmers' practice (1.42).

D. Performance of FLD

Yield of demonstrations and potential yield of the crop was compared to estimate the yield gap further it was categorized into extension gap, technology gap and technology index. The extension gap and technology gap observed could be attributed to dissimilarities in soil fertility levels, weather conditions. Hence, to narrow down the yield gaps location specific technologies needs to be adopted Chaitanya *et al.* (2020); Rambabu *et al.* (2022). The technology gap in the yield of rice was 2.43q/ha. The extension gap was 10.01 q/ha. This shows that there was more extension gap in the yield levels; however, some more efforts are yet to be incorporated to procure the benefits and adequacy of IPM approaches. The knowledge enhancement on eco friendly, farmer friendly and cost effective technologies, proper use of IPM inputs at correct time and accessibility of IPM inputs on occasion of need may make positive effect on the improved yields of rice and furthermore impact in the decrease of stem borer pest load.

The lower technology index was 3.87 % showed the feasibility of the evolved technology in farmers' fields. The lower value of technology index the more shall be feasibility of the technology. This shows that the technology is 96% feasible. The productivity gain under FLD over farmers' practices created greater awareness and motivated the other farmers to adopt suitable IPM technology of paddy in the district. The disputes faced by the farmers were different for various technologies. Therefore, extension agencies should be made their efforts in their transfer of technology programmes to consider the constraints as perceived by the farmers in this investigations as well as personal. Therefore, for enhancing the production and productivity of paddy crop, strategy should be made for getting more and more recommended technologies adopted by the farmers (Sharma *et al.*, 2011; Singh *et al.*, 2018).

Table 2: Management practices adopted in demonstration fields and farmers' practice fields.

Particulars	Demonstration	Farmers' practice	Gap(s)
Variety	KNM 118	KNM 118	Nil
Land Preparation	Three Ploughings and Puddling	Three Ploughings and Puddling	Nil
Seed rate	55 kg/ha	55 kg/ha	Nil
Seed Treatment	*Trichoderma* @ 5g/kg seed	Nil	Full gap
Time of Sowing	November 15th - December 10th	November 15th - December 10th	Nil
Time of Transplanting	January first week	January first week	Nil
Method of cultivation	Transplanting	Transplanting	Nil
Fertilizer application	N-200 kg, P-50 kg, K- 60 kg	N-200 kg, P-50 kg, K- 60 kg	Nil
Weed Management	Hand Weeding, application of Bensulfuron methyl @ 10kg/ha	Hand weeding application of Bensulfuron methyl @ 10kg/ha	Nil
Plant Protection			
Installation of pheromone traps	10/ha for pest monitoring	—	Full gap
Application of carbofuran granules	Yes (160g in nursery and 25kg/ha 15DAT in main field)	No	Full gap
Cost of pesticides	1200/ha	3600/ha	Full gap
No. of sprayings	1	3	Full gap

Table 3: Calendar of works followed in Demonstration and Farmers' practice.

Stage of the crop	Demonstration		Farmers' practice	
	Type of Pesticide	Time of Application	Type of Pesticide	Time of Application
Nursery	Carbofuran granules@ 160g/cent nursury	20DAS	—	—
Transplanted Rice	Carbofuran granules (3G) 25kg/ha	15 DAT	Bio Granules	20 DAT
Tillering stage	Pheromone traps @ 10/ha	20 DAT	Chlorpyriphos @ 1ml/l	30 DAT
Panicle initiation stage	Cartaphydro chloride @ 1000g/ha	45 DAT	Chlorantraniliprole @ 0.3ml/l	40 DAT
Grain Filling stage	—	—	Chlorantraniliprole + thiomethoxam @ 0.5ml/l	65 DAT

Dates of interventions from Farmers' practice were collected through Personal interview.

Table 4: Per cent of damage by stem borer in Demonstration and Farmers' practice.

Incidence of Yellow stem borer	2017-18		2018-19		2019-20		Mean	
	Demonstration	Farmers' practice	Demonstration	Farmers' practice	Demonstration	Farmers' practice	Demonstration	Farmers' practice
% Dead hearts	2.7%	8%	3.2%	6.3%	2.2%	6.8%	2.70%	7.03%
% White ears	1.8%	6.6%	2%	4.8%	2.1%	5.3%	1.96%	5.56%

Table 5: Economic and Extension analyses of Demonstration and Farmers' practice.

Year	Average yield (q/ha)		Per cent increase in Yield	Technology gap (q/ha)	Extension gap (q/ha)	Technology index (%)	Net Returns		B:C ratio	
	Demonstration	Farmers' practice					Demonstration	Farmers' practice	Demonstration	Farmers' practice
2017-18	73.70	66.25	11.24	6.3	7.45	7.87	72300	64300	1.48:1	1.34:1
2018-19	78.00	64.20	21.49	2.0	13.8	2.5	82400	76100	1.83:1	1.64:1
2019-20	81.00	72.20	12.18	-1.0	8.8	1.25	90300	75200	1.67:1	1.3:1
Average	77.56	67.55	14.97	2.43	10.01	3.87	81,667	71,867	1.66:1	1.42:1

CONCLUSION

In rice Yellow stem borer management, IPM technology was found as imperative and the adoption of IPM technology increased the net income. There is need to adopt multipronged strategy that includes enhancing income of rice farmers through effective management of insect pest with the adoption of IPM technology. Hence, the technology might be promoted to moderate the extension gap. The economic, environmental, and social benefits derived from adoption of this important tool will have positive inference for the farmers.

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