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Evaluation of pest management modules in *kharif* rice

V. VISALAKSHMI, P. R. MOHANA RAO AND [1]N. H. SATYANARAYNA

Agricultural Research Station, Ragolu,
Aricultural Research Station, Amadalavalasa
Srikakulam District, Andhra Pradesh, India

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ABSTRACT

Three modules were evaluated against conventional farmers' practice to manage pest problems in rice at farmers field of Ragolu village, Srikakulam, Andhra Pradesh during kharif 2008 and2009.Module III comprising of application of carbofuran 3G@1kg a.i/ha in nursery, pheromone trap with 5mg lure @20 per hectare and field releases of Trichogramma chilonis @1,00,000 t ha^{-1} five times from 15 days after transplanting at ten days interval found good with low incidence of stem borer (3.26 to 6.78% dead hearts,5.56to7.40 % white ears and 5.61 to8.20% silver shoots)with highest grain yield of 5.89 t ha^{-1}during2008and5.95tha^{-1}during2009withcost benefit ratios of 1:2.38 and 1:3.77during 2008 and 2009 respectively.

Key-words*:* Gall midge, incremental cost benefit ratio, IPM modules and rice stem borer

Rice is one of the most important crop in North Costal Zone of Andhra Pradesh. Damage by insect pests is one of the major constraints to increase rice production. In addition, quality aspects such as pest-free and residue-free agricultural products are becoming increasingly important. Conventional pest control means use of chemical pesticides, however, their excessive and inappropriate use in our agro-ecosystem in the last two decades or so has resulted in degradation of our environment while our pest problems like development of resistance, resurgence and pesticide treadmill seem greater than ever (Trivedi and Ahuja, 2011) . There are more and more reports of resistance of pests to pesticide (Alam, 2000). The extent of pesticide residues in the environment is also a matter of great concern. Research results have indicated that food commodities are contaminated with persistent pesticide residues (Arora *et al.*, 2006). Hence there is a urgent need to evolve strategies and technologies that will not only meet increasing demands for food but also those that will enable us to produce more without the problems encountered as stated above. This target can be achieved only with Integrated Pest Management. This concept was proposed in sixties by Stern *et al.*,1959. It is implemented by utilizing a sound ecological approaches which is aimed at optimizing control measures rather than maxizing them. Realizing the benefits of IPM, International Rice Research Institute , Phillippines has been advocating rice IPM techniques and demonstrating their efficiency in the farm level since 1980 (Samiayyan *et. al.*, 2010). Considering the merits of rice IPM, four modules were evaluated for their suitability and economic gain in IPM, was assessed.

MATERIALS AND METHODS

Field experiments were conducted in rice growing farmer's field at Ragolu village, Srikakulam district in Andhra Pradesh during *kharif* 2008 and 2009 with three IPM modules in comparison with farmers practice as fourth module to validate and popularize the IPM modules in rice. The experiment was laid out in RBD with six replications. Thirty day old seedlings planted in 30 ×22m size plots. The crop was adopting standard agronomic practices. The different modules used for evaluation were as follows:

***Module I*: Chemical based module**

1. Growing high yielding variety Swarna
2. Application of carbofuran 3G @ 1.0kg ha^{-1} in nursery at 25 DAS.
3. Spraying of cartap hydrochloride 50SP @ 300g a.i ha^{-1} at 45 & 60 DAT.

***Module II*: Non chemical based module**

1. Growing gall midge resistant variety RGL 5613
2. Pheromone traps with 5mg lure @ 20traps/ha against yellow stem borer for mass trapping
3. Field release of *Trichogramma chilonis* 1,00,000 adults 5 times from 15 DAT onwards at 10 days interval obtained from Department Entomology, Regional Agricultural Research Station, Anakapalle.

***Module III*: Chemical + non chemical base**

1. Growing susceptible variety Swarna.
2. Application of carbofuran 3G @ 1kg a.i ha^{-1} in the nursery at 25 DAS
3. Pheromone mass trapping with 5mg lure @ 20traps/ha against yellow stem borer.
4. Field release of *Trichogramma chilonis* @ 1,00,000 adults, 5 times from 15DAT onwards at 10days interval

***Module IV*: Farmers Practice**

1. Growing high yielding variety Swarna.
2. Spraying monocrotophos @ 500g *a.i* ha^{-1} in nursery
3. Spraying chlorpyriphos @ 30DAT.
4. Spraying cartap hydrochloride 5 0SP @ 300g *a.i* ha^{-1}

Email : visalakshmi.v@gmail.com

Observations on incidence of stem borer (dead hearts) and gall midge (silver shoots) was taken from 50 randomly selected hills per plot from 15DAT at 10 days interval. The white ears incidence was observed at pre-harvest. The data on pest information arrived to percentages by following the below formula.

$$\text{Percent dead hearts/silver shoots /white ears} = \frac{\text{Total no.of dead hearts/silver shoots/white ears from 50hills}}{\text{Total number of tillers from 50 hills}}$$

Grain yield (t ha^{-1}) has been calculated from five crop cuts of 5 × 5m area in each sub plot.

RESULTS AND DISCUSSION

The data on pest incidence, grain yield and cost benefit ratio were pooled for two years and subjected to statistical analysis after necessary transformation and presented in Table-1along with incremental cost benefit ratio for each module.

Stem borer

In 2008, module I and III have recorded reduced stem borer infestation which is inflicted as 6.7% and 6.8% dead hearts, respectively. In contrast to this farmer's practice recorded 7.5% DH. In 2009, module III (3.3%) was better than module I (4.8%) to check stem borer damage in paddy. The occurrence of dead hearts at vegetative stage was least in module III being 5% and was on par with module I which recorded 5.8%DH.

In 2008, module I recorded minimum incidence of white ears being 5.8%followed by 7.4% in module III. Module III recorded least white ears appearance of 5.6% followed by 5.8% in module I in 2009. With regard to mean white ear incidence, the most effective treatment combination was module I which possibly due to spraying cartap hydrochloride 50SP@300g a.i ha $^{-1}$ at 60days after transplanting. Module III was the second best treatment having 6.4% white ears.

The IPM module I controlled the stem borer both at vegetative and reproductive stages which included carbofuran 3G @1kg a.i. ha^{-1} in the nursery and cartap hydrochloride 50SP@300 g a.i. ha^{-1} at 45 and 60 DAT. Release of egg parasitoid of stem borer, *Trichogramma chilonis* coupled with installation of pheromone traps attributed to the low incidence of dead heart due to stem borer in module III.

Gall midge

The percent silver shoots incidence was low in module III in 2008 and 2009 being 8.2% and 5.6%, respectively (Table 1). Incidence of gall midge was low with module III accounting for 6.9% silver shoots and was at par with module I. Lower incidence of gall midge in the main field in module III and module I could be due to application of carbofuran 3G@1 kg a.i. ha^{-1} in the nursery.

Yield

The highest grain yield of rice 5.9 t ha^{-1} was recorded in module III followed by 5.4 t ha^{-1} module I in 2008 (Table 1). Similar trend was observed in 2009 when grain yields were 6.0 t ha^{-1}, 5.4t ha^{-1} in module III and I, respectively. Highest mean yield was recorded in module III being 5.9t ha^{-1}. Overall, module III was found best and effective to reduce the pest load which resulted in higher yields. Module I was on par with module III.

Incremental cost benefit ratio

During *kharif* 2008, the highest incremental cost benefit ratio was obtained in module III being 1:2.38 (table 1). Same trend was continued in *kharif* 2009. The module III was cost effective and was also eco-friendly followed by module I which included with recommended chemicals.

During both the season's highest yield and cost benefit ratio were observed in module III which is in agreement with Dash *et al.*,2005, Dash *et al* .,2006, Karthikeyan *et al* .,2010.

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Table 1: Performance of pest management modules on Stem borer and Gall midge in rice

Module	% dead hearts			Stem borer % white ears			Gall midge % silver shoots			Yield (tha^{-1})			Incremental cost benefit ratio		
	2008	**2009**	**Mean**	**2008**	**2009**	**Mean**	**2008**	**2009**	**Mean**	**2008**	**2009**	**Mean**	**2008**	**2009**	**Mean**
I	6.7(15.0)	4.8(12.7)	5.8	5.8(13.9)	5.8(13.9)	5.8	9.9(18.3)	8.4(16.9)	9.1	5.4	5.4	5.4	1:2.03	1:3.25	1:2.64
II	10.0(18.4)	5.3(13.3)	7.6	7.6(16.0)	8.1(16.5)	7.8	9.9(18.3)	9.8(18.2)	9.9	4.5	4.5	4.5	1:1.88	1:2.81	1:2.34
III	6.78(15.1)	3.26(10.5)	5.0	7.4(15.8)	5.6(13.7)	6.5	8.2(16.6)	5.6(13.7)	6.9	5.9	6.0	5.9	1:2.38	1:3.77	1:3.08
IV	7.53(15.9)	6.79(15.1)	7.2	9.0(17.5)	6.1(14.3)	7.5	11.0(19.4)	11.1(19.5)	11.0	4.6	4.7	4.6	1:1.90	1:3.07	1:2.48
LSD (0.05)	1.0	2.1	1.6	3.0	1.1	2.0	3.1	3.2	3.2	0.6	0.6	0.6			
CV (%)	21.9	19.1	20.5	15.2	10.6	12.9	25.9	19.9	22.9	8.9	9.6	9.3			

Note: Figures in parenthesis are arc sin transformed values