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PEST ABUNDANCE IN *KHARIF* RICE AS INFULUENCED BY CULTIVATION AND PLANT PROTECTION PRACTICES

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ABSTRACT

Yellow stem borer *Scirpophaga incertulas* (Walker), hispa beetle *Dicladispa armigera* (Oliver) and leaf folder *Cnaphalocrocis medinalis* (Guenée) are some important pests observed in rice crop. An experiment was conducted in a split plot design in the College Farm, Rajendranagar with three methods of cultivation viz., transplanting, broadcasting and drum sowing as the main treatments and plant protection measures viz., organic protection, farmers' practice and no protection as sub-treatments. Two years data reveal that broadcasting plus farmers' practice resulted in significantly least incidence of deadhearts (2.05%); and white ear infestation was significantly minimum (0.45 -0.52%) in the organic protection and farmers' practice in all the main treatments and higher in the 'no protection' plots (0.59-1.18%). Leaf folder incidence was significantly least in the drum sown plus farmers' practice (0.77 folded leaves/hill) and significantly maximum in 'no protection' plots of transplanted and drum sown rice. Drum sown and broadcasted cultivation systems resulted in lesser pest incidence than the conventional transplantation methods, while farmers' practice led to lesser incidence compared to the organic protection and 'no protection' methods.

Key word:

India is the second largest producer of rice after China (Statistica, 2016). Insect pests are important factors affecting higher productivity. Yellow stem borer *Scirpophaga incertulas*, hispa beetle, *Dicladispa armigera* and leaf folder, *Cnaphalocrocis medinalis* are some of the pests observed. Cultivation techniques and plant protection measures practiced play an important role in pest dynamics. The cultivation techniques determine the canopy cover and spacing between rows and plants, thereby influencing the microclimate surrounding the pests impacting their abundance, ecology and diversity. These techniques when with protection measures impact pests and bringing out their interaction is very important for IPM Hence, the present study with a field experiment done in a split plot design with main treatments consisting of cultivation techniques viz., transplanted, broadcasted and drum sown rice, while the sub-treatments consisted of organic protection methods, farmers' practices and no protection methods.

MATERIALS AND METHODS

The experiments were laid out in a plot of 1500 m^2 at the College farm, Rajendranagar during *kharif* 2014 and 2015 with rice variety BPT 5204 in split plot design with three main modules- of different cultivation techniques viz., transplanting, broadcasting and drum sowing in plots of size 36 x 12 m each. Recommended dosages of fertilizers were applied to all these modules. Under each module, three types of plant protection measure viz., organic protection, farmers' practice and "no protection" were taken up. Transplantation, broadcasting and drum sowing were done in the last week of July.

Main module of transplanting was done with 26 days old seedlings; and in the broadcasting module, sprouted seeds were broadcast on puddled soil with very thin water film. In drum sowing module, sprouted seeds sown in the puddle soil with a very thin water film, using a drum seeder. Water level was maintained in these for the first 10-15 days after and thereafter flood irrigation was given. The sub-treatments, were as follows with each main plot divided into three subplots prepared by treatment bunds, with size being 12 x 12 m. Treatment sprays were taken up when the pest crossed the Economic Threshold Level (ETL) at 36 SMW and again at 39 SMW. Sub-treatments included organic protection (use of trichocards, pheromone traps, botanical sprays), farmers' practices (spray of

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chlorpyriphos @ 2.50 ml/l water) and 'no protection'.

Organic protection consisted of: 1. Biological control- trichocards containing *Trichogramma japonicum* pinned to the underside of the leaves @ 50,000 ha^{-1}/ release and six such releases carried out starting at 35 days after transplantation. *T. chilonis* cards were also pinned to the leaves @ 50,000 ha^{-1}/ release and six such releases carried out starting at 37 standard week at the time of the second spray when leaf folder adults were noticed in the field; 2. Use of pheromone traps- pheromone traps from M/s. Agri Life Ltd., Bollaram, Medak dist., installed at 30 DAT, with the lure changed once every 22 days till 70 DAT; and 3. Botanicals- sprays of neem oil 1.0% given when the pest crossed economic threshold level once at 36 SMW and again at 39 SMW. Farmers' practices sub-treatment included: carbofuran 3G granules applied one week before pulling of nursery applied @ 200 g/cent of nursery in the transplantation module plots; in the broadcasted and drum sown rice, carbofuran 3G applied at 30 days after sowing @ 25 kg/ha. In addition, foliar sprays of chlorpyriphos @ 2.50 ml/l water given when the pests crossed the Economic Threshold Level (ETL) once at 36 SMW and again at 39 SMW. No protection sub-treatment remained untreated.

Weekly observations on the populations of pests were made in the morning hours between 7.00 and 9.00 a.m. in five quadrats (1 x 1m)/ plot from 30 to 120 DAT; in each plot, the metal quadrat was placed in the four corners and in the centre to get a uniform count of the insects. For *S. incertulas*, at each weekly count, the number of deadhearts and healthy tillers were counted till 41 SMW. Dead hearts were removed from the infested tillers so that only fresh infestation could be realized at each observation. And when white ears appeared, counts were taken on the total number of healthy ears and the white ears till 47 SMW. For *C. medinalis,* number of fully folded leaves in each quadrat was counted from 34 to 47 SMW. Folded leaves were removed from the infested hills so that only fresh infestation is realized at each observation. For *D. armigera,* number of adults in each quadrat was counted. These weekly population means were pooled and pooled mean was computed. In addition, counts were taken one day before and three, seven and fifteen days after each spray. Weekly means of pest in different treatments were computed, transformed and the transformed values were subjected to ANOVA by INDOSTAT Package.

RESULTS AND DISCUSSION

Scirpophaga incertulas

Incidence was observed as early as 30 days after transplantation and two peaks were observed, first at 44 DAT coinciding with the second week of September and second in the first week of October, when treatment sprays were taken up. Analysis of pooled data revealed that deadheart incidence was significantly lowest in farmers' practices of broadcasted plots (2.05%) followed by transplanted plots (2.22%) and drum sown plots (2.15%). In the organic protection plots, significantly higher damage ranging from 2.48-2.54% was recorded (Table 1; Fig. 1, 2). The 'no protection' plots recorded maximum damage of 4.26-4.55%. This indicated that the impact of plant protection measures on pest abundance was more than that of the establishment methods.

Insecticides used in the farmers' practices could manage the pest successfully. Organic protection and farmers' practices plots under all the modules tested registered significantly lower incidence of white ears (0.45-0.52%) and it was on par with unprotected drum sown rice which recorded 0.59% white ears. Significantly higher (0.71%) white ear damage was recorded in unprotected broadcasted plots. Broadcasted and drum sown techniques offered considerable spacing between the plants. This coupled with organic plant protection practices suppressed the pest better. Organic protection plots though recorded higher deadhearts in the vegetative stage registered lesser white ears later indicating a slow but successful pest suppression. Transplanted plots registered higher incidence of deadhearts and white ears.

Similar results had been reported by Rillon and Justo (1998) who found that transplanted rice crops harboured significantly higher whitehead (stem borer injury) resulting in significantly lower yields. However, Chavan et al. (2013) reported that deadheart infestation was significantly higher in drilled paddy than transplanted paddy. Kakde and Patel (2014) recorded peak damage in the first week of October in transplanted rice and in the first week of August in the SRI rice method. Kumar and Sudhakar (2001) found the peak activity to be in second fortnight of October during *kharif* season at Rajendranagar, Hyderabad.

Cnaphalocrocis medinalis

Incidence was observed from 50 DAT though the population was very less. It built up gradually by

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Table 1. Influence of cultivation technique and plant protection measures on rice pests (pooled data)

Treatments	Treatment means (pooled means)			
	Scirpophaga incertulas		*Cnaphalocrocis medinalis**	*Dicladispa armigera**
	Dead Hearts (%)*	White ears (%)*		
Cultivation technique				
M1 Transplanted rice	3.10 (5.22)	0.71 (2.49)^{c}	1.53 (3.74)^{c}	2.10 (4.20)^{b}
M2 Broadcasted rice	3.02 (5.08)	0.53 (2.19)^{b}	1.32 (3.48)^{b}	2.09 (4.22)^{b}
M3 Drum sown rice	3.09 (5.16)	0.44 (2.14)^{a}	1.28 (3.43)^{a}	1.57 (3.69)^{a}
CD (0.05)	NS	0.1	0.02	0.04
SEm±	0.05	0.002	0.01	0.007
Plant Protection measure				
S1 Organic protection	2.53 (4.75)^{b}	0.50 (2.07)^{a}	1.31 (3.49)^{b}	1.49 (3.66)^{b}
S2 Farmers' Practices	2.18 (4.39)^{a}	0.43 (2.01)^{a}	0.99 (3.07)^{a}	1.09 (3.13)^{a}
S3 No Protection	4.52 (6.32)^{c}	0.75 (2.68)^{b}	1.82 (4.08)^{c}	3.12 (5.32)^{c}
CD (0.05)	0.04	0.1	0.04	0.02
SEm±	0.01	0.04	0.01	0.009
Interaction Effects (M X S)				
Main at same level or different level sub				
Transplanted organic protection	2.54 (1.59)^{c}	0.49 (0.69)^{a}	1.52 (1.26)^{d}	1.63 (1.28)^{f}
Transplanted farmers' practices	2.22 (1.49)^{b}	0.52 (0.72)^{a}	1.17 (1.08)^{c}	1.04 (1.02)^{b}
Transplanted 'no protection'	4.55 (2.13)^{e}	1.18 (1.09)^{c}	1.89 (1.40)^{f}	3.63 (1.91)^{i}
Broadcasted organic protection	2.51 (1.59)^{c}	0.45 (0.67)^{a}	1.21 (1.13)^{c}	1.49 (1.22)^{e}
Broadcasted farmers' practices	2.05 (1.43)^{a}	0.46 (0.68)^{a}	1.03 (1.03)^{b}	1.24 (1.12)^{c}
Broadcasted 'no protection'	4.26 (2.06)^{d}	0.71 (0.84)^{b}	1.73 (1.32)^{e}	3.54 (1.88)^{h}
Drum sown organic protection	2.48 (1.57)^{c}	0.50 (0.71)^{a}	1.21 (1.11)^{c}	1.34 (1.16)^{d}
Drum sown farmers' practices	2.15 (1.46)^{b}	0.46 (0.68)^{a}	0.77 (0.96)^{a}	1.00 (1.00)^{a}
Drum sown 'no protection'	4.52 (2.13)^{e}	0.59 (0.76)^{ab}	1.86 (1.36)^{f}	2.36 (1.54)^{g}
CD (0.05)	0.07	0.18	0.08	0.03
SEm±	0.02	0.09	0.03	0.01

* Figures in parentheses square root transformed values; Means with the same letter not significantly different

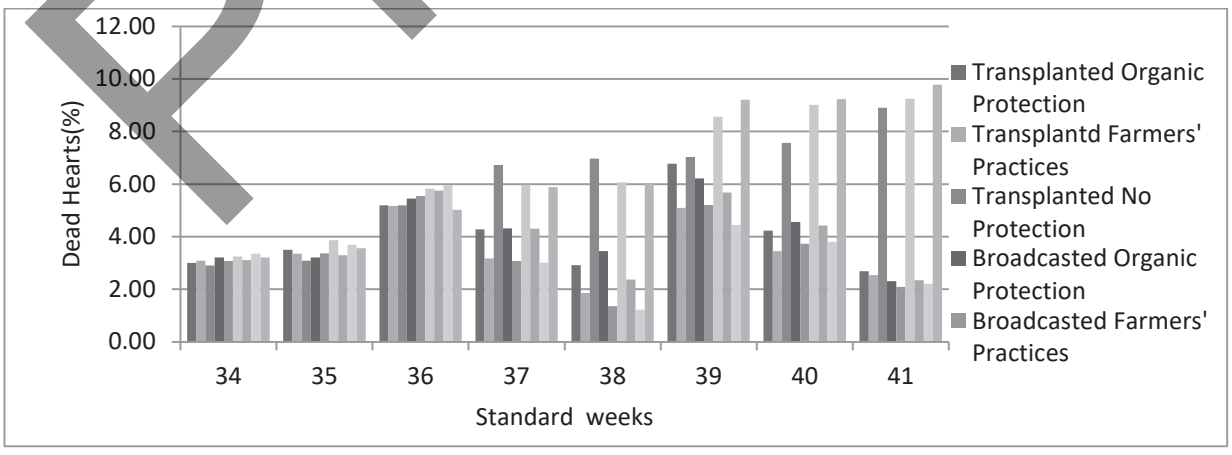

Fig.1. Dead hearts by S.incertulas in different treatments (pooled data)

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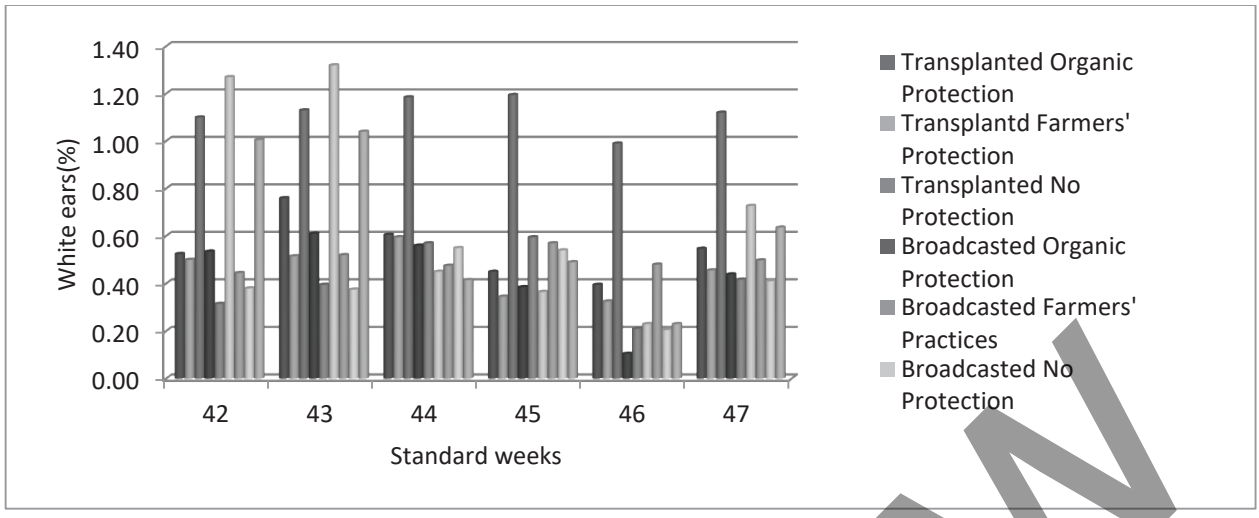

Fig. 2. White ears caused by S.incertulas (pooled data)

60 DAT, when spraying was taken up. Pooled data indicated that plots with drum sown rice protected with farmers' practices had significantly lesser incidence (0.77 folded leaves/hill) followed by farmers' practices in broadcasted rice (1.03 folded leaves/hill) (Table 1; Fig. 3). Insecticide treatments proved to be successful in suppressing leaf folder. Organically protected plots in all methods were the next better. It was followed by transplanted organic protection rice, and then unprotected broadcasted rice. Unprotected drum sown and transplanted rice recorded significantly highest leaf folder damage.

In contrast, Kakde and Patel (2015) observed that conventional rice growing method led to 2.30% incidence, while SRI method recorded 2.66% in the last week of September which was the peak period. Gole (2012) recorded the least leaf damage in Standard Transplanting Method (STP) compared to SRI and was found it to be significantly superior.

Dicladispa armigera

This caused damage from 10 DAT, and continued till the end of the crop. Drum sown cultivation technique with farmers' practices registered significantly lesser population. Pooled data in Table 1 and Fig. 4 revealed that the farmers' practices in drum sown plots showed the least incidence (1.00 beetles/quadrat) followed by farmers' practices in transplanted (1.04 beetles/quadrat) and broadcasted plots (1.24 beetles/quadrat).

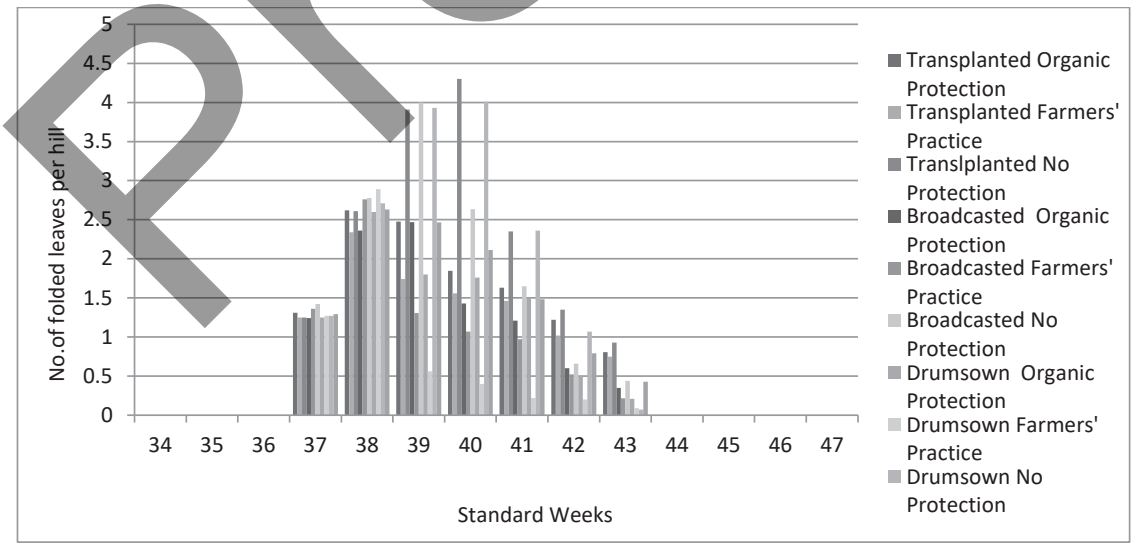

Fig. 3. Incidence of C.medinalis (pooled data)

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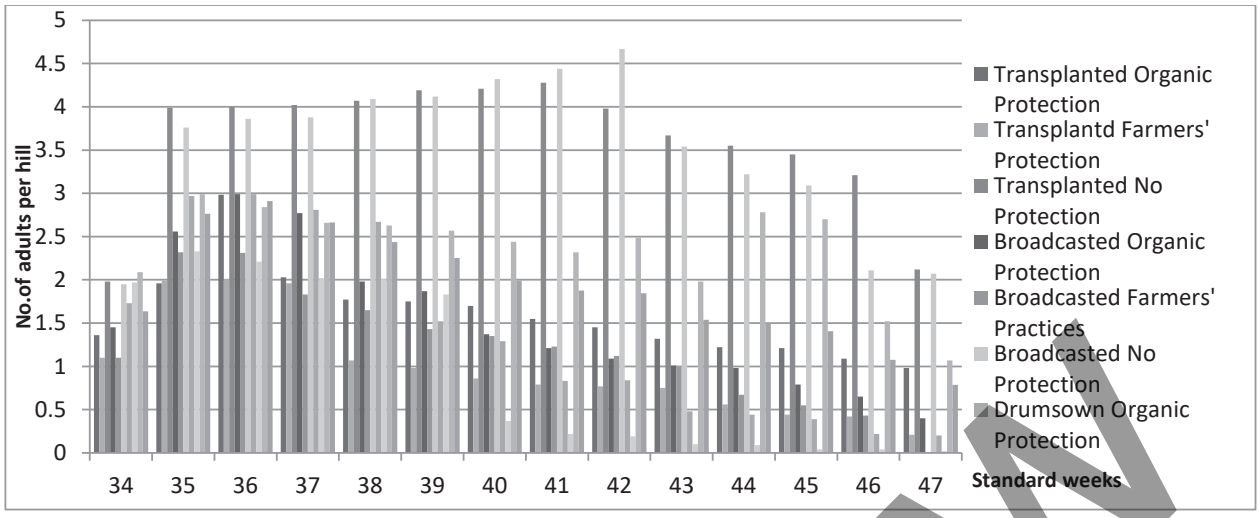

Fig.4. Incidence of D. armigera (pooled data)

Insecticide treatments led to least populations of beetles. Significantly maximum population of 3.63 adults/hill was observed in unprotected transplanted rice crop. Similar results were reported by Hossain and Rabbi (2002) who obtained significantly higher mortality with neem oil (4%). Chakraborty and Deb (2012) observed 0.17+0.12 to 7.45+2.61 adults/hill in the Dinajpur area, West Bengal.

Cultivation techniques thus influenced the abundance of pests. It was observed that among the two factors viz., cultivation technique and plant protection measures, the latter had a greater. Cultivation techniques modify the microclimate and impact pest populations. Their interaction effects have a bearing on pest abundance and crop damage. Chemical treatments showed their superiority in pest reduction in the farmers' practices plots. In general, direct seeded rice is affected by similar pests and diseases as transplanted rice; however, under some conditions there may be greater chance of outbreak of insect pests and diseases in direct seeded rice with high rice plant densities (Joshi et al., 2013). Sometimes the attack of insect pests is reduced in direct seeded rice compared to transplanted rice (Oyediran and Heinrichs, 2001). This transition from transplanted rice to direct seeded rice also changes the mineral nutrients dynamics of soil, for example, the availability of most micro elements is reduced in direct seeded rice. Direct sowing will reduce the cost of cultivation to an extent of Rs 9,166/ha by avoiding nursery raising and also due to reduction in cost of transplanting. Row sowing facilitated to take up fertilizer application, plant protection measures and weed control in an efficient manner (Chandrasekhar Rao et al., 2013. In addition, they reported that, crop duration was reduced by 8-10 days and more area is covered/ unit time. Direct seeded rice with suitable conservation practices has potential to produce slightly lower or comparable yields as that of transplanted rice and appears to be a viable alternative to overcome the problem and water shortage (Joshi et al., 2013).

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