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EFFECT OF AGRONOMIC PRACTICES ON YELLOW RICE STEM BORER, *SCIRPOPHAGA INCERTULAS* (WALKER)

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ABSTRACT

The experiments were conducted to study the effect of agronomic practices like cutting heights of stubbles and post-harvest cultural practices on the survival and mortality of hibernating immature stages of yellow rice stem borer (YRSB), *Scirpophaga incertulus* (Walker). Rice stubbles at different heights i.e. 5,10,15,20 25 and 35 cm were cut above soil surface .The results indicate that as stubble height increased, the larval population decreased. No significant difference of larval population was observed between 15.00 and 20.00 cm of stubble above the soil surface. Highly significant difference was noted in the different heights of stubbles of paddy. Maximum population was noted in stubble height of 15.00 cm. The result also indicates that the harvesting at 15.00 to 20.00 cm above soil surface is recommended, because not only density of larval and pupal population is reduced but it also provides good quality straw for feeding animals. The results of post-harvest cultural practice revealed that in the ploughed rice field, lower number of larvae and pupae, and higher mortality was observed as compared with un-ploughed field. The rice field should not be left fallow or cultivated without plough. Moldboard (MB) plough uproots paddy stubbles which resulted in drying and tearing of stubbles and caused mortality of hibernating larvae of *S.incertulas.*

Keywords: Cutting heights, Post-harvest practices, stubbles, YRSB.

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important crop in the world, providing food for nearly half of the global population (FAO, 2004). It is a key source of employment and income for rural people, who live in developing countries. Rice is grown on over 145 million hectares in more than 110 countries. It occupies one fifth of the world crop land under cereal (Pathak and Khan, 1994). Almost 90% of the rice is grown and consumed in Asia. It is used as a food for more than two billion people in developing countries of Asia (FAO, 1995; Khush and Brar, 2002). Rice plays an important role in the economy of Pakistan. It is a major foreign exchange earner. Rice comes next to wheat as the staple diet and second cash crop become next to cotton crop in Pakistan (Shafique and Ashraf, 2007). About

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23% of the total foreign exchange is shared by rice (Salim *et al*., 2003; Bhutto *et al*., 2007). The rice plant is subject to attack by more than hundred species of insects, twenty of them can cause economic damage (Chatterjee and Maiti, 1979). They infest all parts of plants, at all growth stages (Pathak and Khan, 1994). Among them, the rice stem borers are the main devastators, which are responsible for economic crop losses in Pakistan (Mahar and Hakro, 1979). Among the stem borers, yellow rice stem borer, *Scirpohaga incerulas* (Walker) is the most destructive insect pests of rice crop (Mahar *et al.,* 1985). Globally, yellow rice stem borer alone causes yield losses of 10 million tons and accounts for 50% of all insecticides used in rice field (Huesing and English, 2004). This insect attacks rice crop from the seedling to the harvesting stage and thus causes complete loss of affected tillers (Salim and Masih, 1987). Deadhearts are produced when the insect attacks at vegetative stage while whiteheads occur when the stem borer attack at time of heading (Mahmood-ur-Rehman *et al*., 2007). In Pakistan, the yield loss attribute to insect pests was estimated about 15-17% (Hashmi, 1994). Yellow rice stem borer *S. incertulas* is responsible for a steady annual damage of 15-10% of the rice crop with local catastrophic outbreaks of up to 60% damage (Catling and Islam, 1981; Pathak and Khan 1994; Daryaei, 2005).The major tool to control insect pest is the use of chemical insecticides. Indiscriminate use of pesticides has caused major outbreaks of insects pests. In the last three decades, only attention was paid to chemical control of pests in Pakistan. Integrated pest management (IPM) offers promise to reduce dependence on pesticides. Pest management is an intelligent selection and use of pest management tactics by taking into consideration appropriate economics, ecological and sociological factors (Salim *et al.,* 2003). Nevertheless, insect pest management in rice crop can be successfully adopted to keep this insect within economic limits. Cultural control is the most important component of IPM. The aim of this study was to minimize population of YRSB through cultural practices like the effect of various cutting heights of stubbles of rice crop and the post-harvest operation on hibernating immature stages of YRSB.

MATERIALS AND METHODS

Different cuttings of stubble height

The experiment was conducted at experimental area of Rice Research Institute, Dokri. Sindh, Pakistan. Rice variety Basmati-370 (aromatic) was transplanted. Six levels of stubble cuttings, viz: 5, 10, 15, 20, 25 and 35 cm above soil surface were done. Randomly twenty-five stubbles from each cutting was taken immediately after harvesting and examined in laboratory. The collected stubbles were dissected with sharp knife from top to bottom and soil of the stubbles was also examined. Live and dead larvae and pupae were counted. Mortality percentage of larvae and pupae was calculated. The infestation percentage caused by *S. incertulas* was recorded and calculated by using Abbott formula (Abbott, 1925). The data was analyzed using statistical program Minitab (Minitab, 1993).

Abbott formula

$$\frac{X}{Y} \times \frac{X_1}{Y_1} \times 100$$

(X = Infested Plants, Y= Total Observed Plants, X1 = Infested Tillers, Y1 = Healthy Tillers)

Post harvest cultural practices

Experiment was conducted at experimental area of Rice Research Institute, Dokri, Sindh, Pakistan.
Following five cultural practices were adopted:

1. Moldboard (MB) ploughed and kept fallow,
2. MB ploughed and cultivated with wheat (*Triticum astivium* L.)
3. Un-ploughed and kept fallow
4. Un-ploughed and cultivated pea (*Pisum sativum* L.)
5. Un-ploughed and cultivated mustard (*Brassica compestris* L.)

Investigations were conducted to determine the effect of cultural practices on survival and mortality of immature stages of yellow rice stem borer, *S. incertulas.* Each post-harvest practice was conducted on an area of 1000 m^2. Twenty-five stubbles from each post-harvest practice were randomly collected from the field and examined in laboratory. The collected stubbles were dissected with sharp knife from top to bottom and soil of the stubbles was also examined. Number of live and dead larvae and pupae were recorded. Mortality percentage of larvae and pupae was calculated. The infestation percentage caused by *S. incertulas* was recorded and calculated according to Abbott formula (Abbott, 1925). The data was statistically analyzed using statistical program Minitab (Minitab, 1993).

RESULTS AND DISCUSSION

Six different levels of stubbles cuttings (5.00, 10.00, 15.00, 20.00, 25.00 and 35.00 cm) from soil surface were examined in laboratory. The results revealed that larval and pupal population was 28, 25, 22, 22, 16 and 16, and pupal population was 9, 8, 9, 10, 15 and 16 (25 stubbles/each post-harvest practice) on the stubbles height 5.00, 10.00, 15.00, 20.00, 25.00 and 35.00 cm, respectively. As stubbles height increased, larval populations decreased and it was lower at 25 and 35 cm (Fig.1). Practically, lower the size of stubbles cutting, less larval population was recorded. The harvest closer to ground level is not preferred, as the straw becomes poor in quality for feeding domestic animals. Rehman *et al.* (2002) reported that mature larvae of yellow rice stem borer pass the winter in the rice stubbles in a stage of diapauses and as warm weather begins in April-May, the larvae pupate. No significant differences in larval populations were observed between 15.00 and 20.00 cm and 25 and 35cm (Fig.1). Highly significant difference was observed for larval (F = 201.80; DF= 5, 10; P<0.0001) and pupal (F=211.80; DF=5, 10; P< 0.0001) population of yellow rice stem borer in the different heights of stubbles of paddy. Dead larvae and pupae of *S. incertulas* were observed in different heights of stubbles given in Fig. 2.

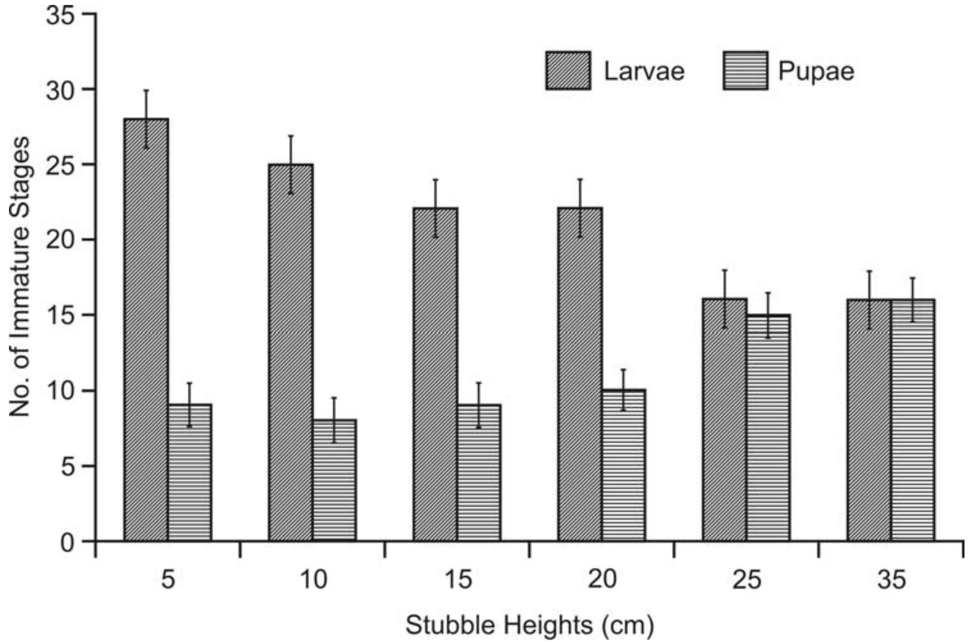

Figure 1. Larval and pupal population found in the different heights of stubbles.

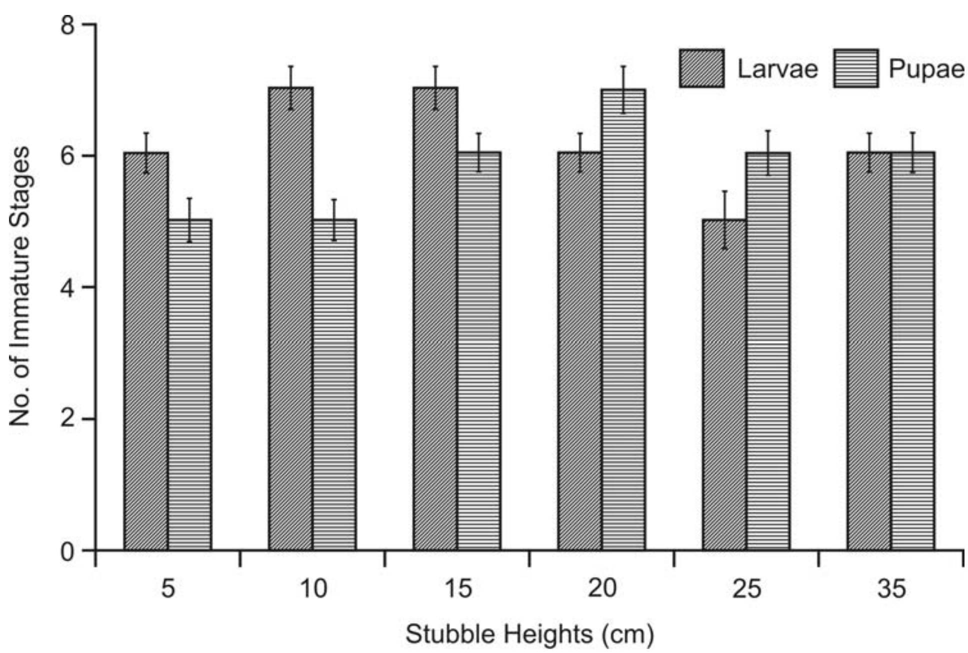

Figure 2. Dead (D) larval and pupal population found in the different heights of stubbles.

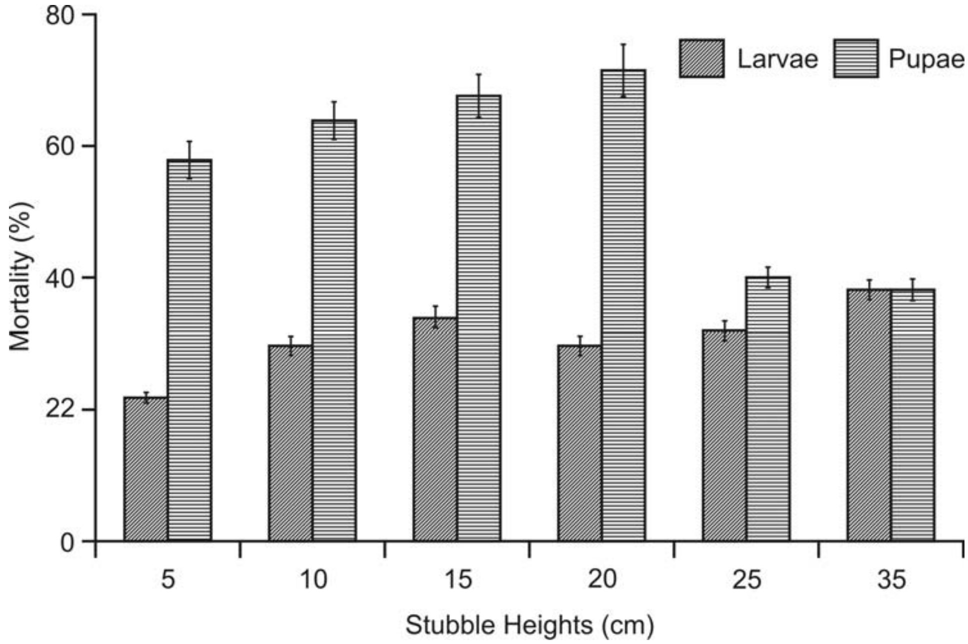

Figure 3. Larval and pupal mortality percentage in the different heights of stubbles.

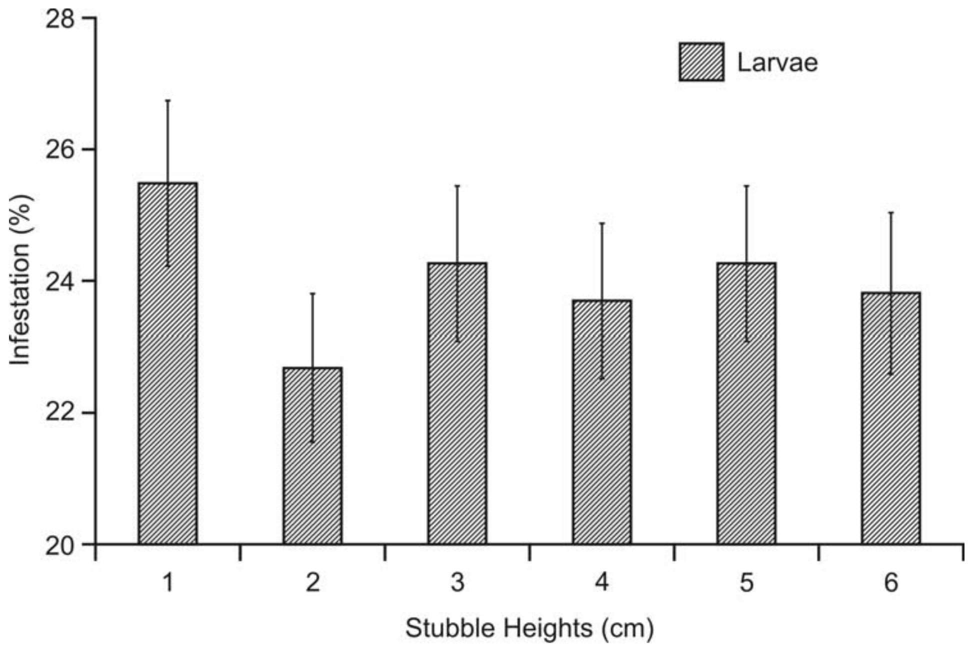

Figure 4. The infestation percentage during harvest in the different heights of stubbles.

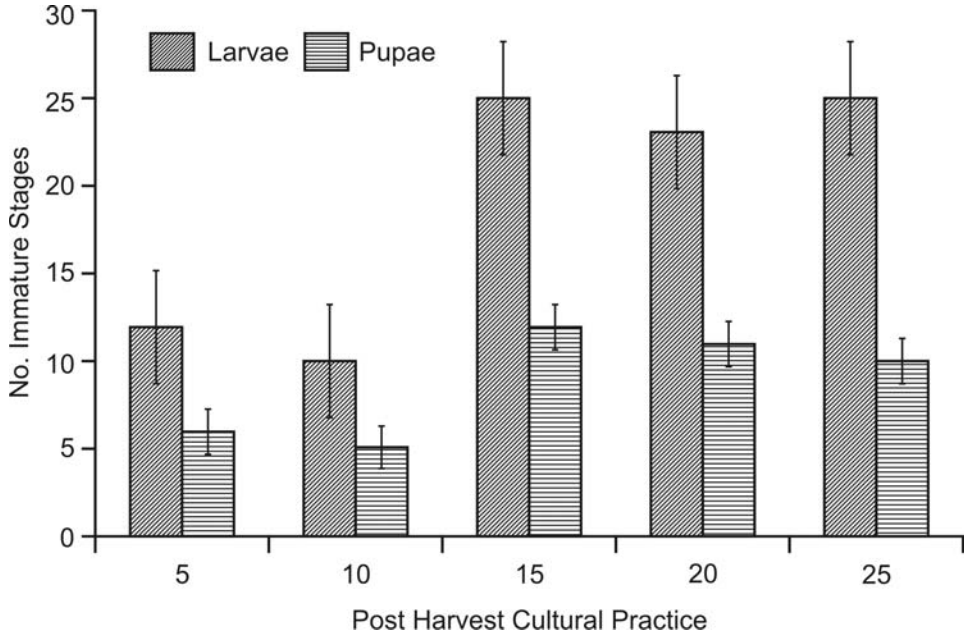

Figure 5. Effect of post-harvest cultural practices on larval and pupal population.

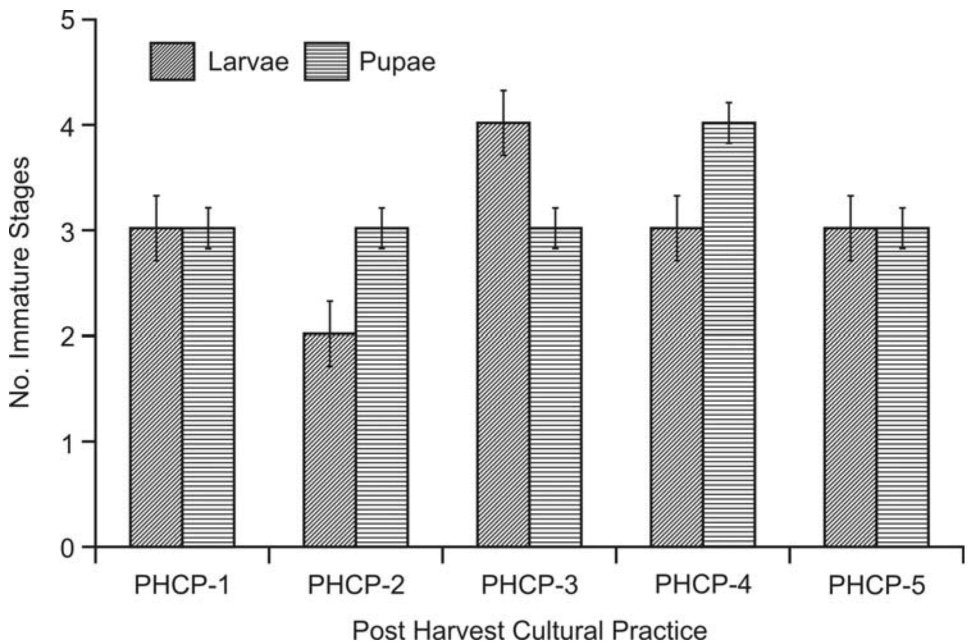

Figure 6. Effect of post-harvest cultural practices on dead larval and pupal population.

The maximum number of larvae (28) was recorded at stubble height 5.00cm above soil surface. Maximum pupal populations were noted on stubble height 35.00 cm (16.00) and also highest mortality of pupae was observed on 20.00 cm (70.00%) (Fig. 2) and (Fig. 3).

Infestation percentage caused by yellow rice stem borer, *S. incertulas* in the different heights of stubbles was observed by using Abbott formula (Abbott, 1925) and results are given in Fig. 4. No significant difference of pupal population of yellow rice stem borer was recorded on the cutting 5.00cm and 15.00 cm, whereas slight difference was observed between 15.00 and 20.00cm. The results indicated that the harvesting of stubbles at 15.00 to 20.00 cm above soil surface is recommended because of low larval and pupal population density as well provide good quality straw for feeding animals. Highly significant difference ($F=10.13$; $DF=2, 4$; $P<0.0001$ larvae and $F=32.67$; $DF=2, 4$; $P<0.0001$ pupae) was noted in the post-harvest cultural practices in both larval and pupal population of yellow rice stem borer.

The results revealed that larval population in cultural practice MB ploughed and kept fallow, and MB ploughed and cultivated wheat similar. No significant difference was noted between cultural practices un-ploughed fallow, un-ploughed and cultivated pea and un-ploughed and cultivated mustard (Fig. 5) Number of dead larvae and pupae were recorded and no significant difference was observed (Fig. 6). The maximum larval mortality was recorded in cultural practice of MB ploughed and kept fallow and MB ploughed cultivated wheat. Pupal mortality was also noted in these cultural practice. High number of larvae of *S. incertulas* was found in fallow (un-ploughed) field than ploughed field (Rehman *et al.,* 2002). The least larval (12.00%) and pupal 30.00% mortality were recorded in the un-ploughed and cultivated mustard.

CONCLUSION

The results revealed that lower number of larvae and pupae and higher mortality was recorded in the ploughed rice field as compared with un-ploughed field. The result suggested that rice field should not be left un-ploughed (fallow or cultivated). Lower densities and higher mortalities of *S. incertulas* were noted in ploughed rice fields due to drying and tearing of stubbles. This is very effective tool in reducing the hibernating larvae of yellow rice stem borer.

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