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Incidence of the Pink Noctuid Stem Borer, *Sesamia inferens* (Walker), on Wheat under Two Tillage Conditions and Three Sowing Dates in North-western Plains of India

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ABSTRACT

The pink stem borer, *Sesamia inferens* (Walker) (Lepidoptera: Noctuidae) is emerging as an important pest of wheat in India due to change in tillage system. It causes severe damage by forming "dead hearts" at seedling stage and "white ears" at ear-head stage. Studies were undertaken to know the effect of different tillage conditions and date of sowing on the incidence and damage caused by pink stem borer. The experiment was configurated in split block design with tillage conditions as main plot treatment and dates of sowing as sub plot treatment. Both tillage conditions and dates of sowing have significant effect on the incidence and damage caused of pink stem borer. However, effect of tillage conditions on yield was non-significant. Interaction of tillage conditions and dates of sowing indicated that there was no significant difference between two tillage conditions for pink stem borer incidence in the timely sown crop but it was higher in zero tillage if the crop was sown earlier or later than the recommended time period.

Key words: *Sesamia inferens* (Walker), tillage conditions, dates of sowing, rice wheat system, North-Western plains of India

INTRODUCTION

Wheat is the principal cereal crop of India and last year it was grown on 29.24 million hectares with annual production 85.92 million tonnes of food grains (Anonymous, 2011). This system of wheat cultivation has the immediate advantage of reduced cost of tillage. The pest scenario of wheat is also undergoing change with the change in tillage system. Bacterial leaf blight *Xanthomonas oryzae* pv. *oryzae* (Akhtar *et al*., 2003) and pink stem borer *Sesamia inferens* (Walker) (Lepidoptera: Noctuidae) originally a pest of rice (Pathak and Khan, 1994) became an important pest of wheat causing severe damage (Singh, 1986; Nagrajan, 1989) due to the adoption of zero tillage system of sowing crop in North-Western plains of India.

Nagrajan (1989) and Singh (1986) described it as a well-established pest of wheat. S. inferens occasionally causes heavy losses in restricted areas. From an estimate it was found that every one percent increase in stem borers' incidence at the vegetative phase resulted in a loss of 0.28% yield in rice (Jaipal *et al*., 2005). In Rajasthan (India), 5.7 to 11.1% infestation of pink stem borer has been recorded in wheat varietal trials (Singh, 1986). Very few sources of resistance (BAW 743 and BAW 769) are available in literature against this pest (Ahad *et al*., 2002). Signs of its damage in wheat are similar to those recorded in rice and damage caused by larvae of this insect is expressed as "dead hearts" at seedling stage and "white ears" at ear-head stage (Deol, 2002).

A lot of work on the effect of tillage conditions on agronomic parameter is available in literature (Azam *et al*., 2008; Erdem *et al*., 2006; Khuhro *et al*., 2002) but very little information

is available regarding their effect on insect pests. Thus survey were carried out on wheat grown under different tillage conditions in the past few years which indicated medium to high damage caused by pink stem borer in sporadic early sown zero tilled wheat fields in north-western plains of India (Anonymous, 2008). The present studies were also undertaken to know the effect of different tillage conditions and dates of sowing on the incidence and damage caused by pink stem borer in wheat.

MATERIALS AND METHODS

First of all to confirm the insect species, twenty dead hearts from different locations in non experimental plots were collected and excised with sharp knife and the larvae were collected in vial containing 75% alcohol. These were taken to Wheat Entomological Laboratory, Department Punjab Agricultural University, Ludhiana and were observed with unaided eye and also under simple microscope.

Incidence of Pink stem borer in two tillage conditions and three dates of sowing: The field studies were carried out at Experimental Area, Department of Plant Breeding and Genetics, Punjab Agricultural University, Ludhiana, India (30°55'N 75°54'E, 247 m above the sea level) on sandy loam soil using spring wheat cultivar PBW 343 during 2007-08 and 2008-09. The experiment was conducted in the field where no insecticide was used in preceding rice crop for the control of insect pest. The preceding rice crop was sickle- harvested and the height of rice stubbles left in the field was about 6-8 inches. The crops were sown in 25 sq m plots in conventional and zero tillage conditions at three different dates of sowing viz., early (before 25 October), timely (25 October to 25 November) and late (after 25 November) following recommended agronomic practices (Anonymous, 2009). The experiment was configurated in split block design with three replications. The tillage conditions were main plot treatment and dates of sowing were sub plot treatment. The observations on the pink stem borer incidence were recorded randomly from five spots in each plot by counting damaged and total number of tillers from one metre row lengths. The data was recorded at weekly intervals during January, February and March during 2008 and 2009. The grain yield data was recorded on whole plot basis and converted in q ha^{-1}.

Data analysis: The data on incidence of pink stem borer in different tillage conditions and dates of sowing was subjected to analysis of variance (ANOVA) in split plot design following square root transformation and the means were compared using Least Significant Differences ($p = 0.05$).

RESULTS AND DISCUSSION

It was observed that all the larvae collected from the non experimental plots belonged of S. inferens and no other species of stem borer was observed to attack wheat crop. The incidence of pink stem borer and damaged caused by it was shown in the Fig. 1 and 2. After causing damage to one tiller of young wheat seedling, the larvae of this insect shifted to nearby tillers resulting similar damage. The damage caused by this insect was localized in certain pockets of wheat fields and it was not randomly distributed in the field.

Treatments effect on incidence of pink stem borer and yield of wheat were almost similar during 2007-08 and 2008-09. The years were analyzed separately because the year effect was highly significant (<0.0001). Both tillage conditions (A) and dates of sowing (B) have significant effect on the incidence of pink stem borer. However, effect of tillage conditions on yield was non-significant.

Fig. 1: Larva of pink stem borer (*Sesamia inferens*) causing damage to wheat crop

Fig. 2: Pink stem borer damaged wheat crop

Interaction effect (tillage conditions x dates of sowing) for the pink stem borer incidence was significant for both the years except January 2008, whereas for yield, the interaction were non-significant during both years (Table 1).

Incidence of pink stem borer in different tillage conditions: The effect of tillage conditions on the incidence of pink stem borer was significant during 2008-09 although it was non-significant in the month of February and March during 2007-08 (Table 2). The mean incidence of pink stem borer was more in zero tillage plots as compared to conventional tillage. Higher incidence of pink stem borer in zero tillage was also reported by Razzaq *et al*. (1997) and he attributed it to higher number of infested stubbles in no tillage field. The incidence of pink stem borer was also observed in conventional tillage plots. It may be due to the reason that conventional tillage did not completely destroy the rice stubbles and they remained in field even after ploughing several times as described by Inayatullah *et al*. (1989). The yield data indicated non-significant difference between tillage conditions although it was numerically more in conventional tillage as compared

Table 1: Level of significance for the incidence of pink stem borer (*Sesamia inferens*) and yield of wheat for tillage conditions and dates of sowing

	Pink stem borer incidence (%damage)							
	2007-08			2008-09			Yield (q ha^{-1})	
Treatment factors	January	February	March	January	February	March	2007-08	2008-09
Tillage conditions (A)	0.000097	-	-	0.00065	0.0025	0.00	-	-
Date of sowing (B)	-	0.00079	0.011	0.000089	0.0012	0.0045	0.0011	0.0035
Interaction (A×B)	-	0.00097	0.0030	0.0054	0.037	0.079	-	-

Table 2: Incidence of pink stem borer (*Sesamia inferens*) under different tillage conditions

	Incidence of pink stem borer (per cent dead heart)			
Treatments	January	February	March	Yield (q ha^{-1})
2007-08				
Conventional tillage	1.81(1.58)	3.14 (1.92)	0.44 (1.19)	40.69
Zero tillage	4.44 (2.28)	4.81 (2.35)	0.88 (1.36)	38.37
LSD (p = 0.05)	0.41	NS	NS	NS
2008-09				
Conventional tillage	2.02(1.73)	2.86 (1.95)	1.91 (1.70)	27.04
Zero tillage	3.88 (2.18)	4.66 (2.35)	3.48 (2.10)	24.36
LSD (p = 0.05)	0.36	0.39	0.13	NS

Values within parentheses are square root transformed mean, NS: Not signigicant

to zero tillage. In the month of January, the wheat is in tillering stage and side tillers emerged after incidence of pink stem borer might have compensated some of the crop-loss. This might be one of the reasons for non-significant difference in yield. Earlier, Jaipal *et al.* (2005) also reported compensatory tillering in pink stem borer infested wheat crop in Uchana (Haryana, India).

Incidence of pink stem borer in different dates of sowing: The early sown wheat crop suffered higher incidence of pink stem borer as compared to timely and late sown crop except during January 2008, where it was non-significant among different dates of sowing (Table 3). In general, Pimentel and Goodman (1978) described that early plantings escape pest colonization but it was not true in case of pink stem borer where it increased in early sown crop. This may be due to the reason that pink stem borer found host quite early in early sown conditions and start feeding on it. Whereas in timely and late sown wheat crop, the pest population get reduced due to lack of host crop and various other abiotic and biotic factors like picking of larvae by birds.

The incidence of pink stem borer increased in both tillage conditions till the month of February and thereafter it decreased. This might be due to the reason that first generation larvae of pink stem borer reached in their late instars in the month of February where they caused maximum damage to the wheat crop and thereafter they underwent pupation. The subsequent damage to wheat crop was in late March and it was due to the next generation of pink stem borer larvae. Comparatively higher incidence of pink stem borer in the month of March in late sown crop may also be attributed to the second generation larvae of pink stem borer. Singh (1986) also noticed higher incidence of pink stem borer in late sown wheat.

Table 3: Incidence of pink stem borer (*Sesamia inferens*) in different date of sowing

Treatments	Incidence of pink stem borer (per cent dead heart) January	February	March	Yield (q ha^{-1})
2007-08				
Early sown	4.94 (2.41)	6.16 (2.64)	0.66 (1.28)	44.34
Timely sown	2.27 (1.73)	3.16 (2.00)	0.99 (1.38)	40.23
Late sown	2.16 (1.65)	2.60 (1.76)	2.60 (1.76)	34.02
LSD (p = 0.05)	NS	0.33	0.29	4.04
2008-09				
Early sown	4.03 (2.21)	5.16 (2.46)	3.50 (2.10)	28.03
Timely sown	2.10 (1.75)	2.60 (1.89)	2.10 (1.75)	26.77
Late sown	2.73 (1.90)	3.53 (2.09)	2.50 (1.85)	22.23
LSD (p = 0.05)	0.32	0.22	0.18	2.82

Values within parentheses are square root transformed mean

Table 4: Interaction effect of tillage condition and date of sowing on the incidence of pink stem borer (per cent dead hearts) and grain yield (q ha^{-1})

Time of observations	Tillage conditions	Date of sowing Early	Timely	Late
January, 2008	Conventional tillage	3.96 (2.22)	0.88 (1.32)	0.55 (1.21)
	Zero tillage	5.88 (2.60)	3.66 (1.80)	3.77 (2.09)
	LSD (p = 0.05)	NS	NS	NS
February, 2008	Conventional tillage	5.22 (2.48)	3.99 (2.20)	0.22 (1.09)
	Zero tillage	7.11 (2.80)	2.32 (1.80)	4.99 (2.44)
	LSD (p = 0.05)	0.46	0.46	0.46
March, 2008	Conventional tillage	0.44 (1.19)	0.88 (1.34)	0.33 (1.14)
	Zero tillage	0.88 (1.36)	1.10 (1.42)	4.88 (2.39)
	LSD (p = 0.05)	0.41	0.41	0.41
2008 grain yield (q ha^{-1})	Conventional tillage	44.83	41.13	36.12
	Zero tillage	43.85	39.33	31.92
	LSD (p = 0.05)	NS	NS	NS
January, 2009	Conventional tillage	2.60 (1.89)	1.80 (1.67)	1.66 (1.63)
	Zero tillage	5.46 (2.54)	2.40 (1.84)	3.80 (2.18)
	LSD (p = 0.05)	0.17	0.17	0.17
February, 2009	Conventional tillage	4.06 (2.25)	2.46 (1.85)	2.06 (1.74)
	Zero tillage	6.26 (2.68)	2.73 (1.93)	5.00 (2.44)
	LSD (p = 0.05)	0.32	0.32	0.32
March, 2009	Conventional tillage	2.33 (1.82)	1.73 (1.64)	1.66 (1.62)
	Zero tillage	4.66 (2.37)	2.46 (1.86)	3.33 (2.07)
	LSD (p = 0.05)	NS	NS	NS
2009 grain yield (q ha^{-1})	Conventional tillage	28.64	29.43	22.93
	Zero tillage	27.43	24.12	21.53
	LSD (p = 0.05)	NS	NS	NS

The yield data indicated significant differences among different dates of sowing. It was more in early sown crop, followed by timely sown and late sown crop. Although pink stem borer damage contributed to the difference in yield in different dates of sowing, yet it was more due to the effect of dates of sowing because the early and the timely sown crop has more duration to complete its life cycle as compared to the late sown crop.

Interaction effect of tillage conditions and dates of sowing: The interaction effect of tillage conditions and dates of sowing for the incidence of pink stem borer was significant except in January 2008 and March 2009 (Table 4). The data also revealed that the incidence of pink stem borer was higher in zero tillage conditions in the early and the late sown crop in all the observations. However, same trend was not observed in the timely sown crop.

The interaction effect of tillage conditions and dates of sowing for the wheat yield was non-significant during both the years. In general, the yield was more in conventional tillage as compared to zero tillage. Also, it was more in the early sown crop followed by the timely sown and the late sown crop.

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