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Incidence of Insect Pest Damage in Rice Crop in Relation to Meteorological Parameters in Punjab – A Plant Clinic Data Based Case Study

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ABSTRACT

The data incidence of insect pest of rice crop received at Plant Clinic, PAU Ludhiana during 2000-2009 were used to a study to analyse the effect of various meteorological parameters. Under Punjab conditions, maximum number (percent) of insect pest damage samples received at Plant Clinic were for plant hopper (44%) followed by leaf folder (30%) and stem borer (29%). The weather conditions conducive for the build up of rice pest population were cloudy weather coupled with a well distributed rainfall received in more number of rainy days during the crop season. Such conditions were observed during the high pest infestation years (pest samples >200) a well distributed (more number of rainy days) near or above normal rainfall was received during June to October, The climatic normals alongwith the interaction of rice crop, weather and insect population dynamics and these can be used as a tool for preparation of weather based agro-advisory.

Key words: Rice, insect pest, activity period, meteorological parameters, yield, crop-weather-insec.

Rice is grown in area where mean monthly temperature across the growing season ranges from 23.3-27.7 °C, within a daily minimum temperatures of 15 °C and maximum temperature of 39 °C. These temperatures fall well within the favourable range for rice insect pests (Mochida *et al*, 1987).

Insect-pests such as stem borer (*Scirpophaga incertulus*), leaf folder (*Cnaphalocrosis medinalis*), plant/ grass hoppers (*Sogatella furcifera, Nephotettix spp., and Nilaparvata lugens*) were reported as major pests while hispa (*Dicladispa armigera*), ear-cutting caterpillar/ armyworm (*Mythimna separata*) and root weevil (*Echinocnemus oryzae*) as the minor pests of rice (Dhaliwal and Singh, 1983; Singh *et* al, 1993, Singh, *et* al., 2002 and Butter and Singh, 2005).

During the last decade insect-pests scenario of rice has witnessed considerable changes due to changes in prevailing weather conditions in Punjab. The incidence and population build up of a pest is highly dependent on prevailing weather conditions and growth stage of the crop. The present investigation was planned to study the effect of meteorological parameters on the development of important pests of rice and formulate a tool for issuing agro-advisory for need based pesticide spraying schedule in rice.

MATERIALS AND METHODS

The Punjab Agricultural University, Ludhiana established a Plant Clinic (Agricultural Technology Information Centre (ATIC)) at the Directorate of Extension Education in April, 1999 which provides diagnostic services to the farmers and extension functionaries. In the process of providing services, Plant Clinic scientists of various disciplines i.e., entomology, plant pathology, agronomy and soils diagnose the crop disorders and devise the remedial measures to the farmers as per guidelines given by university package of practices.

From the day of establishment of Plant Clinic till date crop samples received through farmers pertaining to various disorders were regularly diagnosed and their records have been maintained. Based on receipt of farmers samples at Plant Clinic, a study was conducted to analyse the effect of various meteorological parameters on the incidence of important pests of rice crop from *kharif* 2000 to *kharif* 2009.

The rice pest considered in the study were plant hoppers, leaf folder, stem borer as the major pests whereas hispa, ear-cutting caterpillar/armyworm and root weevil as the minor pests. The data on monthly meteorological parameters w.r.t. maximum and minimum temperature, maximum and minimum relative humidity, rainfall,

Table 1 : The peak activity period (monthly) of rice insect pest during *kharif* 2000 to 2009 in Punjab

Crop year	Plant Hopper	Leaf folder	Stem Borer	Rice Hispa Weevil	Armyworm	Root
2000	Sept>Aug>Oct	Jul>Sept> Aug	Sept>Jul=Aug	Aug	-	-
2001	Aug>Sept	Aug>Sept>Jul	Aug>June	-	-	-
2002	-	Sept>Aug>Jul	Sept>Aug>Jul>Oct	-	Sept	Aug
2003	Aug>Sept	Jul>Sept> Aug	Aug=Sept>Jul	Aug	-	-
2004	Sept>Aug>Jul	Aug>Jul>Sept	Aug>Sept>Jul	Aug	Sept	-
2005	Sept>Aug	Sept>Aug>Jul	Jul>Aug>Sept	-	Sept	Jul
2006	Sept>Aug>Oct	Aug>Sept>Jul	Aug>Sept>Jul	Aug	Sept=Oct	Jul
2007	Sept	Sept	Sept	-	-	-
2008	Sept>Aug>Oct	Aug>Sept>Jul> Oct>Jun	Sept>Aug>Jul>Oct	Aug>Sept> Jul	-	-
2009	Sept>Aug=Oct	Sept>Aug> Oct>Jul	Sept>Aug>Jul	-	Oct>Sept= Aug	Sept>Jul =Oct>Aug

Table 2 : Climate normals for insect pest of rice

Insect Pest	Climatic normal
Plant hopper	Maximum Temp 33^{0}C, Minimum Temp 25^{0}C, Optimum Temp 28-30^{0}C, RH85%
Leaf folder	Maximum Temp 34-35^{0}C, Minimum Temp 24-27^{0}C, Maximm RH 90-99%, Minimum RH 67-81%
Stem Borer	Maximum Temp 35^{0}C, Minimum Temp 17^{0}C, Optimum Temp 24-29^{0}C, RH 90-100%, Sunshine 14.5-16 Hrs
Rice Hispa	Max Temp 32-35^{0}C, Min Temp 24-26^{0}C, Max RH96-99%, Min RH 75-81%
Armyworm	Temperature 15-35^{0}C
Root weevil	Temperature 20-27.5^{0}C

number of rainy days, evaporation and sunshine hours from July to October (2000 to 2009) were collected from the meteorological observatory located at Punjab Agricultural University, Ludhiana.

RESULTS AND DISCUSSION

Activity period of rice pest population versus rice yield in Punjab

The peak activity period of rice pest considered in the study ranged from July to October in Punjab (Table 1). Amongst the various insect pests plant hoppers remained active during July to September with a peak activity during August to September. The leaf folder is also active during July to September with peak activity during August to September. The rice stem borer remained active during July to October with peak activity during August to September. During the last three years there has been considerable change in the scenario of insect pests of rice in Punjab due to change in time of sowing, cropping pattern and large scale cultivation of high yielding varieties. The rice stem borer remained pest of rice but now the leaf folder during vegetative phase and plant hoppers during re-productive phase are becoming serious on rice. The change in time of sowing in Punjab is likely to prove useful in the management of rice stem borer. The army worm and rice hispa has started causing damage to rice since 2004. Similar activity period of rice pest have been reported by Singh *et al* (2007) and in the Package of Practices of *kharif* crops (Anonymous 2010) in the Punjab state.

The comparison of total pest damage samples for rice crop received at Plant Clinic with the average rice yield in Punjab (*kharif* 2000 to 2009) are presented in Fig. 1. The normal rainfall for June to October months was 586 mm. Amongst different crop years, least number of pest samples were received during *kharif* 2004 (76) when the

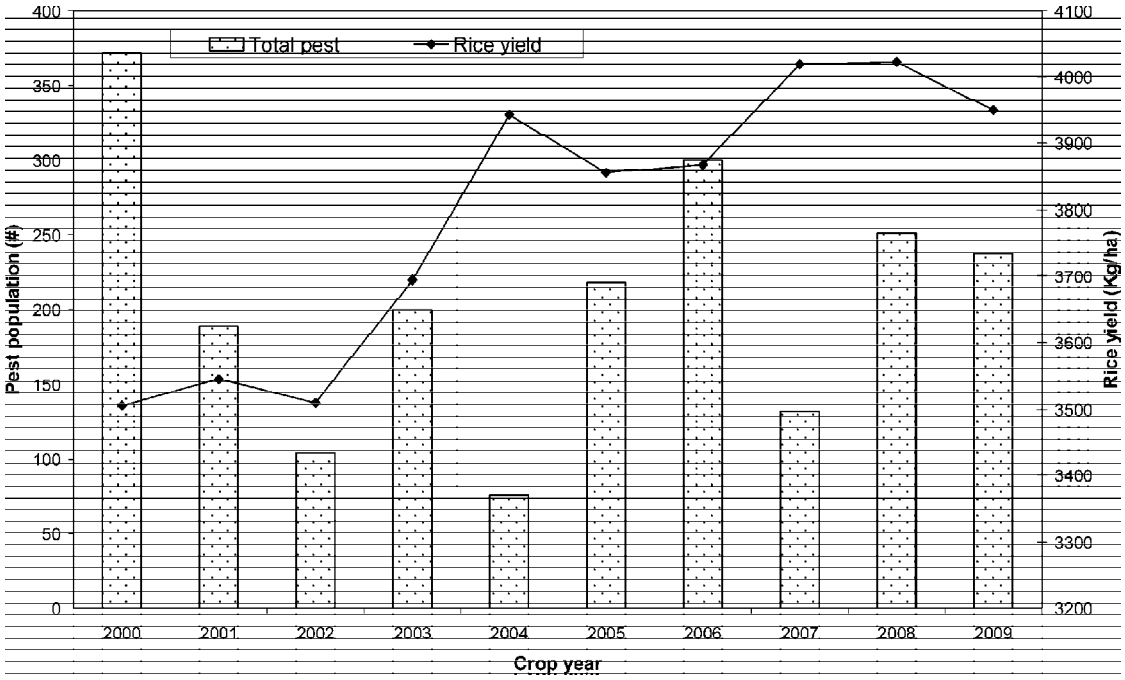

Fig. 1 : Rice pest population versus rice yield in Punjab during the last decade (kharif 2000 to 2009)

rainfall was 237 mm below normal and as a result a high yield of 3943 kg/ha was achieved. Other two good crop years were *kharif* 2002 (104 samples, 293 mm rainfall) and *kharif* 2007 (132 samples, 407 mm) when below normal rainfall was received and the potential rice yield were obtained.

During the high pest infestation years such as *kharif* 2000 (371 samples, 538 mm rainfall), *kharif* 2003 (200 samples, 581 mm rainfall) and *kharif* 2006 (300 samples, 503 mm rainfall) though a below normal rainfall was received but the rainfall was well distributed during June to October (i.e., near or slightly below normal rainfall was received), pest infestation in rice was also severe and the rice yield were adversely affected. But during other high pest infestation years such as *kharif* 2008 (251 samples, 906 mm rainfall) and *kharif* 2009 (237 samples, 858 mm rainfall) the rainfall was well distributed and above normal and as a result of which the rice yields were adversely affected.

Correlation between incidence of rice pest and meteorological parameters

The correlation worked out between monthly weather parameter insect pest population did not show significant association. However, they do indicate interactive effect.

Out of the six pests of rice considered in the study, plant hopper, armyworm and root weevil population build up is favoured under hot, dry and clear sky conditions. On the other hand, leaf folder, stem borer and rice hispa population build up is favoured under wet, humid and cloudy weather conditions. Similar results have been reported by Butter and Singh (2005) and Singh *et al* (2007) for rice pest scenario in the state.

The climatic normal required for major insect pest as well as susceptible crop phenological stages are presented in Table 2. Thus if the climatic conditions are favourable and the pest is present, there are chances of occurrence of the pest attack. The information will act as a scientific guiding tool for issuing agro-advisory for need based spraying of the pesticides for the benefit of farmers of the state.

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