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Weather relations of rice blast in mid hills of Himachal Pradesh

R. PRASAD AND R. S. RANA

Department of Agronomy

CSK Himachal Pradesh Agricutural University, Palampur-176 062

ABSTRACT

Weather and disease data of mid hills of Himachal Pradesh for three seasons 1997, 1998 and 1999 have been used for the study. The disease incidence invariably occurred at the tillering stages in all the three seasons. Correlation and regression analysis indicated that the lower minimum temperature was found associated with the blast disease of rice.

Key words: Rice blast, Minimum temperature, Cloud cover, Weather parameters.

Though inoculums is always present in the environment during rice growing season particularly during July and August, the favourable weather conditions always play a predominant role in the incidence and spread of the rice blast disease. At the time of penetration, structural defense barriers of the host, stability and germination of spores on the host surface are influenced by prevailing meteorological conditions. Also, the weather factors such as light (cloud cover), temperature and humidity on the host surface, determine the exit of pathogen, its sporulation and amount of secondary inoculums produced for dispersal (Singh, 1984). Minimum night temperature range of 20 to 26°C in association with relative humidity (RH) range of 90% and above lasting for a period of a week or more during any of the susceptible stages of crop growth viz., seedling stage, post transplanting tillering and neck emergence stages is ideal for outbreak of the disease (Padmanabhan *et al.,* 1971). Hence, for construction of any disease forecasting system, it is imperative to isolate weather conditions conducive for incidence and spread of particular disease.

MATERIAL AND METHODS

A field experiment with 18 treatments viz., two varieties, three dates of sowing and three fertility levels was conducted in split plot design for three kharif seasons, 1997,1998 and 1999 in the research farm of the CSK Himachal Pradesh Agricutural University, Palampur. Paddy crop was raised with three fertility levels, farmers practice i.e. FYM @ 10 t ha^{-1} + 40 kg N, recommended practice i.e., FYM @ 10 t ha^{-1} + 90 kg N + P_2O_5 and K_2O @ 40 kg and improved practice i.e., FYM @ 10 t ha^{-1} + 25% higher N, P and K than recommended practice, and three different dates (July 16, 21 and 25) with two varieties, Himalaya 741 and HPU-2216. The variety, Himalaya, 741 was sensitive to disease and was taken as an indicator variety for the incidence of the disease. During 1997 the crop was raised through sprouted seeds whereas in the other two years transplanted crops were raised. Disease scoring was done by following International Rice Research Institute, Standard Evaluation System (IRRI, 1988) for Rice. Seasonal behaviour of weather parameters viz.,

Table 1: Correlation between rice blast and weather under three sowing dates for two varieties parameters (pooled over three seasons)

Weather parameters	July 16		July 21		July 25		Pooled	
	Himalaya -741	HPU -2216	Himalaya -741	HPU -2216	Himalaya -741	HPU -2216	Himalaya -741	HPU -2216
TMX	NS	NS	NS	NS	NS	NS	-0.351	NS
TMN	-0.550	-0.406	-0.459	-0.565	-0.641	-0.627	-0.699	-0.574
BSS	NS	NS	NS	NS	0.414	0.335	NS	NS
RN	NS	NS	NS	NS	NS	NS	NS	NS
RD	NS	NS	NS	NS	-0.440	-0.392	0.523	-0.271
RH	NS	NS	NS	NS	NS	NS	-0.552	-0.242
DRH≥80	NS	-0.364	NS	NS	NS	NS	NS	NS
CC1	-0.418	-0.486	-0.541	-0.511	-0.518	-0.501	-0.415	-0.442
CC2	-0.449	-0.438	NS	-0.534	-0.512	-0.479	-0.426	-0.500
WETLEAF	NS	-0.374	NS	NS	NS	NS	NS	NS

r (0.05)=0.334

Table 2: Correlation and regression between disease severity and weather parameters (pooled over three seasons)

Variety/dates	Regression equation	r	Standard error of estimate
Himalaya-741			
D_1	$Y=403.24-8.29X_1-6.40X_2-7.58X_9$	0.688	15.67
D_2	$Y=68.42-1.56X_2-4.49X_8$	0.643	10.50
D_3	$Y=233.13-11.38X_2$	-0.641	13.46
HPU-2216			
D_1	$Y=152.09-3.95X_{1-}14.36X_{7,}3.16X_{8,}1.20X_{10}$	0.742	5.86
D_2	$Y=99.16-4.73X_2$	-0.566	6.83
D_3	$Y=139.26-6.73X_2$	-0.627	8.27
Himalaya-741	$Y=156.28-2.1X_{1,}4.02X_2+6.55X_{7,}3.66X_9$	0.789	8.62
HPU-2216	$Y=101.40-0.94X_{1,}7.99X_2+1.87X_{6-}7.87X_{9,}1.37X_{10}$	0.709	11.89

where X_1-*TMX*, X_2-TMN, X_6-RH, X_7-DRH≥80, X_8-CC1, X_9-CC2 and X_{10}-WETLF
r (0.05)=0.2

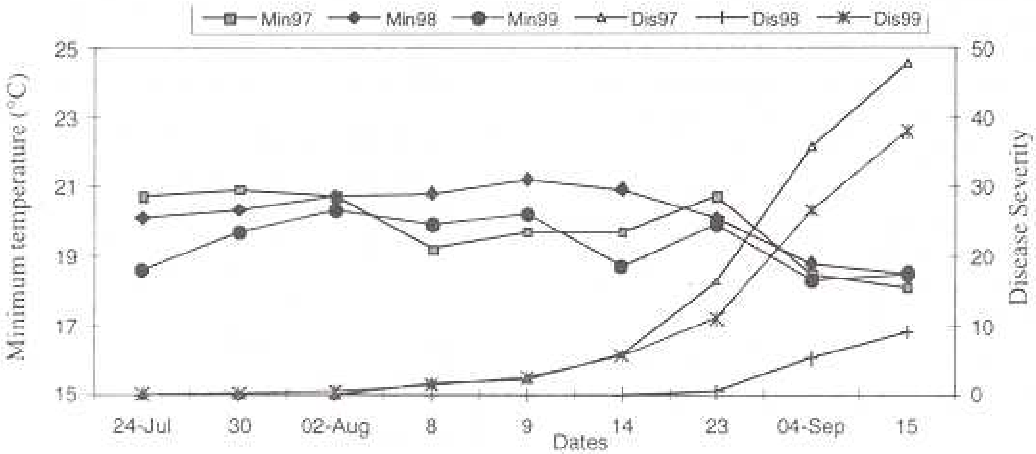

Fig.1 : Minimum temperature and disease severity

maximum temperature (TMX), minimum temperature (TMN), bright sunshine hours (BSS), rainfall (RN), rainy days (RD), relative humidity (RH), days with RH≥ 80% (DRH ≥ 80%), morning cloud cover (CC1), evening cloud cover (CC2), leaf wetness (WETLEAF) and their 5-days mean were analyzed for their correlation with dependent variable (disease severity).

RESULTS AND DISCUSSION

Pooled data for three years and for three dates of sowing indicate that TMN, CC1and CC2 were negatively related with disease severity, whereas BSS was positively and RD were negatively related with for D_1 in both the varieties (Table 1). Best fit multiple regression equations indicate that TMN is negatively and strongly related with disease severity (Table 2).

Behaviour of different varieties with disease indicate variety 741 produced higher disease in all the dates as compared to variety HPU-2216. Disease severity was high during 1997 (Fig.2) when the crop was raised on sprouted seeds. This disease is known to affect the crop more when raised on sprouted seeds (Singh,1984). Moreover, the weather in relation to minimum temperature was also favourable compared to other years. It is evident that parameters TMN, RH, CC1 and CC2 were significantly and negatively related with rice blast disease. Best fit equations indicate that TMX, TMN and CC1 i.e., morning cloud cover were negatively related with disease (Table 2).

Though the minimum temperature hovered around 20°C, yet disease appeared at tillering stages only when nycto- temperature came down to 17.5°C during August 2-10 in *kharif*, 1997, 18.6°C during August 4-13, 1998 and 19 °C during July 26 to 30,1999 in Himalaya 741. There were more fluctuation in minimum temperature of 1997 and 1999 as compared to 1998 and the temperatures were lower and correspondingly higher disease was also observed in these seasons (Fig 1). Low night temperature (20°C) has been reported essential for infection and development of lesions in India (Sadasivan *et. al.*, 1963). Low night temperature as a result of light cloud cover or otherwise is helpful for low silicon absorption by paddy roots, higher absorption of which at higher temperatures gives resistance to the rice plants in relation to rice blast (Prasad and Thakur, 1998). Morning cloud cover was found to have positive relation (Table 3) with TMN i.e., heavy cloud cover produced higher minimum temperature and vice versa due to radiational cooling.

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