Short Communication

Influence of weather on pokkah boeng disease in sugarcane under North-West Alluvial Plains (Zone I) of Bihar

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Sugarcane is the most important industrial and emerging multi-product crop in the country occupying about 52.8 lakh hectares of area with an annual production of 3369 lakh tonnes and productivity of 63.7 tonnes per hectare. In Bihar, it occupies an area of 2.4 lakh hectares with a production of 126.4 lakh tonnes and average productivity of 51.8 tonnes per hectare (ISMA, 2017). Every year, sugarcane contributes nearly 70 per cent of world sugar production and provides raw materials for many other by products (Gawade *et al*., 2012). Among the various factors lowering down the production and productivity of sugarcane, incidence of diseases is one of them. More than 20 diseases of sugarcane caused by various groups of pathogen have been reported from Bihar in which Pokkah boeng has enormous economic importance. The pathogen of this disease can survive for 12 months in the plant debris under natural conditions and it can remain viable for more than 10 months under laboratory conditions (Vishwakarma *et al*., 2013). This disease was identified as major constraint in sugarcane production and is becoming predominant disease in China during recent years (Wang *et al*., 2016).

An experiment was conducted with variety BO 154 at Pusa farm, Sugarcane Research Institute, Dr. Rajendra Prasad Central Agricultural University, Pusa during cropping seasons of 2015 and 2016 to evaluate the effect of weather factors on development of Pokkah boeng disease in sugarcane. The observation was recorded at an weekly interval during both the years of experimentation. The meteorological data on ambient temperature (°C), relative humidity (%), rainfall (mm) and sunshine (hrs.) prevailing cropping seasons were recorded from Agrometeorology Division, Centre for Advance Studies on Climate Change, RPCAU, Pusa. The data on disease development were correlated with weather parameters and multiple regression equations during the course of investigation were work out. The per cent incidence of disease was worked out by using the formula.

Pokkah boeng infection in percentage =

$$\frac{\text{No of affected canes}}{\text{Total no of cane assessed}} \times 100$$

The data on disease development and their angular transformed values as well as prevailing environmental factors presented in Table 1 reveal that disease incidence varied from 0.5 to 14.9 per cent during the course of investigation. The maximum incidence (14.9 per cent) of disease was observed during last week of August followed by 14.2 and 13.6 per cent during 1st and 2nd week of September, respectively. The maximum incidence (14.9 per cent) was recorded when corresponding weather factors *viz*., maximum temperature (°C), minimum temperature (°C), relative humidity (%) at 700 hrs. and 1400 hrs., rainfall (mm), and sunshine (hrs.) were 34.0, 25.5, 89.0, 63.5, 34.7 and 5.7, respectively. The lowest incidence (0.5 per cent) was recorded in the 1st week of May during both the years of study, when corresponding weather factors *viz*., maximum temperature (°C), minimum temperature (°C), relative humidity (%) at 700 hrs. and 1400 hrs., rainfall (mm), and sunshine (hrs.) were 36.4, 20.9, 75.0, 38.0, 13.2 and 8.1, respectively. The incidence of disease was more prevalent during the months of August and September, after which recovery trend of affected sugarcane crop was observed.

Correlation coefficients of incidence of Pokkah boeng disease with meteorological factors indicated that except maximum temperature and sunshine, all other factors exhibited positive correlation (Table 2). The correlation analysis revealed that minimum temperature, relative humidity and rainfall exibited significant positive correlations (r = 0.69**, 0.60**, 0.80** and 0.50**) with disease incidence, whereas maximum temperature and sunshine had significant negative relationship (r = -0.59** and -0.71**). Minimum temperature, relative humidity and rainfall showed statistically significant positive correlation with disease development.

Table 1: Pooled data (2015 and 2016) on incidence of Pokkah boeng disease and corresponding weather observations

| Months | Week | Disease incidence (%) | Temperature (^{0}C) | | Relative humidity (%) | | Rainfall (mm) (X_5) | Sunshine (hrs.) (X_6) |
			Max. (X_1)	Min (X_2)	7.00 hrs. (X_3)	14.00 hrs. (X_4)		
May	I	0.5 (4.2)	36.4	20.9	75.0	38.0	13.2	8.1
	II	0.7 (4.9)	35.8	23.1	79.5	47.0	8.0	8.3
	III	1.1 (6.0)	38.2	23.8	73.0	37.0	13.8	6.9
	IV	1.5 (7.1)	37.4	24.5	73.0	42.0	6.9	7.8
June	I	1.7 (7.7)	34.8	23.2	81.5	47.5	28.5	7.7
	II	2.0 (8.2)	33.0	23.8	81.0	57.5	13.1	8.1
	III	2.4 (8.9)	36.2	25.1	77.5	48.0	10.1	8.4
	IV	3.2 (10.3)	36.3	26.0	80.0	57.5	21.5	6.8
July	I	6.0 (14.1)	34.3	25.8	85.5	68.0	31.0	6.9
	II	7.4 (15.8)	35.0	26.8	80.5	65.5	17.6	5.1
	III	8.5 (16.9)	32.0	25.7	89.0	76.0	54.4	2.6
	IV	9.7 (18.1)	33.6	26.0	88.5	74.0	35.7	6.3
August	I	11.0 (19.4)	32.4	25.3	88.0	74.5	73.2	3.4
	II	12.1 (20.4)	32.9	25.3	90.0	72.5	63.5	4.0
	III	12.8 (21.0)	33.6	25.3	85.5	65.5	2.7	6.0
	IV	14.9 (22.7)	34.0	25.5	89.0	63.5	34.7	5.7
September	I	14.2 (22.1)	33.4	25.2	90.0	72.5	87.1	5.2
	II	13.6 (21.6)	32.7	24.8	89.0	71.0	159.3	5.4
	III	12.7 (20.9)	34.2	25.5	89.5	69.0	23.3	6.4
	IV	10.9 (19.3)	32.7	24.8	89.0	73.0	79.7	3.1
October	I	8.7 (17.2)	33.3	25.1	92.2	72.0	42.4	5.9
	II	4.9 (12.7)	32.1	24.6	92.2	73.5	45.8	4.5
	III	2.3 (8.7)	31.5	23.1	89.5	68.0	49.1	4.9
	IV	0.6 (4.6)	34.6	23.8	90.0	59.0	2.6	7.8

Figures in the parenthesis indicate the angular transformed values.

Table 2: Correlation coefficients between weather parameters and incidence of Pokkah boeng disease

Weather Parameter	Correlation Coefficients
Max temp.	-0.59**
Min temp.	0.69**
RH I	0.60**
RH II	0.80**
Rainfall	0.50**
Sunshine	0.71**

Similar findings were also reported by Vishwakarma *et al.* (2013), which showed that the severe incidence of Pokkah boeng disease was found to occur in the temperature range between 20 to 32 ^{0}C with relative humidity up to 70- 80 per cent and cloudy weather in rainy season from July to September. According to Kumar *et al.* (2011), temperature ranging from 20 to 30 ^{0}C and relative humidity ranging from 75 to 85 per cent were found to be optimum for the growth of *Fusarium* Pathogen. Many authors have also carried out research work pertaining to disease weather relationships (Bose *et. al.,* 2010; Atri and Singh, 2019; More *et. al.,* 2019). Thus, it may be concluded that minimum temperature, relative humidity and rainfall were most significant weather parameters, which contributed to the development and spread of Pokkah boeng disease in sugarcane grown under North-west Alluvial plains (Zone I) of Bihar. The findings of the study would be helpful in developing disease forewarning models for this region.

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