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Full Research Article

Role of Meteorological Parameters on Sheath Blight of Rice under different Planting Methods

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Abstract

The field experiments were conducted during *kharif* 2012 and 2013 to study the incidence and severity of sheath blight (*Rhizoctonia solani*) in relation to meteorological parameters under different planting methods. The experiments comprise of three dates of transplanting (15th June, 30th June and 15th July), two rice varieties (PR-118 and PR-116) and two planting methods (furrow planting and conventional planting). Sheath blight incidence and severity were significantly lower in 15th June transplanted crop followed by 30th June table and 15th July during both the crop seasons and were significantly more in variety PR-116 as compared to variety PR-118. It was more in conventional transplanted crop as compared to bed transplanted crop. Correlation analysis showed that among all the meteorological parameters considered, maximum air temperature and morning relative humidity were key factors to govern this disease in the field. A maximum temperature around 34 °C and a minimum temperature around 26 °C were found to be favourable for the spread of sheath blight after its establishment in the field. High relative humidity (more than 90%) facilitates the spread of this disease. The disease incidence and severity were negatively correlated with maximum temperature, minimum temperature, evening relative humidity and rainfall and positively correlated with morning relative humidity and sunshine hours during both the crop growing seasons. Sheath blight incidence can be reduced by 8-9% by bed planting method.

1. Introduction

The rice-wheat production system contributes about 25% to the total food grain production of the country. In the recent years, the profitability of the system has started declining. The deteriorating performance of the system has mainly been attributed to factors, such as costly tillage practices along with excessive use of chemicals and irrigation water. There are some reports that rice crop in Punjab is the culprit for speedy exhaustion of natural water resources. So there is a need to study other rice growing methods like bed planting without puddling in the field, to save water resources in future. The rice crop is subjected to more than forty diseases, among these sheath blight is an important disease caused by *Rhizoctonia solani*. This disease is attaining significance in rice cultivation in the Punjab state with the introduction of new high yielding rice varieties such as PR-114 and PR-116 during last few years. Sheath blight of rice (*Rhizoctonia solani*) was reported first time in India by Paracer and Chahal (1963) from Punjab. The disease appears both on sheath and laminar portion of leaf (Swamy et al., 2009). Sheath blight can damage various parts of rice plant, resulting in significant losses in yield and milling quality. The spread of sheath blight is largely dependent on inoculum density, warm and high humidity conditions and varietal resistance (Groth and Lee, 2003). The reduction in the grain yield has been reported up to 80% in India by Lakhpale et al., (1996). Losses due to this disease has been reported to vary from 5-13.5% in the state (Thind et al., 2001) although, as high as 58% loss was recorded in a cultivar Pusa Basmati-1 (Chahal et al., 2003).

Under tropical conditions, it is commonly assumed that the critical factors for rice sheath blight infection are temperature and relative humidity. The pathogen thrives when the canopy humidity is 96 to 97%. High infection occurs at 100% relative humidity and gradually falls when decreased; the minimum being 85 to 88%. High temperature (28-32 °C) was reported to favour infection. Frequent rainfall favours disease development. Therefore, the disease is more common during the rainy than in the dry season in the tropics.

Disease development progresses vary rapidly in the early heading and grain filling growth stages during periods of frequent rainfall and overcast skies. The knowledge of critical factors influencing disease development can help in prediction of plant diseases and in taking timely measures for their effective management. The weather and soil conditions like temperature, soil moisture, soil nutrients, light, air humidity, soil pollutants, soil pH etc. influence the seasonal development and geographical distribution of plant diseases. Keeping this in view, the present study was planned to study the effect of different meteorological parameters on sheath blight of rice under different planting methods.

2. Materials and Methods

A field experiment was conducted during *kharif* season of 2012 and 2013 at Punjab Agricultural University, Ludhiana. It is situated at 30°54′ N latitude and 75°48′ E longitude and is 247 m above mean sea level. The area experiences an average annual rainfall of 705 mm of which about 80% is received during June to September. Two varieties of paddy, PR-118 (V_1) and PR-116 (V_2) were transplanted under bed planting method (M_1) and conventional method (M_2). The 30 days old seedlings were transplanted on three different dates viz., 15th June (D_1), 30th June (D_2) and 15th July (D_3) during both the crop seasons. Meterological data for the cropping period have been mention in both Table 1 and 2. Seedlings were transplanted at a spacing of 20×15 cm^2 in conventional method and 30 cm×10 cm in bed planting method. The crop was sprayed with Tilt (Propiconazole) 25 EC @ 200 ml in 200 litres of water when disease was noticed in the field. For disease incidence, total number of infected plants in each plot was counted. Severity of disease was calculated from the proportion of plant tissue infected by the disease. Data on disease incidence and severity were recorded at weekly interval till the maturity of

$$\text{Disease incidence (\%)} = \frac{\text{No. of diseased plants}}{\text{Total no. of plants examined}} \times 100$$

the crop. The following formula was used to calculate disease incidence:

$$\text{Severity index} = \frac{\text{Area of plant tissue infected}}{\text{Total area}} \times 100$$

Severity index was calculated from the proportion of plant tissue infected by the disease using the following formula:

The correlation coefficients between sheath blight and different meteorological factors were calculated.

3. Results and Discussion

3.1. *Incidence and severity of sheath blight*

Data collected on sheath blight incidence and severity indicated that planting method has significantly effect on the rice sheath blight. Sheath blight appeared in rice crop during the first week of August in 2013 and second week of August in 2012. The incidence of sheath blight was first observed in rice variety PR-116. The incidence and severity of sheath blight were recorded minimum (23.0 and 9.5%) on rice transplanted on 15th June followed by crop transplanted on 30th June (27.8 and 12.0%) and 15th July (32.6 and 18.0%) during 2012 (Table 3). The disease incidence and severity (29.2 and 14.7%) were higher in rice variety PR-116 as compared to variety PR-118 (26.5 and 11.7%). The planting methods also had significant effect on sheath blight incidence and severity of rice. The incidence of disease was low (26.9 and 12.4%) in bed planting method as compared to conventional method (33.8 and 20.0%) due to

Table 1: Weekly meteorological data for Ludhiana during crop growth period of *kharif* 2012

SMW	Tmax	Tmin	Mean	RHm	RHe	Mean	RF	SSH
15	32.1	17.7	24.9	76	37	56	19.8	7.9
16	33.4	18.9	26.2	79	30	55	3.7	7.6
17	34	17.6	25.8	68	31	50	15.1	9.4
18	35.2	19	27.1	51	19	35	0	10
19	39	23.1	31.1	50	20	35	0	9.1
20	39.7	23.6	31.7	48	19	34	1.6	7.1
21	40.9	23.1	32	45	17	31	0	9.8
22	43.7	25.9	34.8	43	19	31	0	10.9
23	39.1	25.5	32.3	57	33	45	0	7.2
24	42	25.9	33.9	55	28	42	0	11.4
25	40.8	29.2	35	56	33	45	2	8.3
26	39.4	27.8	33.6	63	39	51	0	8.7
27	36.9	28.6	32.7	70	53	61	9.5	6.6
28	35	27.6	31.3	79	56	67	10.6	6.2
29	36.4	27.6	32.1	73	52	62	1.6	9.3
30	35	28	31.5	82	67	75	44.8	4.9
31	33.8	27.2	30.5	80	67	73	11.4	4.7
32	34	27.1	30.5	88	72	80	24.3	3.9
33	33.8	26.8	30.3	86	72	79	56.4	5.9
34	31.5	25.9	28.7	89	80	84	40.2	3.3
35	33	26	29.5	91	69	80	40.7	4.1
36	33	26.2	29.6	81	69	75	18.8	6.5
37	33.9	24.5	29.7	89	63	76	93.4	7.05
38	30.9	22.5	26.7	93	68	81	27.1	11.1
39	33	20.7	26.9	94	48	71	0	10.2
40	34	19.8	26.9	90	44	67	0	9.9
41	33.3	17.4	25.4	91	41	66	0	9.1
42	30.9	15.9	23.4	90	44	67	0	8.8
43	29.1	12.7	20.9	90	45	67	1	8.7
44	29.6	13.6	21.6	92	42	67	0	7
45	28.7	12.4	20.5	91	39	65	0	5.5

higher availability of solar radiation, low relative humidity and proper light and aeration. Similar results were recorded in 2013. Sarkar and Chaudhary (2003); Kashem et al. (1994); Sarkar et al. (2003) also observed that disease severity decreased with an increase in spacing. Similar results were also reported by Biswas et al. (2012). The overall analysis showed that disease incidence and severity were more during 2013 crop season and was recorded maximum (46.6 and 18.3%) for the crop transplanted on 15th July as compared to crop transplanted on 15th July in 2012 (32.6 and 18.0). During the peak period (33rd SMW) of sheath blight, the weather variables were maximum temperature 33.8 °C, mean relative humidity 79% and rainfall 56.4 mm in 2012 while in 2013 maximum temperature, mean relative humidity and rainfall were 31.2 °C, 83% and 130.6 mm, respectively. The total rainfall received (729.6 mm) in 2013 during *kharif* season was higher than 2012 crop season (385.3 mm) which resulted that higher humidity conditions are favourable for sheath blight incidence. Savray et al. (2001) reported that the rate of sheath blight disease increased in the rainy season than in the dry season. Cloudy weather and rain showers were favourable for the development of the disease.

Table 2: Weekly meteorological data for Ludhiana during crop growth period of *kharif* 2013

SMW	Tmax	Tmin	Mean	RHm	RHe	Mean	RF	SSH
15	34.6	18.3	26.4	70	25	47	0	9.1
16	35.7	19.2	27.5	50	17	34	0	9.8
17	34.4	20.2	27.4	57	29	43	4.4	6.5
18	38.3	19.4	28.9	43	16	30	0	10
19	37.5	21.2	29.3	54	30	42	1.2	9.1
20	41.4	23.2	32.3	51	26	38	0	9.9
21	44.1	27	35.5	51	29	40	0	8.9
22	40.3	26.1	33.2	60	41	50	0	9.3
23	42.1	29.1	35.6	69	35	52	5.2	9.8
24	30.6	24.6	27.6	84	72	78	237.7	6.6
25	37.8	27.6	32.7	76	43	59	0	9.6
26	34.7	26.8	30.7	82	60	71	53.8	7.8
27	35	28.5	31.7	82	64	73	12.6	4
28	35	27.1	31	81	64	73	31.5	7.2
29	34	27.5	30.7	84	65	74	2.2	5.3
30	35.4	28.3	31.8	82	63	73	34.4	8.7
31	33.9	26.9	30.4	83	72	78	78.4	6
32	32.1	26.4	29.3	91	74	83	66.8	5.7
33	31.2	25.6	28.4	91	75	83	130.6	4.2
34	34.8	26.8	30.8	90	63	76	4.5	6.5
35	34.4	26.4	30.4	86	59	73	3.2	9.2
36	34	25.6	29.8	84	68	76	12.2	7.9
37	34.1	24.4	29.2	85	57	71	0	8.7
38	33.6	22.6	28.1	89	55	72	0	8.7
39	33	23.5	28.2	88	62	74	3.6	6.7
40	32.1	24	28.1	89	63	76	22.4	4.8
41	30.6	23.3	26.9	95	67	81	1.8	2.1
42	32.8	18.6	25.7	89	35	62	0	9.1
43	30.7	16.9	23.8	91	38	65	0	5.2
44	28.1	13.8	20.9	87	37	62	12	5.7
45	24.7	11.9	18.3	91	44	67	4.6	4.1

3.2. Effect of meteorological parameters on sheath blight incidence and severity

3.2.1. Correlation coefficients

Meteorological parameters directly or indirectly influence the development of disease. So, the different meteorological parameters from the establishment of pathogen were tested to study the effect of these parameters on the incidence and severity of sheath blight. Weekly meteorological parameters viz., maximum temperature (Tmax, °C), minimum temperature (Tmin, °C), morning relative humidity (RHm, %), evening relative humidity (RHe, %), total weekly rainfall (RF, mm) and sunshine hours (SSH, Hours/day) were correlated with weekly disease incidence and severity under different planting methods (Tables 3, 4, 5, 6 and 7). Sheath blight disease incidence showed a negative correlation with maximum and minimum temperatures, evening relative humidity and total rainfall and was significant at 5% level of significance for both the years. A positive association was observed between morning relative humidity and sunshine hours with disease incidence and severity but sunshine hours were significant at 1% level for all the dates of transplanting during 2012. During 2013 *kharif* season, only morning relative humidity was positively

Table 3: Mean sheath blight incidence and severity of rice under different planting methods during *kharif* 2012 and 2013

No. of treatments	2012		2013	
	Disease incidence	Disease severity	Disease incidence	Disease severity
15th June (D_1)	23.0	9.5	30.4	10.7
30th June (D_2)	27.8	12.0	36.8	13.8
15th July (D_3)	32.6	18.0	46.6	18.3
CD (*p*=0.05)	1.08	2.03	1.68	1.9
PR-118 (V_1)	26.5	11.7	36.0	12.3
PR-116 (V_2)	29.2	14.7	39.8	16.2
CD (*p*=0.05)	0.88	1.65	1.37	1.57
Bed Planting (M_1)	26.9	12.4	37.1	13.3
Conventional Planting (M_2)	33.8	20.0	45.8	22.3
CD (*p*=0.05)	0.68	1.62	1.05	1.35
Interactions DV	NS	NS	NS	NS
MV	NS	NS	NS	NS

Table 4: Correlation coefficients between sheath blight incidence and meteorological parameters during *Kharif* 2012

Treatments	Tmax	Tmin	RHm	Rhe	RF	SSH
$D_1V_1M_1$	-0.23	-0.79**	0.39	-0.70*	-0.68*	0.65*
$D_1V_1M_2$	-0.24	-0.77**	0.36	-0.79**	-0.67*	0.62
$D_1V_2M_1$	-0.23	-0.78**	0.38	-0.70*	-0.67*	0.64*
$D_1V_2M_2$	-0.21	-0.78**	0.37	-0.70*	-0.66*	0.64*
$D_2V_1M_1$	-0.22	-0.81**	0.39	-0.70*	-0.65*	0.65*
$D_2V_1M_2$	-0.22	-0.84**	0.35	-0.70*	-0.66*	0.63
$D_2V_2M_1$	-0.23	-0.83**	0.37	-0.70*	-0.68*	0.64*
$D_2V_2M_2$	-0.21	-0.85**	0.36	-0.71*	-0.67*	0.66*
$D_3V_1M_1$	-0.21	-0.84**	0.40	-0.71*	-0.65*	0.66*
$D_3V_1M_2$	-0.22	-0.86**	0.35	-0.70*	-0.66*	0.63
$D_3V_2M_1$	-0.22	-0.85**	0.35	-0.70*	-0.69*	0.65*
$D_3V_2M_2$	-0.22	-0.87**	0.37	-0.71*	-0.68*	0.66*

*Significant at p=0.05 (=0.63); **Significant at p=0.01 (=0.76) Where D_1: 15th June D_2: 30th June and D_3: 15th July, V_1: PR-118 and V_2: PR-116; M_1: Bed planting and M_2: Conventional planting; Tmax: Maximum temperature, Tmin: Minimum temperature, RHm: Morning relative humidity, RH_e: Evening relative humidity, RF: Rainfall and SSH: Sunshine Hours

Table 5: Correlation coefficients between sheath blight incidence and meteorological parameters during *Kharif* 2013

Treatments	Tmax	Tmin	RHm	Rhe	RF	SSH
$D_1V_1M_1$	-0.39	-0.85**	0.26	-0.57	-0.11	-0.06
$D_1V_1M_2$	-0.37	-0.88**	0.24	-0.63	-0.14	-0.01
$D_1V_2M_1$	-0.38	-0.86**	0.24	-0.60	-0.12	-0.04
$D_1V_2M_2$	-0.36	-0.89**	0.23	-0.64*	-0.13	0.02
$D_2V_1M_1$	-0.40	-0.85**	0.25	-0.57	-0.10	-0.07
$D_2V_1M_2$	-0.37	-0.88**	0.25	-0.61	-0.12	-0.03
$D_2V_2M_1$	-0.40	-0.86**	0.26	-0.58	-0.11	-0.06
$D_2V_2M_2$	-0.35	-0.88**	0.22	-0.63	-0.13	0.01
$D_3V_1M_1$	-0.40	-0.85**	0.25	-0.58	-0.10	-0.06
$D_3V_1M_2$	-0.39	-0.87**	0.26	-0.60	-0.11	-0.05
$D_3V_2M_1$	-0.40	-0.85**	0.26	-0.57	-0.09	-0.07
$D_3V_2M_2$	-0.39	-0.87**	0.26	-0.61	-0.11	-0.04

*Significant at p=0.05 (=0.63); **Significant at p=0.01 (=0.76) Where D_1: 15th June D_2: 30th June and D_3: 15th July, V_1: PR-118 and V_2: PR-116; M_1: Bed planting and M_2: Conventional planting; Tmax: Maximum temperature, Tmin: Minimum temperature, RHm: Morning relative humidity, RH_e: Evening relative humidity, RF: Rainfall and SSH: Sunshine Hours

Table 6: Correlation coefficients between sheath blight severity and meteorological parameters during *Kharif* 2012

Treatments	Tmax	Tmin	RHm	Rhe	RF	SSH
$D_1V_1M_1$	-0.29	-0.86**	0.38	-0.86**	-0.64*	0.67*
$D_1V_1M_2$	-0.26	-0.86**	0.33	-0.87**	-0.64*	0.58
$D_1V_2M_1$	-0.29	-0.87**	0.36	-0.87**	-0.66*	0.64*
$D_1V_2M_2$	-0.24	-0.87**	0.32	-0.88**	-0.67*	0.59
$D_2V_1M_1$	-0.31	-0.86**	0.37	-0.86**	-0.64*	0.67*
$D_2V_1M_2$	-0.27	-0.87**	0.34	-0.87**	-0.66*	0.62
$D_2V_2M_1$	-0.30	-0.86**	0.35	-0.86**	-0.64*	0.64*
$D_2V_2M_2$	-0.24	-0.87**	0.33	-0.88**	-0.64*	0.62
$D_3V_1M_1$	-0.29	-0.87**	0.37	-0.87**	-0.64*	0.67*
$D_3V_1M_2$	-0.26	-0.86**	0.32	-0.87**	-0.65*	0.62
$D_3V_2M_1$	-0.28	-0.87**	0.35	-0.87**	-0.66*	0.64*
$D_3V_2M_2$	-0.26	-0.86**	0.32	-0.86**	-0.62	0.61

Table 7: Correlation coefficients between sheath blight severity and meteorological parameters during *Kharif* 2013

Treatments	Tmax	Tmin	RHm	Rhe	RF	SSH
$D_1V_1M_1$	-0.37	-0.85**	0.26	-0.60	-0.23	-0.04
$D_1V_1M_2$	-0.35	-0.86**	0.23	-0.64*	-0.22	-0.01
$D_1V_2M_1$	-0.33	-0.87**	0.22	-0.65*	-0.25	0.01
$D_1V_2M_2$	-0.36	-0.86**	0.24	-0.63	-0.22	-0.02
$D_2V_1M_1$	-0.35	-0.87**	0.23	-0.64*	-0.23	-0.01
$D_2V_1M_2$	-0.36	-0.87**	0.25	-0.65*	-0.23	-0.01
$D_2V_2M_1$	-0.36	-0.87**	0.24	-0.64*	-0.25	-0.01
$D_2V_2M_2$	-0.36	-0.87**	0.24	-0.65*	-0.22	-0.01
$D_3V_1M_1$	-0.38	-0.86**	0.27	-0.62	-0.23	-0.04
$D_3V_1M_2$	-0.38	-0.86**	0.27	-0.63	-0.23	-0.04
$D_3V_2M_1$	-0.36	-0.87**	0.25	-0.64*	-0.24	-0.02
$D_3V_2M_2$	-0.39	-0.86**	0.27	-0.62	-0.19	-0.05

correlated with all the treatments. Wrather et al. (2007) also reported that *Rhizoctonia solani* thrives well when canopy humidity was recorded 96-97%. The vertical development of disease was strongly influenced by the temperature and humidity as reported by Chu and Sin, (2004). A higher and intermittent rainfall helped in epidemic establishment of disease in the field. Tiwari and Chaure, (1997) also found that temperature and relative humidity influence the disease severity.

3.2.2. Regression analysis

Regression equations were computed for every individual parameter viz., maximum temperature, minimum temperature, morning relative humidity, evening relative humidity, total weekly rainfall and sunshine hours were considered being favourable in the disease development, to show their distribution throughout the disease incidence and severity period. These equations can also be used to identify different meteorological parameters quantitatively. Individually none of the factor was responsible for the incidence and severity of sheath blight, so the stepwise regression analysis between incidence of sheath blight and meteorological parameters was conducted and represented in Tables 8 and 9. In multiple regression analysis

Table 8: Step-wise multiple regression analysis between sheath blight incidence and meteorological parameters during *Kharif* 2012 and 2013

2012	
V_1M_1	Y = 294.53-3.15Tmax-2.63Tmin-0.88RHm-0.59RHe+0.07RF-0.22SSH (R^2 = 0.68)
V_1M_2	Y = 373.46-4.42Tmax-2.34Tmin-0.83RHe+0.08RF-0.46SSH (R^2 = 0.74)
V_2M_1	Y =320.02-3.49Tmax-2.46Tmin-0.64RHe -0.24SSH (R^2 = 0.71)
V_2M_2	Y = 374.43-4.35Tmax-2.37Tmin-0.85RHe (R^2 = 0.78)
2013	
V_1M_1	Y = 394.62+5.02Tmax-7.67Tmin-3.12RHm-0.26RHe-0.90RF-8.37SSH (R^2 = 0.65)
V_1M_2	Y = 352.31+5.33Tmax-8.14Tmin-0.25RHe-0.11RF-7.74SSH (R^2 = 0.71)
V_2M_1	Y = 371.00+4.89Tmax-7.66Tmin-0.24RHe-7.85SSH (R^2 = 0.64)
V_2M_2	Y = 400.48+4.97Tmax-7.97Tmin-0.37RHe (R^2 = 0.73)

Table 9: Step-wise regression analysis between sheath blight severity and meteorological parameters during *Kharif* 2012 and 2013

2012	
V_1M_1	Y = 151.97-2.46Tmax-0.24Tmin-0.41RHm-0.39RHe+0.04RF+0.08SSH (R^2 = 0.71)
V_1M_2	Y = 167.90-2.09Tmax-0.93Tmin-0.34RHe+0.04RF+0.17SSH (R^2 = 0.64)
V_2M_1	Y = 164.22-2.19Tmax-0.85Tmin-0.33RHe (R^2 = 0.65)
V_2M_2	Y = 164.58-1.93Tmax-0.99Tmin-0.55RHm-0.33RHe-0.17SSH (R^2 = 0.73)
2013	
V_1M_1	Y = 211.68+1.23Tmax-2.45Tmin-1.58RHm-0.27RHe-0.23RF-3.71SSH (R^2 = 0.61)
V_1M_2	Y = 228.46+1.17Tmax-2.38Tmin-0.36RHe-0.22RF-3.98SSH (R^2 = 0.64)
V_2M_1	Y = 225.24+1.13Tmax-2.38Tmin-0.31RHe-3.82SSH (R^2 = 0.62)
V_2M_2	Y = 232.41-2.32Tmin-0.37RHe-0.21RF-4.00SSH (R^2 = 0.66)

(Table 8) the maximum R^2 value was recorded maximum (0.78) in 2012 where least weather parameters (maximum and minimum temperature and evening relative humidity) were correlated with sheath blight as compared to disease correlated with maximum weather parameters (maximum and minimum temperature, morning and evening relative humidity rainfall and sunshine hours) and were found statistically significant at 0.05 probability level.

The best fit equation (for 2012 crop season) is as follows:-

Y=374.43-4.35Tmax-2.37Tmin-0.85RHe (R^2=0.78)

The best fit multiple regression equation (for 2013 crop season) is as follows:

Y=400.48+4.97Tmax-7.97 Tmin-0.37RHe (R^2=0.73)

Where,

Tmax=Maximum temperature (°C)

Tmin=Minimum temperature (°C)

RHe=Evening relative humidity (°C)

The above given regression equations had explained 78 and 73% of the variations during both the crop seasons. Similar results were also observed by Biswas et al. (2011). Tiwari and Chaurey, (1997) also reported that mean temperature around 25 °C and humidity range of 80 to 95% were optimum for disease development. Similarly, when step wise regression analysis was performed (Table 9) and the best fit step wise regression equation for 2012 crop season is as follows:

Y=164.58-1.93Tmax-0.99Tmin-0.55RHm-0.33RHe-0.17SSH (R^2=0.73)

The best fit step-wise regression equation (for the year 2013) is as follows:

Y =232.41-2.32Tmin-0.37RHe-0.21RF-4.00SSH (R^2=0.66)

The given equations explained 73 and 66% of variations for the in 2012 and 2013, respectively.

4. Conclusion

The sheath blight incidence and severity were higher in 15th June transplanted crop followed by 30th June and 15th July transplanted crop during both the crop seasons. Disease incidence and severity were more in 2013 crop season as compared to 2012 crop season. Significant relationships were observed between minimum temperature, evening relative humidity and rainfall with% disease incidence and severity. Bed planting method can reduce disease incidence by 8-9% as compared to conventional planting.

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