IJTA © Serials Publications

National Academy of Agricultural Science (NAAS) Rating : 3. 03

Effect of Varieties, Levels of Nitrogen and Meteorological Factors on Severity of Foliar Blight of Barley Caused by *Helminthosporium sativum* Under Irrigated and Rainfed Conditions in Field

Sunita Mahapatra[1], *Netai Mudi*[2] *and Srikanta Das*[1]

Abstract: *A field experiment was conducted from 2011-2012 and 2012-13 during winter seasons at AB block farm of Bidhan Chandra Krishi Viswavidyalaya at Kalyani, Nadia, West Bengal to study the effect of three different levels of nitrogen (40, 60, 80 kg /ha) on three different varities (RD 2552, Azad and NDB 1173) against severity of foliar blight of barley and yield under irrigated and rainfed conditions and the effect of meteorological factors on disease progression in the above treatments. The result showed that maximum foliar blight severity was estimated on rainfed condition and minimum in irrigated condition irrespective of varieties and nitrogen levels. Result also showed that with increasing nitrogen dose, disease severity decreased and maximum in low nitrogen level (N_{40}) in both irrigated and rainfed conditions. Nitrogen level and varieties interaction on irrigated and rainfed condition showed minimum disease (% DLA) with maximum grain yield in RD 2552 with high N level (N_{80}) significantly at par with Azad in same N level in irrigated condition whereas maximum disease with low grain yield in NDB1173 with low nitrogen level (N_{40}). Individual correlation coefficient with disease severity showed that, among the 10 meteorological factors VP, T_{min}, Wv, RH_{min} and BSH were significantly positively or negatively correlated with disease severity under both irrigated and rainfed condition for all the varieties in different nitrogen levels. Among the two growth functions Logistic and Gompertz, Gompertz was fit better for linearising the disease severity in comparison to logistic and it was confirmed by high correlation coefficient value (r).*

Keyword: *Barley, Leaf blight, Water regimes, Meteorological factors, Growth models.*

INTRODUCTION

In India, barley is grown extensively under a wide range of agro climatic conditions. Due to its very hardy nature, barley is successfully cultivated in adverse agro-environments like drought, salinity, alkalinity etc. in varied topographical conditions like plains and hilly areas under rainfed and irrigated conditions. Among the various reasons attributes to low productivity, diseases are a major constraint and suffers from a large number of diseases, that caused by fungi are more important. Among them, the most important fungal disease is foliar blight caused by *Helminthosporium* sp. (Singh and Singh, 1971). The disease has assumed severe proportion with the introduction of high yielding varieties. In India, it was first reported from Pusa, Bihar (Mitra, 1930 and Mitra and Bose, 1935) and from West Bengal (Chattopadhyay and Sengupta, 1952). *Helminthosporium sativum* P.K. and B causes foliar spot blotch, root rot and black points on grains as well as head blight and seedling blight of wheat and barley. A disease can be eliminated by application of different nutrition but the severity of many diseases is reduced by specific levels of fertility gradient, arranged by soil treatment with different NPK and organic matter like FYM before cultivation. So knowledge of host nutrition in relation to disease development provides a basis for

1 Dept. of plant pathology.
2 Subject Matter Specalist, Hooghly Krishi Vignan Kendra, B.C.K.V. Mohanpur, Nadia, W.B.
* *E-mail: sunitamahapatra@yahoo.co.in*

modifying current agriculture practices to reduce disease severity and it should be considered as important cultural weapon in our arsenal for controlling disease in an integrated crop production system. But no attention has been given on the application of fertilizers in soil on different varieties under irrigated and rainfed condition which is also an important factor for disease severity and disease progression.

MATERIAL AND METHODS

The experiment was carried out in university Instructional A-B block farm situated at 9.75 m above sea level and 23.5°N lattitude and 89.0°E longitude. The Soil of the experimental field was sandy loam in texture, fine, mixed hyperthermic family Aerie haplaquept with good water holding capacity. Before fertilizer application fertility of soil was NPK 206.43 kg ha^{-1}, 7.77 kg ha^{-1} and 185.46 kgha-^{1} with organic C 0.52% and PH 7.2. Three varieties and three N doses were considered for this experiment as V_1-RD 2552, V_2 Azad V3-NDB 1173 and N doses were $N_{40,}$ N_{60} and N_{80} kg ha^{-1}. The plot size was 5 × 5′ sqm with 3 replications. Sowing time was 5th Nov of two consecutive years 2011-12 and 2012-13. Design of experiment was split pot where factor *A*. irrigated and rainfed condition, factor *B* three varieties and factor *C* three fertility levels. In case of irrigated field four irrigations were given as 1st seedling/sprouting stage, 2nd at active tillering stage (30-35 DAS), 3rd flag leaf stage (47-52 DAS) and last 4th at milk stage or grains filling stage (60-65 DAS) where as rainfed condition no artificial application of water.

In case of fertilizer application ½N and full dose of P and K applied as basal and remain ½ dose of N was top dressed after 1st Irrigation or 30 DAS at irrigated condition where as in rainfed condition entire quantity of fertilizer were applied as basal at a depth of 8-10 cm into soil. Seed rate was 75-80 kg ha^{-1} used at irrigated condition were as in rainfed 100-120 kg ha^{-1}. Spacing was maintained 25 cm × 4.5 cm in row to row and plant to plant. No plant protection measures were given to control diseases. Sometimes insecticides were used to control aphid at tillering stage of the crop.

Disease notes were recorded at post germination and soft dough stage following double digit (00-99) scale and converted to % DLA according to a recommended formula (Sharma and Duveiller 2003). DLA% = $(A/9 \times B/9) \times 100$

A = First digit of the score.

B = Second digit of the score

The crop was harvested on 25th February in each year.

The environmental parameters recorded were maximum and minimum temperature (T_{max} and T_{min}), Maximum and Minimum Relative Humidity (RH_{max} and RH_{min}), Wind Velocity (W_V), Vapor Pressure (V_P), Soil temperature (S_T), bright sunshine hours (*BSH*), total rainfall (R_T) and Evaporation (*EV*) from nearby observatory and seven days mean of those weather parameters except of 7 days cumulative rainfall were recorded for the entire period of disease assessment.

The results were statistically interpreted as analysis of variance (ANOVA) by a standard method by Gomez and Gomez, (1984) and also to find out the correlation between disease Severity and weather factors at different treatments was studied through regression analysis where disease is the dependent variables and weather factors were independent variables. Before subjecting the data for regression analysis, the logistic (Vander plank 1963), Gompertz transformation (Barger, 1981) were applied to disease proportions to linearise the data of percent disease severity. The Equations were as

$$\text{Logit}(Y) = \ln(Y/1 - Y)$$

$$\text{Gompit}(Y) = -\ln(-\ln(Y)$$

Then the regression models were applied for analyzing the effects of weather parameters on disease progress. The goodness of fit for regression models were evaluated by the correlation coefficient (*r*) values.

RESULTS AND DISCUSSION

The results of leaf blight, yield and environmental parameters on different treatment combinations were presented as.

A. Disease Severity

The leaf blight of barley showed difference in disease severity on three different varieties under three different levels of nitrogen in two different

Table 1
Effect of different varieties of foliar blight of barley (% DLA) and grain yield (q ha-1) in two consecutive years (2011-13) under irrigated and rainfed condition

Treatments	*Disease severity (% DLA)*			*Grain yield (q ha^{-1})*		
	2011-12	*2012-13*	*Pooled*	*2011-12*	*2012-13*	*Pooled*
Irrigated (*I*)	35.90	37.10	36.50	13.50	13.00	13.25
Rainfed (*R*)	37.40	38.70	38.00	12.36	11.00	11.68
SEm (±)	0.35	0.37	0.26	0.17	0.14	0.12
D (*P* = 0.05)	1.36	1.44	0.73	0.66	0.54	0.33
Variety (*V*)						
V_1	35.30	35.40	35.30	14.71	13.67	14.19
V_2	33.0	35.40	34.20	13.43	12.77	13.10
V_3	41.50	43.00	42.30	11.65	10.86	11.25
SEm(±)	0.29	0.25	0.19	0.34	0.30	0.24
CD (*P* = 0.05)	0.86	0.74	0.54	0.95	*0.84*	0.67
(*I* and *R*) × *V*						
$I\ V_1$	34.40	34.10	34.20	14.58	13.03	13.81
$I\ V_2$	32.90	34.70	33.80	13.56	13.66	13.61
$I\ V_3$	40.40	42.50	41.40	12.37	12.31	12.34
$R\ V_1$	36.20	36.60	36.40	12.84	11.70	12.27
$R\ V_2$	33.20	36.10	34.60	13.31	11.88	12.60
$R\ V_3$	42.70	43.90	43.10	10.93	9.42	10.17
SEm(±)	0.30	0.35	0.22	0.48	0.42	0.34
CD (*P* = 0.05) *i*	0.84	0.98	0.62	1.35	1.18	0.95

I = Irrigated condition, *R* = Rainfed condition, V_1 = RD 2552, V_2 = Azad and V_3 = NDB1173

water regimes (irrigated and rainfed) for the two consecutive years 2011-12 and 2012-13 and their differences were statistically significant. In every year the disease severity was minimum in rainfed condition (37.40 and 38.70 for the year 2011-2012 and 2012-2013 respectively) irrespective of nitrogen levels and varieties.

In case of varieties the two years and pooled mean data showed maximum disease in NDB 1173 (41.50 for 2011-12 and 43.00 for 2012-13 and 42.30 in pooled mean) and minimum in Azad (33.0; 35.40 and 34.20 for 2011-12, 2012-13 and in pooled mean respectively) irrespective of nitrogen levels and in different water regimes.

Three varieties on irrigated and rainfed conditions showed some significant differences in disease severity for the two consecutive years and in pooled mean. The two years pooled mean showed that maximum disease severity in NDB1173 (43.10) in rainfed condition followed by the same variety in irrigated condition though their difference was statistically significant. Minimum disease severity was noticed in Azad in irrigated condition (33.80) statistically at par with RD2552 in same water regime (Table 1).

Disease severity on three nitrogen levels and two water regimes showed that leaf blight of barley on three nitrogen levels were different and their differences were statistically significant. It was observed for two consecutive years and also in pooled mean. Disease severity on three nitrogen level showed maximum in low levels N (N_{40}) (37.72; 38.80 and 38.26 for 2011-12, 2012-13 and in pooled mean respectively) followed by N_{60} (36.65; 37.84 and 37.24 for 2011-12, 2012-13 and in pooled mean respectively) and minimum in N_{80} (35.52; 37.12 and 36.32 for 2011-12, 2012-13 and in pooled mean respectively) and their differences were statistically

Table 2
Effect of different levels of nitrogen and verities on (%DLA) of foliar blight disease of barley and grain yield (q ha^{-1}) in two consecutive years (2011-2013) under irrigated and rainfed conditions.

Treatments	*Disease severity (% DLA)*			*Grain yield (q ha^{-1})*		
	2011-12	*2012-13*	*Pooled*	*2011-12*	*2012-13*	*Pooled*
Nitrogen (N)						
N_{40}	37.72	38.80	38.26	10.69	9.76	10.23
N_{60}	36.65	37.84	37.24	13.35	11.81	12.58
N_{80}	35.52	37.12	36.32	14.74	14.43	14.59
SEm(±)	0.29	0.25	0.19	0.34	0.30	0.24
CD (P = 0.05)	0.86	0.74	0.54	0.95	0.84	0.67
(I and R) × N						
IN_{40}	36.80	37.72	37.26	11.42	10.38	10.90
IN_{60}	35.90	37.46	36.68	13.55	13.01	13.28
IN_{80}	34.90	36.28	35.59	15.54	15.60	15.57
RN_{40}	38.70	40.04	39.37	9.96	9.13	9.55
RN_{60}	37.30	38.12	37.77	13.16	10.61	11.88
RNg_{0}	36.10	38.10	37.10	13.95	13.26	13.61
SEm(±)	0.30	0.35	0.22	0.48	0.42	0.34
CD (P = 0.05)	0.84	0.98	0.62	1.35	1.18	0.95
V × N						
V_1N_{4o}	36.10	36.50	36.30	11.34	10.11	10.73
V_1N_{6o}	35.70	35.10	35.40	14.77	12.53	13.65
V_1N_{80}	34.00	34.50	34.30	15.02	14.46	14.74
V_2N_{40}	34.10	36.40	35.30	10.85	10.60	10.72
V_2N_{60}	32.70	35.20	33.90	13.95	12.29	13.12
V_2N_{8o}	32.40	34.60	33.50	15.50	15.42	15.46
V_3N_{4o}	43.10	43.60	43.30	9.89	8.56	9.23
V_3N_{60}	41.40	43.00	42.20	11.34	10.61	10.98
V_3N_{80}	40.10	42.30	41.20	13.71	13.42	13.56
SEm(±)	0.50	0.44	0.33	0.59	0.50	0.42
CD (P = 0.05)	1.49	1.31	0.93	1.66	1.41	1.18

I = Irrigated and R = Rainfed V_1 = RD 2552, V_2 = Azad and V_3 = NDB 1173

significant for both the years and in pooled mean irrespective of different water regimes and their differences were statistically significant (Table 2).

Interaction between N levels and water regimes showed maximum disease was noticed in low N level (N_{40}) in rainfed condition (38.70, 40.04 and 39.37 for 2011-12,2012-13 and pooled mean respectively) and minimum in high nitrogen level in irrigated condition N_{80} (34.90,36.28 and 35.59 for 2011-12,2012-13 and pooled mean respectively) and their differences were statistically significant (Table 2).

The three varieties under three nitrogen levels, the leaf blight severity was different in different treatments for the two consecutive years and in pooled mean. Minimum disease severity was noticed in Azad in high nitrogen levels (N_{80}) (32.40, 34.50 and 33.50 for 2011-12,2012-13 and pooled mean respectively) and maximum in NDB1173 in low nitrogen (N_{40}) levels (43.10,43.60 and 43.30 for 2011-12,2012-13 and pooled mean respectively)(Table 2)

Interaction between different varieties, nitrogen (N) combinations and water regimes (irrigated and rainfed) showed differential foliar

Table 3
Interaction between varieties, Nitrogen levels and water regimes (irrigated and rainfed) on disease severity (%DLA) and grain yield of barley for the two years and in pooled mean.

Treatments	*Disease severity (% DLA)*			*Grain yield (q ha^{-1})*		
	2011-12	*2012-13*	*Pooled*	*2011-12*	*2012-13*	*Pooled*
I × *V* × N						
IV_1N_{40}	35.4	34.9	35.2	11.57	10.62	11.10
IV_1N_{60}	34.9	34.7	34.8	16.07	13.49	14.78
IV_1N_{80}	32.9	32.7	32.8	16.10	15.00	15.55
IV_2N_{40}	33.3	35.5	34.4	11.59	10.59	11.09
IV_2N_{60}	32.2	34.7	33.4	13.48	13.01	13.24
IV_2N_{80}	33.1	34.1	33.6	15.61	17.37	16.40
IV_3N_{40}	41.7	42.6	42.2	11.10	9.94	10.52
IV_3N_{60}	40.5	43.0	41.7	11.11	12.54	11.82
IV_3N_{80}	38.9	41.8	40.4	14.90	14.44	14.67
RV_1N_{40}	36.7	38.0	37.4	11.10	9.61	10.36
RV_1N_{60}	36.6	35.5	36.1	13.48	11.57	12.52
RV_1N_{80}	35.2	36.3	35.7	13.94	13.93	13.94
RV_2N_{40}	34.9	37.4	36.1	10.11	10.62	10.36
RV_2N_{60}	33.1	35.8	34.4	14.43	11.57	13.00
RV_2N_{80}	31.6	35.1	33.4	15.39	13.46	14.43
RV_3N_{40}	44.4	44.6	44.5	8.69	7.18	7.93
RV_3N_{60}	42.2	43.0	42.6	11.57	8.69	10.13
RV_3N_{80}	41.4	42.8	42.1	12.53	12.39	12.46
SEm(±)	0.44	0.73	0.43	0.84	0.75	0.59
CD (P = 0.05)	1.31	2.18	1.28	2.30	2.11	1.66

V_1 = RD 2552, V_2 = Azad and V_3 = NDB 1173, *I* = Irrigated conditions, *R* = Rainfed condition

blight disease severity and their differences were statistically significant in both the two years and in pooled mean. The maximum disease was noticed in low nitrogen (N_{40}) level on variety NDB1173 under rainfed condition (44.4; 44.6 and 44.5 for 2011-12, 2012-13 and in pooled mean respectively) followed by same variety in medium N (N_{60}) level under same rainfed condition (42.2; 43.0 and 42.6 for 2011-12, 2012-13 and in pooled mean respectively) and their difference were statistically significant.

Minimum disease was observed in high N level (N_{80}) on RD2552 variety under irrigated condition (32.9; 32.7 and 32.8 for 2011-12, 2012-13 and in pooled mean respectively) significantly at par with medium N level (N_{60}) on Azad variety at irrigated condition (32.2; 34.7 and 33.4 for 2011-12, 2012-13 and in pooled mean respectively) (Table 3).

The result therefore showed that the foliar blight severity (AUDPC) was minimum in the variety Azad and RD 2552 in high nitrogen level (N_{80}) ha under irrigated condition. The result was in support of Prasad *et al* (2001) .The disease severity was maximum in rainfed condition in low levels of nitrogen also supported by Dubin and Bimb (1994) that the stress condition also increased the severity of leaf blight. They also reported that unbalanced soil fertility increases the pathogen of *Biopalaris sorokiniana* and rainfed condition increases the foliar blight which helps the spread of disease in rain flashes.

B. Grains Yield (q ha^{-1}) Under Different Treatment Combination

The effect of N levels, varieties and water regimes and the occurrence of disease severity have ultimately reflected in the grain yield of crop.

Different year harvested different grain yields under different treatment combinations and their differences were statistically significant. The two years data were not statistically different in between them and so pooled result were discussed here in and maximum grain yield was harvested on RD 2552 (14.19 q ha^{-1}) followed by Azad (13.10 q ha^{-1}) and minimum in NDB1173 (11.25 q/ha) and their differences were statistically significant irrespective of nitrogen level and water regimes (irrigated and rainfed).

Varieties and water regimes showed maximum grain yield on RD2552 (13.81 q ha^{-1}) in irrigated condition statistically at par with Azad (13.61 q ha^{-1}) in the same water regime and minimum in NDB1173 (10.17 q ha^{-1}) under rainfed condition irrespective of different N levels. (Table 1)

Nitrogen levels also affect the grain yield of barley under different water stress condition and maximum grain yield was noticed in high N (N_{80}) levels (N 14.59 q ha^{-1}) flowed by N60 (12q ha^{-1}) and minimum in N_{40} (10.23 q ha^{-1}) and their difference were statistically significant irrespective of water regimes. Interaction between nitrogen levels and water regimes showed maximum grain yield in high N levels (N_{80}) in irrigated condition (15.57 q ha^{-1}) and minimum in low N level (N_{40}) under rainfed condition (9.55 q ha^{-1}) and their difference was statistically significant. (Table 2)

Three variety and three levels of N showed significant difference in grain yield. Maximum grain yield was harvested in Azad in high N level (V_2 N_{80} 15.46 q ha^{-1}) statistically at par with RD2552 V_1 N_{80} level (14.74 q ha^{-1}) and minimum in NDB1173 in low N level (V_3 N_{40} 9.23 q ha^{-1}).

Interaction with water regimes, varieties and nitrogen combination showed different grain yield in two different years and in pooled mean. The pooled mean showed that maximum grain yield in the variety Azad with high N level (N_{80}) under irrigated condition (16.49 q ha^{-1}) statistically at par with variety RD2552 in high N level (N_{80}) in irrigated condition (15.55 q ha^{-1}) where as minimum grain yield in NDB1173 in low N level N_{40} under rainfed condition (7.93 q ha^{-1}) followed by the same variety in medium N level (N_{60}) under rainfed condition (10.13 q ha^{-1}) and their difference were statistically significant. The result was at par with Mathur and Bhatnagar (1993) that the maximum yield was obtained in high N level *i.e.* N_{80} treatments. (Table 3)

C. Disease Severity as a Function of Environment Under Different Treatments Ccombinations

Effect of different meteorological factor on disease severity of barley caused by *Helminthosporium sativum* was assessed for the pooled mean of two years (2011-12 and 2012-13)

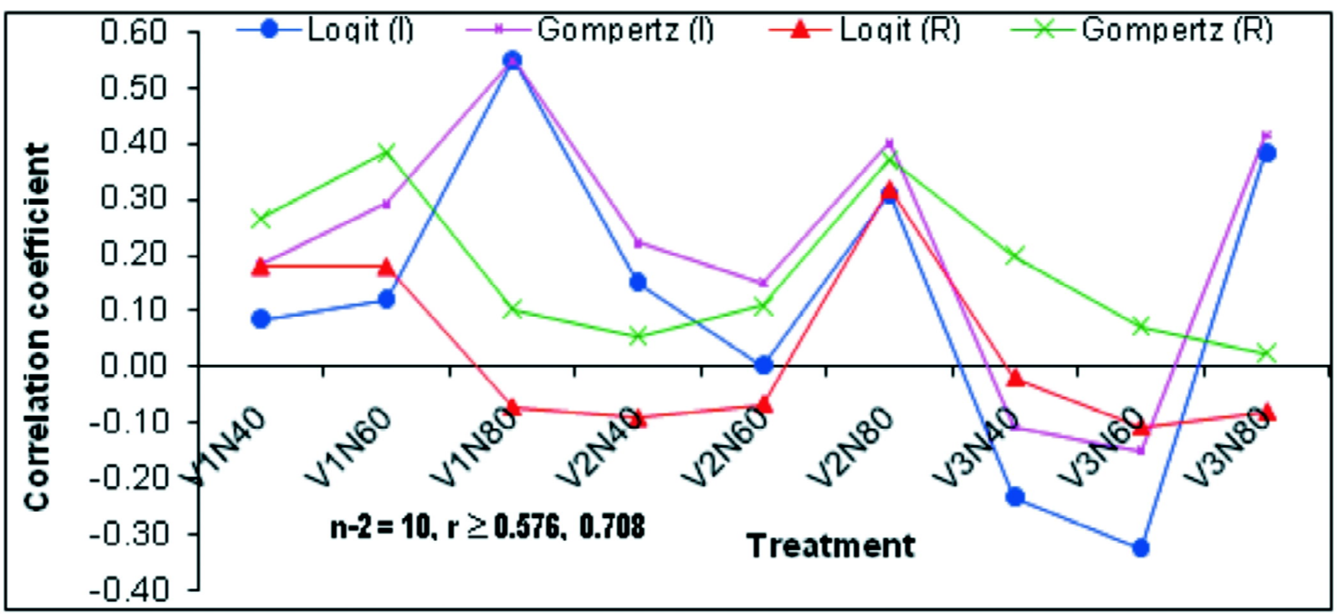

Figure 1. Correlation coefficient of maximum temperature (°C) with disease severity under different treatments in irrigated and rainfed condition

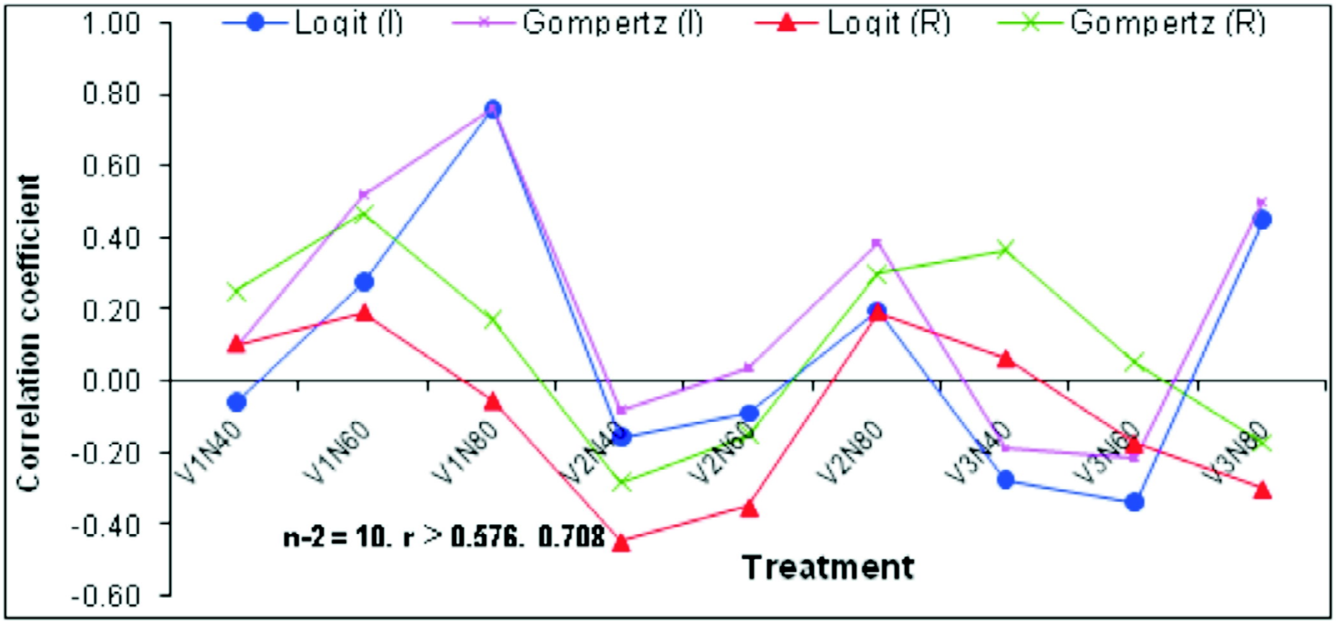

Figure 2: Correlation coefficient of minimum temperature (°C) with disease severity under different treatments in irrigated and rainfed condition

crops in rainfed and irrigated condition on three different varieties taking seven days average disease severity and correlating with ten meteorological parameters that is T_{max}, T_{min}, Soil tempt (ST), Vapour pressure (VP), RH max, RHmin, Wv, BSH, RT and Evaporation (EV) and compared with logistic and gomperts function for accuracy in disease progression.

Analysis of data showed differential reaction of disease severity on different meteorological factor under rainfed and irrigated conditions in different N levels. This was confirmed by high correlation coefficient (*r*) value ≥ 0.576 (P = 0.05) and ≥ 0.708 (P = 0.01). Tmax showed no positive or negative correlation with disease severity for all the varieties and N combinations for in both logit and gompertz functions. In gompertz function three varieties and N levels showed no positive correlation in irrigated conditions except V_3N_{40} and V_3N_{60}. Whereas, in logit function V_3N_{40}, V_3N_{60} and V_3N_{80} showed negative correlation though their relationships was not statistically significant in all those functions. Low co-efficient value (*r*) proved that T max have very negligible effect on disease severity. (Figure 1)

T_{min} under different treatment combinations showed that all the variety and N combinations showed a negative correlation in logit function under irrigated condition, except in V_1N_{60}, V_1N_{80}, V_1N_{40} and V_3N_{60}. Where as in Gompertz function T_{min} showed a positive correlation with disease severity except in V_2N_{40}, V_3N_{40} and V_3N_{60}.

Though in every growth function T_{min} showed no positive significant correlation with disease severity in V_1N_{80} combination under irrigated condition whereas, in rainfed condition no significant correlation was observed. (Figure 2)

Maximum relative humidity (RH_{max}) were negatively correlated with disease severity in both logit and gompertz function under irrigated and rainfed condition. Though, their relationship was not statistically significant. It indicated that RH_{max} have negative relation with disease severity under both irrigated and rainfed condition. (Figure 3)

Minimum Relative humidity (RH_{min}) showed a significant negative correlation with disease severity in all the varieties and *N* combinations under irrigated and rainfed condition in both growth functions. It indicated that with increase in RH_{min} there was a decrease in disease severity under rainfed condition. RH_{min} showed the significant negative correlation with disease were V_1N_{40}, V_1N_{60} and V_3N_{40} in logit function where as in gompertz function significant correlation were observed in V_1N_{40}, V_1N_{60}, V_3N_{60} and V_3N_{60} combinations. (Figure 4).

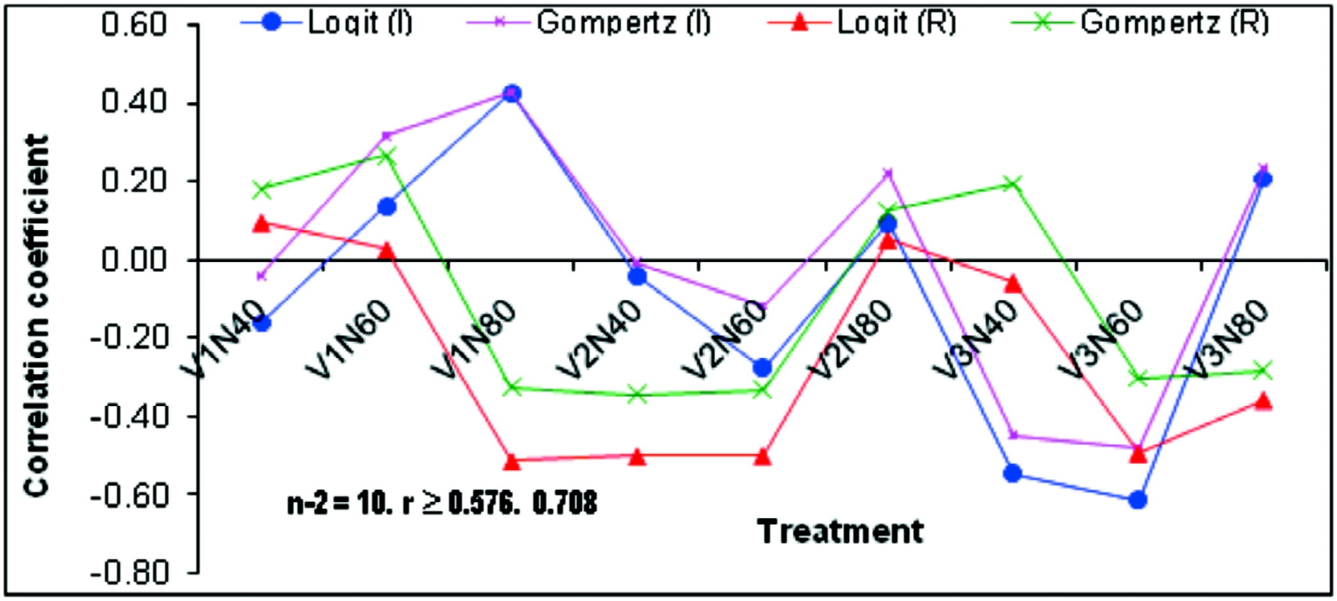

Figure 3: Correlation coefficient of maximum relative humidity (%) with disease severity under different treatments in irrigated and rainfed condition

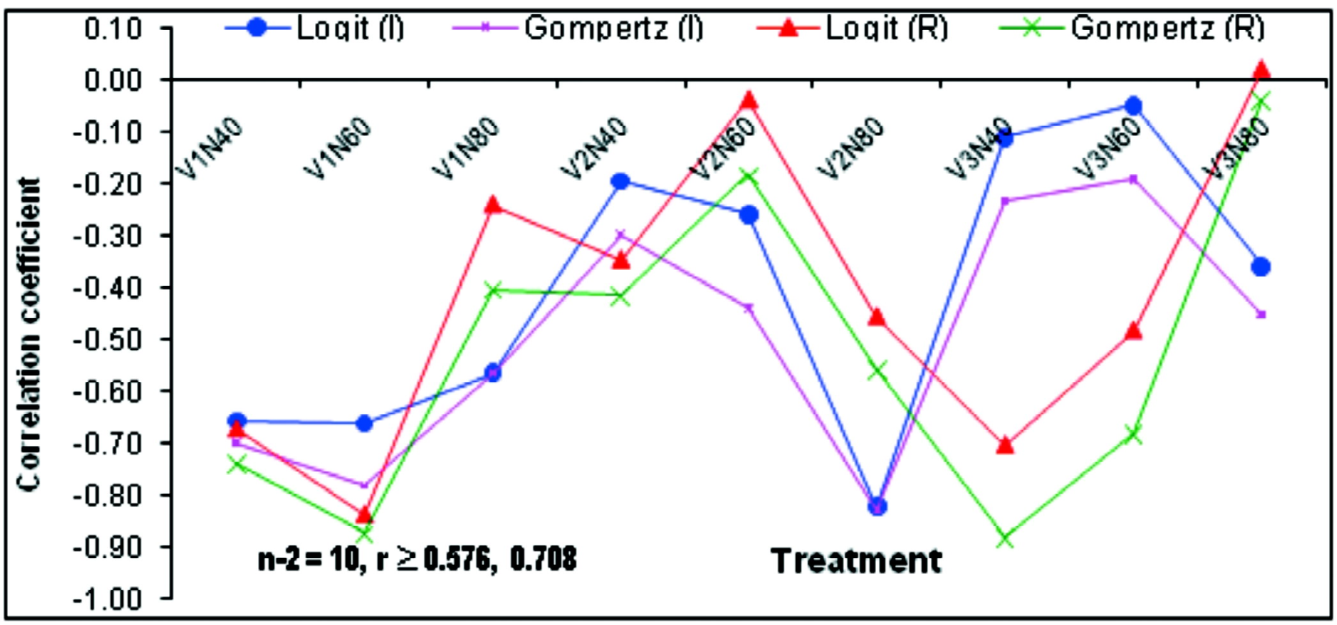

Figure 4 : Correlation coefficient of minimum relative humidity (%) with disease severity under different treatments in irrigated and rainfed condition

The soil temperature (ST) showed a negative correlation with disease severity in all the treatment combinations in logit function but their relationship were not statistically significant except in V_3N_{60}. It indicated that with increasing ST there was a significant decrease in disease severity in V_3N_{60} combination. Whereas, in gompertz function $V_2N_{60,}$ V_3N_{40} and V_3N_{60} treatment combinations showed a positive correlation, though their relationship were not statistically significant. (Figure 5)

Vapour pressure (VP) showed a positive significant correlation with disease severity in V_1N_{80} in logit and in gompertz function V_1N_{60} and V_1N_{60} showed the similar result. It indicated that in those treatment combinations with increase in VP there was an increase in disease severity. Other treatment combinations showed a negative or positive correlation with disease severity in both growth functions though their relationships were not statistically significant. (Figure 6)

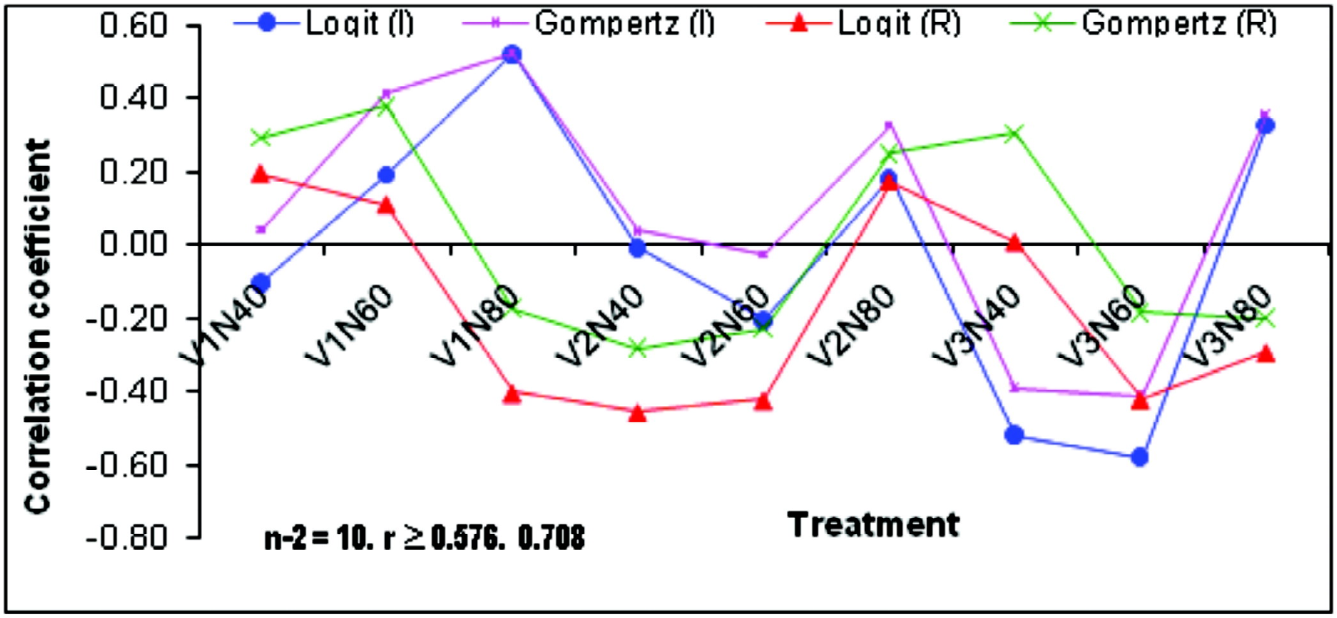

Figure 5. Correlation coefficient of soil temperature (°C) with disease severity under different treatments in irrigated and rainfed condition

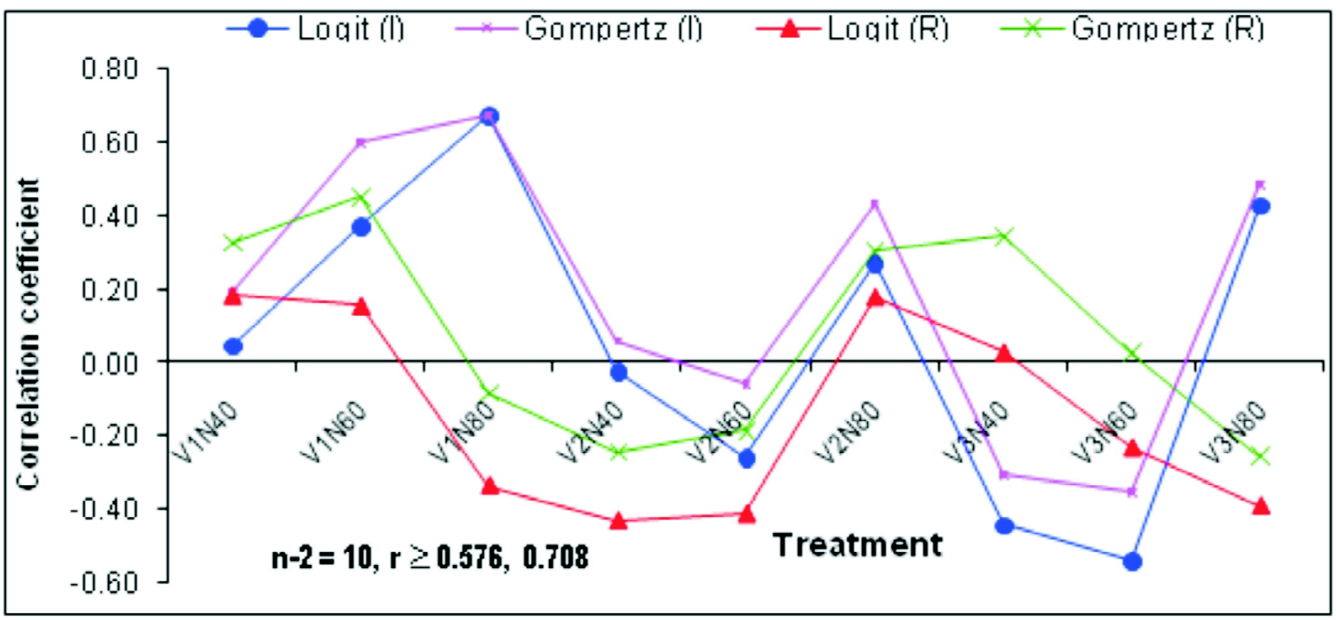

Figure 6: Correlation coefficient of vapour pressure (KPa) with disease severity under different treatments in irrigated and rainfed condition

Wind speed (WS) showed a negative significant correlation on V_1N_{80} and V_3N_{80} combination under irrigated condition in logit function where as in gompertz function this situation was observed in V_1N_{60}, V_1N_{80} and V_3N_{80} combinations. In another treatment V_1N_{80} also showed a negative significant correlation in gompertz function in rainfed condition (Figure 7)

Bright sunshine Hours (BSH) also showed a negative correlation in V_1N_{80}, V_2N_{60}, V_3N_{40} and V_3N_{60} combination in logit and gompertz function under irrigated condition except V_2N_{60} in gompertz function. But under rainfed conditions in logit growth function showed a positive significant correlation with disease severity in V_2N_{60} and V_3N_{80} whereas, in gompertz growth function only V_2N_{80} combination showed a positive significant correlation with disease severity. (Figure 8)

In case of total Rainfall (RT) the result showed that V_1N_{80} and V_3N_{80} combination were positively

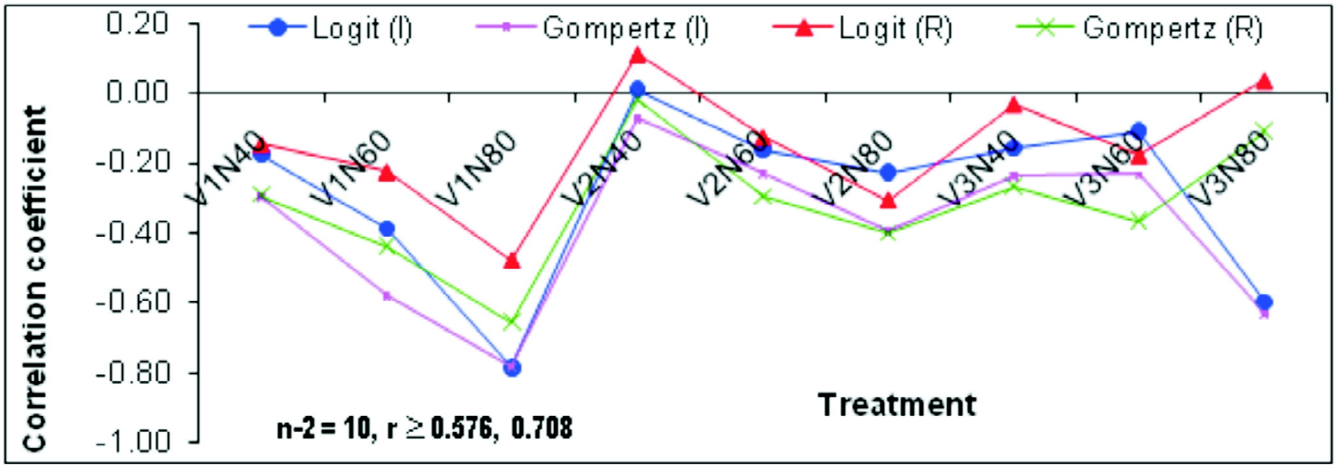

Figure 7: Correlation coefficient of wind speed (km hour^{-1}) with disease severity under different treatments in irrigated and rainfed condition

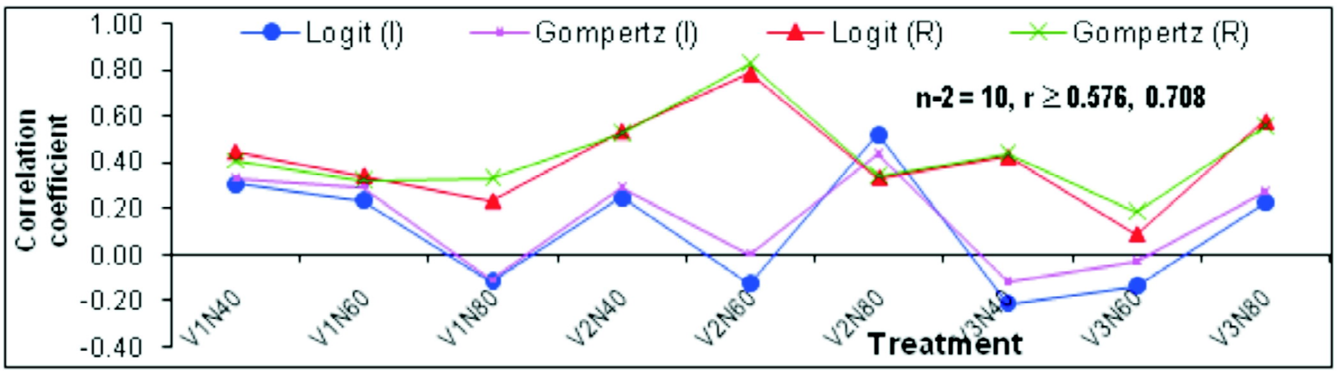

Figure 8: Correlation coefficient of bright sunshine (hour) with disease severity under different treatments in irrigated and rainfed condition

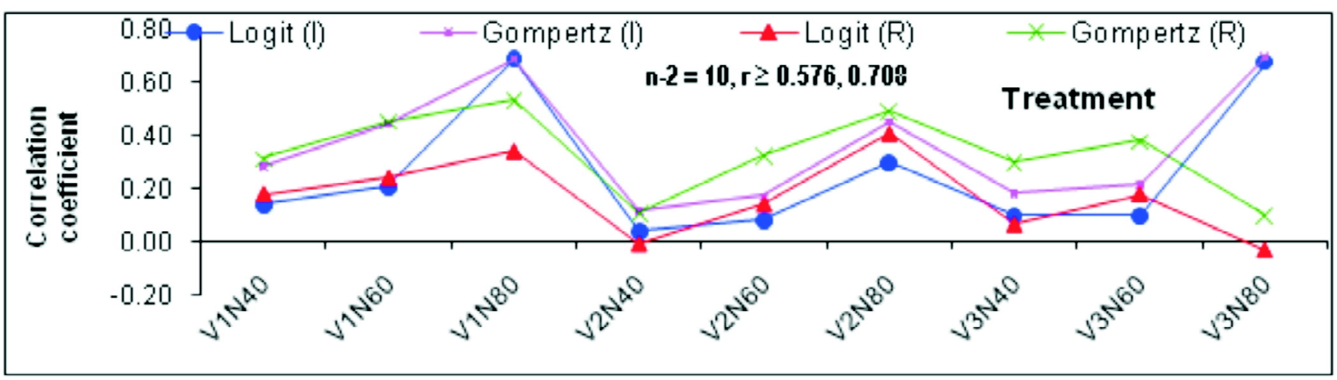

Figure 9: Correlation coefficient of total rainfall (mm) with disease severity under different treatments in irrigated and rainfed condition

significantly correlated with disease severity in irrigated condition under both growth functions. Whereas, in rainfed condition the correlation coefficient value of RT and disease severity showed no significant effect in every treatment combinations though they were positively correlated with an exception in V_2N_{40}, V_3N_{80} (Figure 9)

The evaporation also played a negative role in disease severity and more confined in irrigated condition though the correlation coefficient value proved that their relationship were not statistically significant. Whereas in rainfed condition the negative correlation coefficient value was observed in V_1N_{60}, V_2N_{40} and V_2N_{60} in logit function and V_1N_{40},

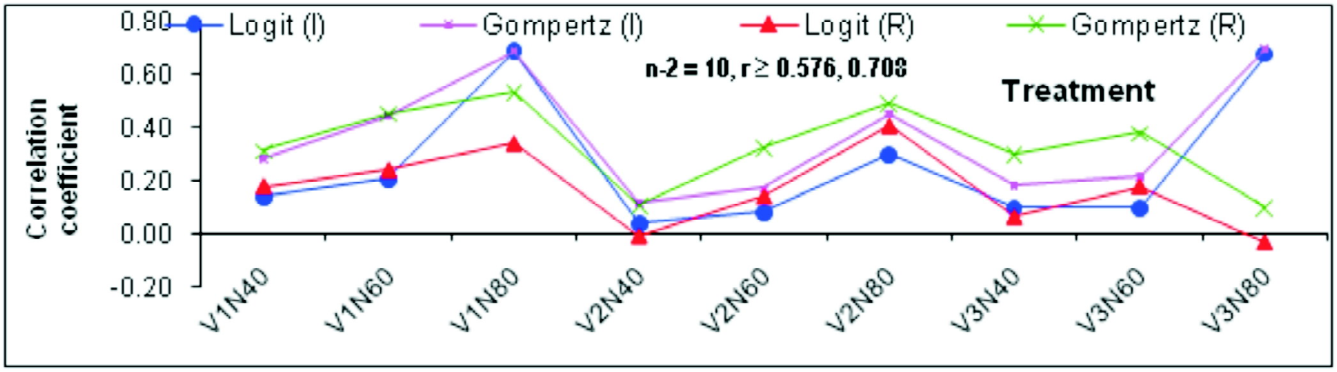

Figure 10: Correlation coefficient of evaporation (mm) with disease severity under different treatments in irrigated and rainfed condition

V_1N_{60}, V_1N_{80} and V_3N_{60} combination in gompertz functions. Though, there relationship was not statistically significant.

The result therefore concluded that T_{min}, *Wv*, *BSH*, *RH* min has negative or positive significant correlation with disease severity which increase the favorable weather on crop canopy, increase the leaf wetness for germination and infection whereas bright sunshine hours (BSH) has negative significant correlation which decrease the leaf wetness and also make disintegration of spores above the crop foliage. It was also observed that gompertz function was effectively proved the relationship between weather parameters and disease severity among the varieties, nitrogen levels under different water regimes (irrigated and rainfed condition) for preparing the future prediction equation of foliar blight of barley.

References

Berger, R.D. (1981), Comparison of Gompertz and logistic equations to describe disease progress. *Phytopathology*, 71: 716-719.

Chattopadhyay, S.B. and Sengupta, S.K. (1952), Addition to fungi of West Bengal. *Bull. Bot. Soc. Bengal*, 6 : 58-59.

Dubin, H. J. and Bimb, H. P. (1994), In : Wheat in Heat stressed environments : Irrigated, Dry Area and Rice-Wheat Farming Systems (Eds. Saunders, D. A. and Hettels, G. P.) pp. 343-352, Mexico, CIMMYT.

Gomez, K.A. and Gomez, A.A. (1984), *Statistical Procedures for Agricultural Research*, John. Wiley and Sons, New York, USA.

Mathur, A.K. and Bhatnagar, G.C. (1990), Effect of mineral element, hormone and urea on stripe disease infection in barley. *Indian Journal of Mycology and Plant Pathology*, 20(2): 192-193.

Mitra, M. (1930), A comparative study of spaces and strains of *Helminthosporium* on certain Indian cultivated crops. *Trans Brit. Mycol. Soc.*, 15 : 254-293.

Mitra, M. and Bose, R.D. (1935), *Helminthosporium* disease of barley and their control. *Indian J. Agric. Sci.*, 4: 692-700.

Prasad, Rajendra, Singh, H.C.; Singh, S. K. and Prasad, R. (2001), Effect of sowing date, temperature and relative humidity on the incidence of net blotch of barely. *Indian Phytopathology*, 54(3): 304-306.

Sharma, R.C. and E. Duveiller. (2003b), Selection index for improving Helminthosporium leaf blight resistance, maturity, and kernel weight in spring wheat. Crop Sci. 43: 2031-2036.

Singh, S. and Singh, A. (1971), Proc. II Int. Symp. Pl. Path. New Delhi pp. 112.

Vanderplank, J. E. (1963), *Plant disease Epidemics and Control.* Academic Press, London. 349pp.