Testing and validation of developed Disease prediction model of Foot rot and Leaf rot of betelvine (*Piper betel* L.) caused by *Phytophthora* sp. in three varieties of betelvine under closed conservatory condition in West Bengal

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Stepwise multiple regression analysis of per cent disease incidence of leaf and foot rot caused by Phytophthora sp on three different varieties of betelvine Ghanagette, Simurali Deshi and Simurali Gol Bhavna) was made by compiling the results of disease incidence during 2006-07,2007-08 and 2008-09 to find out the important meteorological parameters like Tmax, Tmin, RH max, RHmin and rainfall which were responsible for incidence of both the diseases.. The prediction equation for disease incidence which has been developed for foot rot and leaf rot of betelvine on three varieties (Ghanagette, Simurali Deshi and Simurali Gol Bhavna) were further fitted against the disease incidence of foot rot and leaf rot of betelvine in 2009-10 using the effective meteorological parameters of the same year for validation of these equations and models. The results showed poor estimated value during initial disease incidence. Among the two diseases (foot not and leaf rot) the estimated value of leaf rot incidence was nearer to original value. It was observed that in all prediction equation like Logit, Gompertz and Percent transformation, after 10th week of observations, the estimated value was similar to that of original value. It was more validated on leaf rot disease but not in foot rot disease. Among the three varieties tested, in Ghanagette and Simurali Deshi varieties, the prediction equations which were prepared were also showed some validation in predicting the disease incidence of betelvine.

Key words: Foot rot, Leaf rot, Disease prediction model, validation

INTRODUCTION

Cultivation of betelvine is highly risky and returns are uncertain because of its proneness to several diseases, aggravated by the moist and humid conditions of the plantation, that in turn are prerequisites for good harvest. Obviously the major constraint to cultivation of betelvine is its diseases that severally damage root, foot, stem, and foliage. The serious diseases reported include a foot rot syndrome produced by a number of pathogens including *Phytophthora parasitica* var. *piperina*, *P nicotianae* var *parasitica*, species of *Rhizoctonia*,

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Pythium and Sclerotium rolfsii, and foliage diseases like leaf rot by P. parasitica, P. palmivora, leaf spot and stem anthracnose caused by Colletorichum capsici, bacterial leaf spot and stem rot caused by Xanthomonas campestries pv. betlicola. Among the pathogens, Phytophthora sp. perhaps ranks first in its destructiveness under both field and storage conditions. The extent of losses may vary from 30 – 100% in case of foot rot and 20 – 40% in case of leaf rot, leading to almost total crop failure (Maiti and Sen, 1982; Dasgupta and Sen, 1998; Dasgupta et al., 2000).

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The incidence, pathogenesis and control of stem rot and leaf rot of betel vine caused by *P. parasitica*

have been studied in detail by Roy (2001), Sanyal (2002), Mahanty (2004) and under AICRP on betel vine (Anonymous, 2004,2006). Very little information have been received about epidemiology of stem rot caused by Phytophthora parasitica. Maiti and Sen (1982) have reported that the disease occur between June to October and reach its peak intensity during August and September. Observations made under AICRP on betelvine revealed that all the meteorological parameters like maximum and minimum temperature, maximum and minimum relative humidity and rainfall play important role on stem rot and leaf rot of betelvine caused by P. parasitica (Anonymous, 2006; Dasgupta and Maiti, 2008; and Datta et al., 2009). Datta et al., (2009) studied the epidemiology of foot and leaf rot of betelvine considering five meteorological factors in three betelvine varieties to reveal that minimum temperature is more responsible for increase the disease intensity as well as spread of the diseases as observed in original data and also in transformation models in all the three varieties. Individually, in variety Simurali Deshi, in addition to min. temp., max. RH is also responsible for increase the disease intensity of foot rot in all the transformation models. It is also revealed that among the two transformation models Logit transformation fit best for disease prediction and it is confirmed with high R2 value. So, it is concluded that with increase in minimum temperature (> 26.5°C) foot rot and leaf rot diseases increase significantly in case of Ghanagette and Simurali Gol Bhavna varieties whereas increase in minimum temperature and maximum relative humidity (96.5%) there is a significant increase in the intensity of leaf rot of betelvine in Simurali Deshi variety. The present investigation has been carried out to test and validate the developed Disease prediction model of Foot rot and Leaf rot of betelvine caused by Phytophthora sp. in three varieties of betelvine under closed conservatory condition in West Bengal.

MATERIALS AND METHODS

The varieties of betel vine used for epidemiological study were Simurali Gol Bhavna, Ghanagette and Simurali Deshi

The diseases selected for investigation of epidemiological study was foot rot and leaf rot diseases of betel vine caused by *P.parasitica*.

A 'boroj' was selected at Mondouri Farm, in the district of , N-24 Parganas. The size of the 'boroj'

was 500 sq. ft. with length and width of 25ft and 20ft respectively.

The data on meteorological factors, like maximum temperature, minimum temperature, maximum and minimum relative humidity and total rainfall were collected from Bell's thermohygrograph situated within the *boroj*. All the data were collected daily except the rainfall data, which was collected when rain occurred. The experiment was conducted during June to November when the incidence of foot rot and leaf rot diseases due to *P. parasitica* appeared. The disease incidence was recorded at 7 days interval starting from 1st week of June to last week of November.

The foot rot due to *P. parasitica* was calculated as per cent mortality of 100 vines (approx.). The leaf rot due to *P. parasitica* was calculated as per cent disease incidence. Per cent disease incidence was calculated as per cent of leaves infected in a random sample of 500 leaves (approx.). Per cent disease incidence was calculated according to Townsend and Heuberger (1943).

Three varieties Ghanagette, Simurali Deshi and Simurali Gol Bhavna were inoculated with *Phytphthora parasitica* during end of May of each year. The intensity of diseases was recorded from 1st week of June to November at 7 days interval during 2009-10. The average weekly meteorological parameters were used for multiple regression analysis.

The results obtained were analysed by multiple regression analysis (MRA) by compiling three years data where maximum temperature, minimum temperature, maximum relative humidity, minimum relative humidity and rainfall as explanatory variables (independent) and the per cent disease incidence of foot rot and leaf rot of betelvine caused by P. parasitica on above three varieties as dependent variable. For comparison of transformation models on disease prediction, the per cent disease incidence of foot rot and leaf rot data were transformed to Gompertz and Logistic model and step down multiple regression analysis were done with the above independent variables. The prediction equations for disease incidence were prepared by compiling the results of disease incidence of foot rot and leaf rot of betelvine during 2006-07, 2007-08 and 2008-09 with the meteorological parameters that were further fitted against the disease

incidence of foot rot and leaf rot of betelvine in current year (2009-10) using the effective meteorological parameters of current year for testing and validation of these equations and models.

RESULTS AND DISCUSSION

Five meteorological parameters like T_{max} , T_{min} , RH_{max} , RH_{min} and total rainfall played major role within the *boroj* for the growth of the plant as well as the pathogen and were considered for quantify the disease incidence. All the three popular varieties like Ghanagette, Simurali Deshi and Simurali Gol Bhavna showed differential disease reactions within the same environmental condition.

In case of variety Ghanagette, the coefficient determination (R2) values for prediction equations were though significant in different models (Logit and Gompertz) but found very low (Table 1). The results (Table 2) showed poor estimated value during initial disease incidence. Among the two diseases (foot rot and leaf rot) the estimated value of leaf rot incidence was nearer to original value. It was observed that in all prediction equations like Logit, Gompertz and per cent transformation, after 10th week of observations, the estimated value was similar to that of original value. It was more validated on leaf rot disease but not in foot rot disease. After 16th weeks of observation it was showed that in both the diseases the estimated disease and observed diseases were similar. It was also observed that the Logit and Gompertz prediction models were best fitted to predict both the diseases. After 23rd these prediction equations were not suited up to 24th weeks of observations. The disease incidences were low at the latter part of observations as the disease fall due to change in environmental condition. Some erratic results were observed due to erratic change in environmental conditions.

The results (Table 3) showed poor estimated value during initial disease incidence in variety Simurali deshi and the coefficient determination (R²) values (Table 1) for prediction equations were though significant in different models (Logit and Gompertz) but found very low. Among the two diseases (foot rot and leaf rot) the estimated value of leaf rot incidence was nearer to original value. It was observed that in all prediction equations per cent transformation, after 8th week of observations, the estimated value was similar to that of original value. It

was more validated on leaf rot disease but not in foot rot disease. After 17th weeks of observation it showed that in both foot rot and leaf rot diseases the estimated disease and observed diseases were similar. It was also observed that the Logit and Gompertz prediction models were best fitted to predict both the diseases. The disease incidences were low at the latter part of observations as the diseases fall due to change in environmental condition.

The coefficient determination (R2) values for prediction equations were though significant in different models but it found very low in variety Simurali Gol Bhavna (Table 1). The results (Table 4) showed poor estimated value during initial disease incidence. Among the two diseases the estimated value of leaf rot incidence was nearer to original value. It was observed that in all prediction equations like Logit, Gompertz and per cent transformation, the estimated value was similar to that of original value in 9th, 11th, 15th, 16th and 17th weeks of observations. It was more validated on leaf rot disease but not in foot rot disease. After 23rd weeks of observation it showed that in both foot rot and leaf rot diseases the estimated diseases and observed diseases were similar. The prediction equation was not suited in rest of the observations. It was also observed that the Logit and Gompertz prediction models were best fitted to predict both the diseases. The disease incidences were low at the latter part of observations as the disease falls due to change in environmental condition. Moreover, some erratic results were observed due to erratic change in environmental conditions.

It was observed that in all prediction equations, after 10th week of observations, the estimated value was similar to that of original value. It was more validated on leaf rot disease but not in foot rot disease. Among the three varieties tested, in Ghanagette and Simurali Deshi varieties, the prediction equations which were prepared were also showed some validation in predicting the disease incidence of betelvine.

The prediction equations will be best fitted if these equations were prepared by considering the other meteorological parameters like sunshine hours, vapour pressure, wind velocity and also microclimate within the plant population. Yet the prediction equations which were prepared were also showed some validation in predicting the disease incidence of betelvine.

Table contd.....

Table 1: Comparison of different transformation models on prediction of foot rot and leaf rot disease intensity of betelvine

Variety Ghanagelete Filted regression equation Fig. Adjusted RP** Adjusted RP** Foot rol 55 (est.) Diseases (est.) Color of 55 (est.) SE. Diseases (est.) Diseases (est.) Diseases (est.) Diseases (est.) Color of 55 (est.) Color of 55 (est.) Color of 55 (est.) Diseases (est.) Color of 55 (est.)	Year 2006-07	7						
Fitted regression equation R² Adjusted R² Residual S.E.	Variety Ghar	nagette						
Y = -2.24 + 0.022 max, RH** + 0.008 min, Temp* 0.51 0.47 0.04 0.002 Y = -0.22 + 0.002 min, RH** + 0.12 min, Temp* 0.59 0.67 0.04 0.03 0.008 Y = -0.22 + 0.002 min, RH** + 0.12 min, Temp* 0.54 0.56 0.07 Y = -18.10 + 0.13 min, Temp** + 0.14 max, RH** + 0.25 min, Temp** + 0.75 0.75 0.70 0.75 0.01 0.04 max, RH** + 0.04 min, Temp** + 0.75 0.75 0.10 0.01 Y = -0.40 + 0.000 min, RH** + 0.03 min, Temp** + 0.75 0.75 0.00 Y = -0.40 + 0.000 min, RH** + 0.03 min, Temp** + 0.75 0.73 0.04 Y = -0.40 + 0.000 min, RH** + 0.02 max, RH** + 0.04 min, Temp** 0.55 0.73 0.04 Y = -0.30 + 0.02 min, RH** + 0.04 min, Temp** 0.50 0.48 0.03 0.000 Y = -0.30 + 0.02 min, RH** + 0.04 min, Temp** 0.55 0.48 0.03 0.000 Y = -0.30 + 0.02 min, RH** + 0.04 min, Temp** 0.55 0.48 0.03 0.000 Y = -0.30 + 0.03 min, RH** 0.50 0.48 0.03 0.000 Y = -0.30 + 0.03 min, RH** 0.50 0.48 0.03 0.000 Y = -0.30 + 0.03 min, RH** 0.50 0.48 0.03 0.000 Y = -0.30 + 0.03 min, RH** 0.50 0.48 0.03 0.000 Y = -0.30 + 0.03 min, RH** 0.50 0.48 0.03 0.000 Y = -0.30 + 0.03 min, RH** 0.50 0.48 0.03 0.000 Y = -3.39 + 0.03 min, RH** 0.50 0.48 0.03 0.04 0.000 Y = -3.39 + 0.03 min, RH** 0.50 0.49 0.24 0.000 0.50 0.49 0.24 0.000 0.50 0.49 0.24 0.000 0.50 0.49 0.20 0.000 0.50 0.49 0.000 0.	Model	Transformation		H ₂	Adjusted R ²	Residual	S.E.	Disease
Y = -35.62 + 0.31 max. RH** + 0.12 min. Temp** 0.54 0.49 0.59 0.35 Y = -18.10 + 0.13 min Temp** + 0.14 max RH** 0.76 0.74 0.26 0.07 1 Y = -12.57 + 0.11 max RH** + 0.04 min Temp** + 0.78 0.75 0.10 0.01 0.04 max RH* 0.04 max RH** + 0.03 min Temp** + 0.78 0.75 0.10 0.01 0.04 max RH* 0.04 max RH** 0.05 0.003 0.075 0.005 0.003 Y = -0.43 + 0.008 min RH** + 0.23 max RH** 0.57 0.56 0.05 0.003 Y = -0.43 + 0.008 min RH** + 0.23 max RH** 0.57 0.73 0.49 0.24 Y = -3.39 + 0.02 min RH** + 0.04 min Temp** 0.77 0.56 0.48 0.009 Y = -0.30 + 0.005 min RH** 0.50 0.48 0.009 Y = -0.30 + 0.005 min RH** 0.50 0.48 0.009 Y = -0.30 + 0.005 min RH** 0.50 0.48 0.009 0.50 0.48 0.009 0.50 0.48 0.009 0.50 0.48 0.009 0.50 0.48 0.009 0.50 0.48 0.009 0.50 0.48 0.009 0.50 0.48 0.009 0.50 0.49 0.22 0.50 0.49 0.22 0.50 0.49 0.20 0.50 0.40 0.40 0.40 0.50 0.40 0.40 0.40 0.50 0.40 0.40 0.40 0.50 0.40 0.40 0.40 0.50 0.40 0.40 0.40 0.50 0.40 0.40 0.40 0.50 0.40 0.40 0.40 0.40 0.50 0.40 0.40 0.40 0.40 0.40 0.40 0.40	Stepwise	Percent	+ +	0.51	0.47	0.04	0.002	Foot rot
Y = -18.10 + 0.13 min Temp** + 0.14 max RH*** 0.76 0.74 0.26 0.07 1 Y = -12.74 + 0.03 min Temp** + 0.04 min Temp** 0.59 0.78 0.70 0.01 1 0.04 max RH** + 0.008 min RH** + 0.03 min Temp** + 0.78 0.55 0.05 0.003 1 Y = -0.40 + 0.008 min RH** + 0.03 min Temp** + 0.57 0.56 0.05 0.003 1 Y = -0.40 + 0.008 min RH** + 0.23 max RH** 0.51 0.49 0.24 0.40 1 Y = -0.40 + 0.10 min RH** + 0.23 max RH** 0.55 0.54 0.20 0.04 1 Y = -0.29.69 + 0.24 min RH** + 0.04 min Temp** 0.51 0.56 0.54 0.20 0.04 1 Y = -0.30 + 0.002 min RH** + 0.04 min Temp** 0.50 0.48 0.03 0.000 1 Y = -0.30 + 0.002 min RH** + 0.04 min Temp** 0.50 0.49 0.22 0.04 0.002 1 Y = -0.30 + 0.002 min RH** 0.32 max RH** 0.50 0.49 0.23 0.52 1 Y = -0.30 + 0.002 min RH** 0.32 max RH** 0.50 0.49 0.23 0.52 1 Y = -0.30 + 0.003 min RH** 0.003 min RH** 0.000 0.58 0.49 0.23 0.52 1 Y = -0.30 + 0.003 min RH** 0.000 0.50 0.000	Occurrence		Y = -35.62 + 0.31 max. RH** + 0.12 min. Temp**	0.54	0.49	0.59	0.35	Foot rot
Y = -12.57 + 0.11 max RH** + 0.04 min Temp** + 0.78	asiwdaic	Logic	Y = -18.10 + 0.13 min Temp** + 0.14 max RH**	92.0	0.74	0.26	0.07	Leaf rot
Y = -5.74 + 0.008 min RH** + 0.03 min Temp** + 0.78 0.75 0.75 0.10 0.01 1 Y = -0.40 + 0.007 min RH** + 0.03 min RH** + 0.03 max RH** 0.51 0.54 0.63 0.05 0.003 1 Y = -0.43 + 0.008 min RH** 0.54 0.055 0.005 0.003 1 Y = -0.36 + 0.010 min RH** 0.23 max RH** 0.55 0.54 0.27 0.07 1 Y = -0.20 + 0.003 min RH** 0.20 min RH** 0.50 0.48 0.03 0.000 Y = -0.20 + 0.003 min RH** 0.30 min RH** 0.50 0.48 0.03 0.000 Y = -0.20 + 0.003 min RH** 0.50 0.48 0.03 0.000 Y = -0.30 + 0.003 min RH** 0.50 0.48 0.03 0.000 Y = -0.30 + 0.003 min RH** 0.50 0.48 0.83 0.69 Y = -0.30 + 0.003 min RH** 0.50 0.49 0.23 0.52 Y = -0.30 + 0.003 min RH** 0.50 0.04 0.05 Y = -0.30 + 0.003 min RH** 0.50 0.00 0.58 0.000 Y = -0.30 + 0.003 min RH** 0.05 0.00 0.58 0.000 Y = -3.39 + 0.003 min RH** 0.000 0.00 0.00 0.00 Y = -3.39 + 0.003 min RH** 0.000 0.00 0.00 0.00 0.00 Y = -3.39 + 0.003 min RH** 0.000 0.00 0.00 0.00 0.00 0.00 Y = -3.39 + 0.003 min RH** 0.000 0.00 0.00 0.00 0.00 0.00 0.00			Y = -12.57 + 0.11 max RH** + 0.04 min Temp**	0.54	0.50	0.21	0.04	Foot rot
Y = -0.40 + 0.007 min RH** 0.57 0.56 0.05 0.003 Y = -0.40 + 0.008 min RH** 0.64 0.63 0.05 0.003 Y = -0.43 + 0.008 min RH** 0.75 0.49 0.84 0.003 Y = -29.69 + 0.24 min RH** 0.75 0.73 0.49 0.04 Y = -29.69 + 0.24 min RH** 0.75 0.73 0.49 0.24 Y = -3.36 + 0.0 min RH** 0.05 0.56 0.54 0.27 0.07 Y = -0.20 + 0.003 min RH** 0.50 0.48 0.03 0.0002 P Y = -0.33 + 0.005 min RH** 0.50 0.48 0.03 0.000 P Y = -0.31 + 0.03 min RH** 0.50 0.49 0.23 0.52 0.49 0.23 0.52 Y = -3.39 + 0.03 min RH** 0.50 0.58 0.24 0.06 0.58 0.24 0.06 1.00 Y = -3.39 + 0.03 min RH** 0.50 0.49 0.23 0.24 0.06 1.00 0.07 0.07 0.01 1.00 Y = -3.39 + 0.03 min RH** 0.05 0.07 0.07 0.07 0.07 0.07 <td>Stepwise</td> <td>Gompertz</td> <td>-5.74 + 0.008 min RH* + 0.03 min Temp** max BH*</td> <td>0.78</td> <td>0.75</td> <td>0.10</td> <td>0.01</td> <td>Leaf rot</td>	Stepwise	Gompertz	-5.74 + 0.008 min RH* + 0.03 min Temp** max BH*	0.78	0.75	0.10	0.01	Leaf rot
Y = -0.40 + 0.007 min RH** 0.57 0.56 0.05 0.003 F Y = -0.43 + 0.008 min RH** 0.51 0.63 0.05 0.005 0.003 1 Y = -0.45 + 0.10 min RH** 0.25 0.73 0.49 0.24 0.40 0.40 0.40 0.40 0.40 0.40 0.40 0.27 0.08 0.08	Variety Simu	rali Deshi						
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Y = -0.20 + 0.003 min RH** 0.50 0.48 0.03 0.0009 F Y = -0.30 + 0.005 min RH** 0.55 0.53 0.04 0.002 Y = -0.30 + 0.005 min RH** 0.55 0.53 0.04 0.002 Y = -40.71 + 0.30 min RH** 0.75 0.73 0.61 0.38 Y = -3.14 + 0.03 min RH** 0.60 0.58 0.24 0.06 Y = -3.39 + 0.03 min RH** 0.60 0.58 0.24 0.06 Y = -3.39 + 0.03 min RH** 0.60 0.58 0.24 0.06 Y = -3.39 + 0.03 min RH** 0.60 0.58 0.24 0.06 Y = -3.39 + 0.03 min RH** 0.12 0.07 0.03 0.0001 Y = -5.04 + 3.006 min Temp* + 0.04 min Temp* + 0.027 0.17 0.03 0.007 0.03 0.0001 Y = -2.83 + 0.001 rainfall 0.10 0.07 0.03 0.045 0.02 P Y = -1.054 - 0.0005 rainfall 0.10 0.03 0.14 0.02 0.17 0.03 0.02 0.14 0.02 0.17 0.03 0.02 0.10 0.03 0.14 0.02 0.10	Stepwise	Gompertz	= - 3.36	0.56	0.54	0.27	0.07	Foot rot Leaf rot
Y = -0.20 + 0.003 min RH** Y = -0.30 + 0.005 min RH** Y = -40.71 + 0.30 min Temp** + 0.32 max RH** On Fitted regression equation Fitted regression Fitte	Variety Simu	rali Gol Bhavna						
The first of the following the first of the	Stepwise	Percent	11	0.50	0.48	0.03	0.0009	Foot rot
The Y = -10.33 + 0.10 min RH** Y = -40.71 + 0.30 min Temp** + 0.32 max RH** Y = -40.71 + 0.03 min RH** Y = -40.71 + 0.03 min RH** Y = -3.39 + 0.03 min RH** Stock that the temp and the series of the side of the temp and t			11	0.55	0.53	0.04	0.002	Leaf rot
Y = -40.71 + 0.30 min Temp** + 0.32 max RH** 0.75 0.73 0.61 0.38 1 repertz Y = -3.14 + 0.03 min RH** 0.60 0.52 0.49 0.23 0.52 6.52 6.49 0.23 0.52 6.52 <td>Stepwise</td> <td>Logit</td> <td>11</td> <td>0.50</td> <td>0.48</td> <td>0.83</td> <td>69.0</td> <td>Foot rot</td>	Stepwise	Logit	11	0.50	0.48	0.83	69.0	Foot rot
ppertz $Y = -3.14 + 0.03 \min RH^{**}$ 0.52 0.49 0.23 0.52 P 0.24 0.06 L 1 0.05 Min RH** 0.60 Min RH** 0.05 Min Temp* 0.12 0.07 0.03 0.0001 F 0.03 max RH V = -2.83 + 0.005 rainfall 0.10 0.03 max Temp* + 0.12 min Temp* - 0.08 0.17 0.05 0.14 0.05 max Temp* 0.10 0.09 0.16 0.10 0.10 0.09 Pertz $Y = 9.71 - 0.15 \max Temp* + 0.12 \min Temp* - 0.08 0.28 0.17 0.53 0.27 L 0.20 RH*$			= -40.71	0.75	0.73	0.61	0.38	Leaf rot
Y = -3.39 + 0.03 min RH** N = -3.39 + 0.03 min RH** Isformation Fitted regression equation Fitted regression equation Y = -5.04 + 3.006 min Temp* O.03 max RH Y = -2.83 + 0.001 rainfall Y = -2.83 + 0.001 rainfall Y = -2.83 + 0.005 min RH* O.10 O.10	Stepwise	Gompertz	11	0.52	0.49	0.23	0.52	Foot rot
Signation Fitted regression equation R ² Adjusted R ² Residual S.E			= -3.39	0.60	0.58	0.24	90.0	Leaf rot
Secondation Fitted regression equation R ² Adjusted R ² Secondarial S.E	Year 2007-0	8						
Transformation Fitted regression equation R² Adjusted R² Residual S.E SS (est.) Y = -5.04 + 3.006 min Temp* 0.12 0.07 0.07 0.03 0.0001 F Percent Y = 3.916 - 0.05 max Temp* + 0.04 min Temp* - 0.027 0.17 0.16 0.03 0.045 0.007 0.0007 0.0007 0.0000 0.00	Variety Ghar	nagette						
Y = -5.04 + 3.006 min Temp* Percent Y = 3.916 - 0.05 max Temp* + 0.04 min Temp* - 0.27 0.17 0.03 0.0001 0.03 max RH V = -2.83 + 0.001 rainfall Y = -4.81 + 0.052 min RH* Y = -4.81 + 0.052 min RH* Y = -4.81 + 0.052 min RH* O.10 0.03 0.16 1.00 1.00 Y = -1.054 - 0.0005 rainfall Gompertz Y = 9.71 - 0.15 max Temp* + 0.12 min Temp* - 0.08 0.28 0.17 0.53 0.27	Model	Transformation		H ₂	Adjusted R ²	Residual SS	S.E (est.)	Disease
Percent Y = 3.916 - 0.05 max Temp* + 0.04 min Temp* - 0.27 0.17 0.16 0.027 0.03 max RH 0.03 max RH 0.01 coint Y = -2.83 + 0.001 rainfall			+	0.12	0.07	0.03	0.0001	Foot rot
Logit Y = -2.83 + 0.001 rainfall 0.10 0.03 0.45 0.20 V = -4.81 + 0.052 min RH* 0.19 0.16 1.00 1.00 V = -1.054 - 0.0005 rainfall 0.10 0.03 0.14 0.02 Gompertz Y = 9.71 - 0.15 max Temp* + 0.12 min Temp* - 0.08 0.28 0.17 0.53 0.27	Stepwise	Percent	- 0.05 max Temp* + 0.04 min Temp* RH	0.27	0.17	0.16	0.027	Leaf rot
Y = -4.81 + 0.052 min RH* Y = -4.81 + 0.052 min RH* Y = -1.054 - 0.0005 rainfall Gompertz Y = 9.71 - 0.15 max Temp* + 0.12 min Temp* - 0.08 0.19 0.19 0.10 1.00 1.00 0.17 0.053 0.27	Ctonwico	tipo I	Y = -2.83 + 0.001 rainfall	0.10	0.03	0.45	0.20	Foot rot
Y = -1.054 – 0.0005 rainfall 0.10 0.03 0.14 0.02 Gompertz Y = 9.71 – 0.15 max Temp* + 0.12 min Temp* - 0.08 0.28 0.17 0.53 0.27 max RH*	Cichwise	Logic	$Y = -4.81 + 0.052 \text{ min RH}^*$	0.19	0.16	1.00	1.00	Leaf rot
Gompertz Y = 9.71 – 0.15 max Temp* + 0.12 min Temp* - 0.08 0.28 0.17 0.53 0.27 I max RH*			Y = -1.054 - 0.0005 rainfall	0.10	0.03	0.14	0.05	Foot rot
	Stepwise	Gompertz	$Y = 9.71 - 0.15 \text{ max Temp}^* + 0.12 \text{ min Temp}^* - 0.08 \text{ max RH}^*$	0.28	0.17	0.53	0.27	Leaf rot

Variety Simurali Deshi	rali Deshi						
Stepwise	Percent	$Y = -0.40 + 0.001 \text{ min RH}^*$	0.15	0.12	0.24	0.0005	Foot rot
Stepwise	Logit	Y = -0.39 + 0.03 min RH* Y = -3.02 rainfall** Y = -7.84 + 0.28 min Temp**	0.24	0.20	0.17	0.028 0.14 40.95	Leaf rot Foot rot Leaf rot
Stepwise	Gompertz	Y = -1.17 Rainfall** Y = -3.00 + 0.118 min Temp**	0.00	0.00	0.17	0.01	Foot rot Leaf rot
Variety Simur	Variety Simurali Gol Bhavna						
Stepwise	Percent	Y = 0.23 - 0.0088 max Temp + 0.010 min Temp - 0.002 min RH + 0.0002 Rainfall	0.29	0.15	0.030	0.0009	Foot rot
Stepwise	Logit	Y = 0.32 + 0.033 min Temp** - 0.03 max Temp* Y = -1.37 - 0.07 min Temp	0.40	0.33	0.114	0.013	Leaf rot Foot rot
		Y = -7.63 + 0.26 min Temp**	0.46	0.44	0.890	0.80	Leaf rot
Stepwise	Gompertz	Y = -1.610 + 0.055 max Temp - 0.055 min Temp + 0.0016 Rainfall* Y = -0.75 + 0.13 min Temn** - 0.088 max Temn*	0.48	0.31	0.13	0.017	Foot rot
Year 2008-09	6		5	5		5	רפמו וסו
Variety Ghanagette	agette						
Model	Transformation	on Fitted regression equation	\mathbb{R}^2	Adjusted R ²	Residual SS	S.E (est.)	Disease
		Y = -3.65 + 0.03 min Temp** + 0.037 max RH** - 0.004 min BH* - 0.002 Bainfall	0.51	0.41	0.081	0.006	Foot rot
Stepwise	Percent	Y = -5.54 - 0.045 min Temp** + 0.059 max RH** - 0.011 min RH* - 0.002 Rainfall	0.45	0.34	0.13	0.016	Leaf rot
		Y = -6.33 + 0.18 min Temp**	0.35	0.32	0.86	0.73	Foot rot
Stepwise	Logit	Y = -42.69 + 0.31 min Temp** + 0.42 max RH** - 0.06 min RH* - 0.019 Rainfall	0.54	0.44	0.80	0.64	Leaf rot
Stepwise	Gompertz	Y = - 2.27 + 0.065 min Temp** Y = -19.84 + 0.15 min Temp* + 0. 20 max RH* -	0.30	0.26	0.365	0.12	Foot rot Leaf rot
Variety Simurali Deshi	rali Deshi						
Stepwise	Percent	Y = -0.41 + 0.024 min Temp** Y = -0.37 + 0.02 min Temn*	0.39	0.36	0.10	0.01	Foot rot
Stepwise	Logit	= -6.90 + 0.21	0.29	0.25	0.81	99.0	
÷)	Y = -9.70 + 0.32 min Temp**	0.37	0.34	1.01	1.03	Leaf rot
		$Y = -2.90 + 0.094 \text{ min Temp}^*$	0.28	0.24	0.36	0.14	Foot rot
Stepwise	Gompertz	Y = -3.3 + 0.1 min Temp*	0.24	0.20	0.48	0.23	Leaf rot

Variety Simul	Variety Simurali Gol Bhavna							
	Percent	Y = -5.04 + 0.04 min Temp** + 0.05 max RH** -	0.57	27	0.48	0.09	0.009	Foot rot
Stepwise	transformati-	transformati- 0.007 min RH* - 0.002 Rainfall**						
	on	Y = -6.20 + 0.05 min Temp** + 0.06 max RH** -	0	0.46	0.35	0.14	0.020	Leaf rot
		0.01 min RH* - 0.002 Rainfall						
040	-	Y = -36.92 + 0.30 min Temp** + 0.30 max RH** -	0.	0.52	0.42	0.72	0.53	Foot rot
Siepwise	Logii	0.05 min RH* - 0.01 Rainfall*						
		Y = -4.70 + 0.14 min Temp*	0	0.17	0.12	1.07	1.15	Leaf rot
		Y = -19.3 + 0.07 max Temp - 0.13 min Temp +0.16	0	0.55	0.42	0.33	0.10	Foot rot
000000	1	RH** - 0.02 min RH - 0.0071 Rainfall*			v.			
Stepwise	Gompenz	Y = -21.31 + 0.18 min Temp** + 0.21 max RH** -	0	0.51	0.41	0.43	0.19	Leaf rot
		0.03 min RH* - 0.007 Rainfall						

Table 2: Prediction equation for validation on disease incidence (variety Ghanagette)

Weeks		Meteorological parameters	ogical par	ameters							Transf	Transformation					
	Max.	Min.	Max.	Min.	Rain			Per cent			Lo	Logit			Gom	Gompertz	
	Temp.	Temp.	H	BH	Fall	Foot	rot	Leaf rot	rot	Foot rot		Leaf rot	rot	Foot rot	rot	Leaf rot	rot
			0.000	n Is	15000	Yest	Yohs.	Yest	Yohs	Yest	Yohs.	Yest	Yobs.	Yest	Yohs	Yest	Yohs.
-	35.3	26.7	88.6	64.3	23.8	8 12.26 (0.00	29.16	3.33	6.983	00.00	18.38	3.33	60.6	0.00	25.09	3.33
2	35.9	28.1	89.4	61.3	0.0	13.42	0.00	29.12	0.00	8.66	00.0	20.45	00.00	10.69	0.00	31.00	00.00
8	36.9	26.7	89.5	62.2	4.5	12.31	0.00	22.21	6.67	7.046	0.00	14.28	6.67	9.158	0.00	19.6	6.67
4	34.6	27.2	90.4	7.69	38.0	12.68	5.33	29.99	3.33	7.56	5.33	22.2	3.33	9.660	5.33	27.54	3.33
2	32.1	26.3	94.8	80.3	113.8	11.94	5.33	28.54	3.33	6.576	5.33	28.14	3.33	8.682	5.33	27.71	3.33
9	32.5	26.4	94.1	74.7	10.1	12.03	0.00	28.75	6.67	6.686	0.00	27.06	6.67	8.795	0.00	30.05	6.67
7	32.4	26.6	93.6	77.6	45.7	12.20	3.33	30.50	16.67	6.910	3.33	28.24	16.67	9.022	3.33	29.73	16.67
8	34.0	26.6	93.0	73.1	57.8	12.21	0.00	25.87	10.00	6.921	0.00	22.21	10.00	9.032	0.00	25.03	10.00
6	33.2	25.9	97.3	80.0	164.8	11.60	0.00	19.59	13.33	6.173	0.00	22.71	13.33	8.261	0000	21.07	13.33
10	32.5	27.1	95.4	79.1	39.4	12.60	0.00	28.16	26.67	7,435	0.00	29.33	26.67	9.541	0.00	30.34	26.67
F	32.7	26.0	0.96	74.4	123.8	11.70	3.33	23.92	23.33	6.286	3.33	24.99	23.33	8.380	3.33	27.50	23.33
12	30.9	25.8	96.2	85.4	65.30	11.51	3.33	28.91	23.33	6.062	3.33	30.96	23.33	8.142	3.33	27.35	23.33
13	31.1	25.9	95.1	82.3	86.70	11.66	3.33	30.47	13.33	6.238	3.33	30.71	13.33	8.330	3.33	29.17	13.33
14	33.1	26.3	96.3	77.8	86.00	11.95	3.33	22.56	23.33	6.586	3.33	24.28	23.33	8.692	3.33	24.58	23.33
15	33.5	26.4	94.9	76.1	36.00	12.00	0.00	23.88	20.00	6.646	0.00	23.21	20.00	8.754	0.00	24.33	20.00
16	33.6	26.4	94.6	9.69	2.40	12.00	3.33	23.93	26.67	6.646	3.33	22.84	26.67	8.754	3.33	27.94	26.67
17	31.8	25.1	8.76	84.6	76.80	10.98	6.67	21.64	23.33	5.484	6.67	25.30	23.33	7.511	6.67	21.07	23.33
18	33.0	23.9	94.7	64.4	0.00	10.00	10.0	19.91	43.33	4.551	10.00	17.90	43.30	6.42	10.00	22.73	43.33
19	32.7	21.5	93.7	56.2	14.30	8.07	10.0	16.89	23.33	3.128	10.00	13.26	23.30	4.58	10.00	18.51	23.33
20	32.1	18.1	93.6	52.9	0.00	5.36	6.67	10.84	20.00	1.837	6.67	8.666	20.00	2.66	6.67	9.965	20.00
21	32.2	21.3	93.7	59.8	0.00	7.92	6.67	18.15	30.00	3.042	6.67	13.99	30.00	4.46	6.67	17.68	30.00
22	32.7	20.3	92.1	53.1	0.00	7.12	3.33	16.76	20.00	2.601	3.33	11.08	20.00	3.83	3.33	15.51	20.00
23	29.0	19.0	93.7	58.5	3.80	6.12	3.33	23.54	3.33	2.134	3.33	16.93	3.33	3.12	3.33	22.10	3.33
24	27.9	13.6	93.5	48.2	0.00	1.79	0	14.65	3.33	0.904	0.00	8.998	3.33	1.12	0.00	10.85	3.33

Table 3: Prediction equation for validation on disease incidence (variety Simurali Deshi)

Min. Haja Foot cont Leaf rot Foot rot Leaf rot Logist Leaf rot Logist Control Leaf rot Control Logist Year Yobs Year Yobs Year Year Yobs Year Year Yobs Year Year </th <th>Mate</th> <th>orok</th> <th>Meteorological parameters</th> <th>natare</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>Trong</th> <th>Contraction</th> <th></th> <th></th> <th></th> <th></th> <th></th>	Mate	orok	Meteorological parameters	natare							Trong	Contraction					
RH Fall Footroit Leaf not Footroit Leaf not Leaf	Min.		Мах.	Min.	Rain		Per	cent			Lo	git			Gomi	pertz	
64.3 23.8 Yest Yobs 64.3 3.3.8 16.15 0.00 19.95 0.00 1.975 0.00 28.79 0.00 3.99 0.00 62.2 4.5 16.24 3.33 16.08 3.33 16.08 3.33 16.08 0.00 80.7 38.0 16.9 0.00 22.78 10.00 3.39 0.00 27.1 10.00 64.3 0.00 80.3 113.8 15.55 0.00 26.85 3.33 56.4 0.00 27.1 10.00 64.3 0.00 77.4 45.7 16.05 0.00 27.17 3.33 56.4 0.00 27.1 10.00 8.46 0.00 73.1 57.8 16.06 3.33 2.455 0.00 27.1 10.00 8.46 0.00	Temp.		RH	RH	Fall	Foot	rot		rot	Foot			rot	Food		Leafrot	rot
64.3 23.8 16.15 0.00 19.95 0.00 1.975 0.00 20.37 0.00 3.99 0.00 61.3 0.0 18.33 0.00 22.78 667 3.617 0.00 28.79 667 8.79 6.07 8.79 0.00 23.83 6.64 0.00 28.71 1.00 6.43 0.00 9.00						Yest	Yobs	Yest	Yobs.	Yest	Yobs	Yest	Yobs	Yest	Yobs	Yest	Yohs
61.3 0.0 18.33 0.00 22.78 6.67 3.617 0.00 28.79 6.67 6.78 0.00 62.2 4.5 16.24 3.33 16.08 3.33 2.455 3.33 15.78 3.33 4.87 3.33 69.7 34.5 16.08 3.33 2.455 3.33 16.00 6.49 0.00 29.86 3.33 4.87 3.33 6.60 0.00 29.86 3.33 16.00 6.00 0.00 29.86 3.33 16.00 6.00 0.00 29.86 3.33 16.00 29.86 0.00 29.15 3.33 4.87 3.33 20.00 19.89 3.33 20.00 19.89 3.33 22.79 0.00 29.15 3.33 9.76 0.00 77.1 46.8 16.78 3.33 22.79 20.00 4.983 3.33 20.00 19.75 3.33 19.76 0.00 79.1 39.4 16.78 3.33 2	26.7		88.6	64.3	23.8	16.15	0.00	19.95	0.00	1.975	0.00	20.37	0.00	3.99	0.00	20.15	0.00
62.2 4.5 16.24 3.33 16.08 3.33 2.455 3.33 15.78 3.33 4.87 3.33 69.7 38.0 16.9 0.00 23.5 10.00 3.39 0.00 27.1 10.00 64.3 0.00 80.3 113.8 15.55 0.00 26.85 3.33 6.64 0.00 29.16 3.33 10.60 0.00 77.6 45.7 16.06 3.33 22.00 29.16 3.33 10.60 0.00 73.1 57.8 16.06 3.33 22.00 29.15 3.33 10.60 0.00 73.1 57.8 16.06 3.33 22.79 20.00 9.670 3.33 22.18 20.00 13.75 3.33 79.1 39.4 16.78 3.33 22.79 20.00 9.670 3.33 24.19 0.00 80.0 16.48 10.00 22.18 20.00 13.27 3.33 3.41 3.33 <td>28.1</td> <td></td> <td>89.4</td> <td>61.3</td> <td>0.0</td> <td>18.33</td> <td>0.00</td> <td>22.78</td> <td>6.67</td> <td>3.617</td> <td>0.00</td> <td>28.79</td> <td>6.67</td> <td>6.78</td> <td>0.00</td> <td>25.15</td> <td>6.67</td>	28.1		89.4	61.3	0.0	18.33	0.00	22.78	6.67	3.617	0.00	28.79	6.67	6.78	0.00	25.15	6.67
69.7 38.0 16.9 0.00 23.5 10.00 3.39 0.00 27.1 10.00 6.43 0.00 80.3 113.8 15.55 0.00 26.85 3.33 6.64 0.00 29.16 3.33 10.60 0.00 74.7 10.1 15.72 0.00 26.83 3.33 5.69 0.00 29.15 3.33 9.754 0.00 73.1 57.8 16.06 3.33 22.79 20.00 4.983 3.33 29.46 0.00 73.1 57.8 16.06 3.33 22.79 20.00 9.670 3.33 22.18 20.00 13.57 3.33 79.1 39.4 16.78 3.33 28.24 20.00 9.670 3.33 22.18 20.00 13.57 3.33 79.1 59.0 14.74 0.00 28.21 12.27 0.00 25.11 20.00 13.33 11.67 3.33 82.3 86.70 15.0	26.7		89.5	62.2	4.5	16.24	3.33	16.08	3.33	2.455	3.33.	15.78	3.33	4.87	3.33	15.87	3.33
80.3 113.8 15.55 0.00 26.85 3.33 6.64 0.00 29.86 3.33 10.60 0.00 74.7 10.1 15.72 0.00 26.23 3.33 5.654 0.00 29.15 3.33 9.754 0.00 77.6 45.7 16.05 0.00 27.17 3.33 5.654 0.00 31.50 3.33 9.754 0.00 73.1 36.8 16.06 3.33 22.79 20.00 9.670 3.33 22.18 0.00 79.1 39.4 16.78 3.33 22.79 20.00 9.670 3.33 22.18 0.00 79.1 39.4 16.78 3.33 28.20 20.00 9.670 3.21 20.00 13.57 3.33 74.4 123.8 15.10 0.00 28.21 20.00 9.677 3.33 11.61 0.00 85.4 65.30 14.74 0.00 28.21 13.33 16.00	27.2		90.4	69.7	38.0	16.9	0.00	23.5	10.00	3.39	0.00	27.1	10.00	6.43	0.00	-0.32	10.00
74.7 10.1 15.72 0.00 26.23 3.33 5.89 0.00 29.15 3.33 9.754 0.00 77.6 45.7 16.05 0.00 27.17 3.33 5.654 0.00 31.50 3.33 9.754 0.00 77.6 45.7 16.05 0.00 27.17 3.33 5.654 0.00 31.50 3.33 9.754 0.00 79.1 39.4 16.06 3.33 22.79 20.00 9.670 3.33 24.59 20.00 8.646 3.33 9.754 0.00 79.1 39.4 16.08 3.33 28.24 20.00 9.670 3.33 24.59 3.33 35.15 20.00 13.57 0.00 3.21 20.00 13.57 0.00 13.27 0.00 24.53 26.67 7.727 0.00 25.14 20.00 13.23 31.61 0.00 85.4 65.30 14.74 0.00 28.21 13.33 1.61	26.3		94.8	80.3	113.8	15.55	0.00	26.85	3.33	6.64	0.00	29.86	3.33	10.60	0.00	28.30	3.33
77.6 45.7 16.05 0.00 27.17 3.33 5.654 0.00 31.50 3.33 9.476 0.00 73.1 57.8 16.06 3.33 22.00 4.983 3.33 24.59 20.00 8.646 3.33 80.0 164.8 14.92 3.33 22.79 20.00 9.670 3.33 22.18 20.00 13.57 3.33 79.1 39.4 16.08 3.33 22.79 20.00 9.677 3.33 22.18 20.00 13.57 3.33 74.4 123.8 15.10 0.00 24.53 26.67 7.727 0.00 25.11 26.67 11.73 0.00 82.3 86.70 15.03 3.33 28.20 20.00 8.904 0.00 25.11 26.67 11.73 0.00 82.3 86.00 15.57 0.00 24.26 20.00 8.904 0.00 25.11 26.67 11.73 0.00 10.81 33.33	26.4		94.1	74.7	10.1	15.72	0.00	26.23	3.33	5.89	0.00	29.15	3.33	9.754	0.00	27.62	3.33
73.1 57.8 16.06 3.33 23.00 4.983 3.33 24.59 20.00 8.646 3.33 80.0 164.8 14.92 3.33 22.79 20.00 9.670 3.33 22.18 20.00 13.57 3.33 79.1 39.4 16.78 3.33 28.24 20.00 9.670 3.33 22.18 20.00 13.23 3.33 74.4 123.8 15.10 0.00 24.53 26.67 7.727 0.00 25.11 26.67 11.73 0.00 85.4 65.30 14.74 0.00 28.21 1.607 0.00 25.11 26.67 11.73 0.00 82.3 86.70 15.00 24.26 20.00 8.904 0.00 25.59 20.00 12.88 0.00 76.1 36.00 15.57 0.00 24.26 20.00 8.904 0.00 25.59 20.00 12.88 0.00 12.88 10.00 26.465 23.33	26.6		93.6	77.6	45.7	16.05	0.00	27.17	3.33	5.654	0.00	31.50	3.33	9.476	0.00	29.09	3.33
80.0 164.8 14.92 3.33 22.79 20.00 9.670 3.33 22.18 20.00 13.57 3.33 79.1 39.4 16.78 3.33 28.24 20.00 9.257 3.33 35.15 20.00 13.23 3.33 74.4 123.8 15.10 0.00 24.53 26.67 7.727 0.00 25.11 26.67 11.73 0.00 85.4 65.30 14.74 0.00 28.21 13.33 7.607 0.00 25.11 26.67 11.73 0.00 82.3 86.70 15.03 3.33 28.20 20.00 6.391 3.33 11.61 0.00 77.8 86.00 15.57 0.00 24.26 20.00 8.904 0.00 25.59 20.00 12.88 0.00 76.1 36.00 15.57 0.00 24.26 20.00 8.904 0.00 25.59 20.00 12.88 0.00 10.78 3.33 10.78 </td <td>26.6</td> <td></td> <td>93.0</td> <td>73.1</td> <td>57.8</td> <td>16.06</td> <td>3.33</td> <td>23.00</td> <td>20.00</td> <td>4.983</td> <td>3.33</td> <td>24.59</td> <td>20.00</td> <td>8.646</td> <td>3.33</td> <td>23.77</td> <td>20.00</td>	26.6		93.0	73.1	57.8	16.06	3.33	23.00	20.00	4.983	3.33	24.59	20.00	8.646	3.33	23.77	20.00
79.1 39.4 16.78 3.33 28.24 20.00 9.257 3.33 35.15 20.00 13.23 3.33 33.33 28.24 20.00 9.257 3.33 35.15 20.00 13.23 3.33 3.33 28.20 26.67 7.727 0.00 25.11 26.67 11.73 0.00 85.4 65.30 14.74 0.00 28.21 13.33 7.607 0.00 30.47 13.33 11.61 0.00 82.3 16.70 15.03 3.33 28.20 20.00 6.347 13.33 11.61 0.00 77.8 86.00 15.57 0.00 24.26 20.00 8.904 0.00 25.59 20.00 12.88 0.00 76.1 36.00 15.66 3.33 23.26 16.67 6.47 6.47 24.465 25.33 10.78 3.33 10.70 8.73 10.40 6.67 24.25 16.67 11.80 26.67 11.80 26.67	25.9		97.3	80.0	164.8	14.92	3.33	22.79	20.00	9.670	3.33	22.18	20.00	13.57	3.33	22.70	20.00
74.4 123.8 15.10 0.00 24.53 26.67 7.727 0.00 25.11 26.67 11.73 0.00 85.4 65.30 14.74 0.00 28.21 13.33 7.607 0.00 30.47 13.33 11.61 0.00 82.3 14.74 0.00 28.21 13.33 7.607 0.00 30.47 13.33 11.61 0.00 82.3 14.74 0.00 28.21 20.00 6.391 3.33 31.08 20.00 10.31 3.33 77.8 86.00 15.57 0.00 24.26 20.00 8.904 0.00 25.59 20.00 12.88 0.00 76.1 36.00 15.66 6.67 23.26 16.67 6.465 6.47 24.23 16.67 10.40 6.67 24.05 23.33 17.80 26.67 17.10 6.67 24.05 23.33 17.80 26.67 11.10 26.67 11.10 26.67 11.10 <t< td=""><td>27.1</td><td></td><td>95.4</td><td>79.1</td><td>39.4</td><td>16.78</td><td>3.33</td><td>28.24</td><td>20.00</td><td>9.257</td><td>3.33</td><td>35.15</td><td>20.00</td><td>13.23</td><td>3.33</td><td>31.06</td><td>20.00</td></t<>	27.1		95.4	79.1	39.4	16.78	3.33	28.24	20.00	9.257	3.33	35.15	20.00	13.23	3.33	31.06	20.00
85.4 65.30 14.74 0.00 28.21 13.33 7.607 0.00 30.47 13.33 11.61 0.00 82.3 86.70 15.03 3.33 28.20 20.00 6.391 3.33 31.08 20.00 10.31 3.33 77.8 86.00 15.57 0.00 24.26 20.00 8.904 0.00 25.59 20.00 12.88 0.00 76.1 36.00 15.66 3.33 23.54 23.33 6.801 3.33 24.65 23.33 10.78 3.33 69.6 2.40 15.66 6.67 24.05 6.87 24.23 16.67 10.46 6.67 24.25 6.67 24.23 16.67 10.46 6.67 24.25 6.67 24.23 16.67 10.46 6.67 24.25 6.67 24.25 16.67 10.46 6.67 24.25 10.46 6.67 24.23 10.46 6.67 24.23 10.46 6.67 24.23 <td< td=""><td>26.0</td><td></td><td>96.0</td><td>74.4</td><td>123.8</td><td>15.10</td><td>0.00</td><td>24.53</td><td>26.67</td><td>7.727</td><td>0.00</td><td>25.11</td><td>26.67</td><td>11.73</td><td>0.00</td><td>24.99</td><td>26.67</td></td<>	26.0		96.0	74.4	123.8	15.10	0.00	24.53	26.67	7.727	0.00	25.11	26.67	11.73	0.00	24.99	26.67
82.3 86.70 15.03 3.33 28.20 20.00 6.391 3.33 31.08 20.00 10.31 3.33 77.8 86.00 15.57 0.00 24.26 20.00 8.904 0.00 25.59 20.00 12.88 0.00 76.1 36.00 15.66 3.33 23.54 23.33 6.801 3.33 24.65 23.33 10.78 3.33 69.6 2.40 15.66 6.67 24.05 23.33 16.67 24.23 16.67 10.46 6.67 84.6 76.80 13.75 6.67 24.05 23.33 17.80 26.67 24.23 16.67 10.40 6.67 64.4 0.00 11.92 3.33 17.39 26.67 3.258 10.40 6.67 52.9 10.00 10.93 33.33 1.291 10.00 5.116 33.33 2.561 10.00 52.9 10.00 8.02 33.33 11.59 30.00 </td <td>25.8</td> <td></td> <td>96.2</td> <td>85.4</td> <td>65.30</td> <td>14.74</td> <td>0.00</td> <td>28.21</td> <td>13.33</td> <td>7.607</td> <td>0.00</td> <td>30.47</td> <td>13.33</td> <td>11.61</td> <td>0.00</td> <td>29,458</td> <td>13.33</td>	25.8		96.2	85.4	65.30	14.74	0.00	28.21	13.33	7.607	0.00	30.47	13.33	11.61	0.00	29,458	13.33
77.8 86.00 15.57 0.00 24.26 20.00 8.904 0.00 25.59 20.00 12.88 0.00 76.1 36.00 15.66 3.33 23.54 23.33 6.801 3.33 24.65 23.33 10.78 3.33 69.6 2.40 15.66 6.67 24.05 23.33 6.801 24.65 23.33 10.78 3.33 84.6 76.80 13.75 6.67 24.05 25.33 8.762 6.67 21.91 22.33 12.72 6.67 64.4 0.00 11.92 3.33 17.39 26.67 3.29 10.40 6.67 24.91 10.40 6.67 56.2 14.30 8.29 10.00 10.93 33.33 1.291 10.00 25.16 10.00 52.9 0.00 3.23 2.14 33.33 1.218 33.33 1.518 30.00 33.33 1.518 10.00 59.8 0.00 6.52	25.9		95.1	82.3	86.70	15.03	3.33	28.20	20.00	6.391	3.33	31.08	20.00	10.31	3.33	29.669	20.00
76.1 36.00 15.66 3.33 23.54 23.33 6.801 3.33 24.65 23.33 10.78 3.33 69.6 2.40 15.66 6.67 23.26 16.67 6.41 6.67 24.23 16.67 10.40 6.67 84.6 76.80 13.75 6.67 24.05 23.33 8.762 6.67 21.91 23.33 12.72 6.67 64.4 0.00 11.92 3.33 17.39 26.67 3.29 11.80 26.67 6.17 21.91 23.33 1.516 33.33 2.661 10.00 52.9 0.00 3.21 3.33 1.291 10.00 5.116 33.33 2.561 10.00 59.8 0.00 3.33 11.59 30.00 1.213 33.33 1.518 3.33 5.248 30.00 2.395 3.33 58.5 3.80 4.63 3.33 12.81 10.00 0.625 3.33 4.142 10.00	26.3		96.3	77.8	86.00	15.57	0.00	24.26	20.00	8.904	0.00	25.59	20.00	12.88	0.00	24.989	20.00
69.6 2.40 15.66 6.67 23.26 16.67 6.461 6.67 24.23 16.67 10.40 6.67 84.6 16.67 10.40 15.66 6.67 24.05 24.05 24.05 8.762 6.67 21.91 23.33 12.72 6.67 84.6 11.92 3.33 17.39 26.67 3.258 3.33 11.80 26.67 6.157 3.33 25.6 110.00 10.93 33.3 1.291 10.00 5.116 33.33 2.561 10.00 52.9 0.00 3.21 3.33 2.14 33.33 0.457 3.33 1.518 33.33 0.700 3.33 59.8 0.00 8.02 3.33 11.59 30.00 1.213 3.33 5.248 30.00 2.395 3.33 53.1 10.00 6.52 0.00 7.37 10.00 0.640 0.00 3.236 10.00 1.117 0.00 58.5 3.80 4.63 3.33 12.81 10.00 0.625 3.33 4.142 10.00 1.077 3.33 0.00 3.34 6.27 0.00 -3.49 0.00 -0.72 3.33 0.117 0.00 0.607 3.33 0.063 0.00	26.4		94.9	76.1	36.00	15.66	3.33	23.54	23.33	6.801	3.33	24.65	23.33	10.78	3.33	24.151	23.33
84.6 76.80 13.75 6.67 24.05 23.33 8.762 6.67 21.91 23.33 12.72 6.67 64.4 0.00 11.92 3.33 17.39 26.67 3.258 3.33 11.80 26.67 6.157 3.33 56.2 14.30 8.29 10.00 10.93 33.33 1.291 10.00 5.116 33.33 2.561 10.00 52.9 0.00 3.21 33.33 2.14 33.33 0.457 3.33 1.518 33.33 0.700 3.33 59.8 0.00 8.02 3.33 11.59 30.00 1.213 3.33 5.248 30.00 2.395 3.33 59.8 0.00 6.52 0.00 7.37 10.00 0.640 0.00 3.236 10.00 1.17 0.00 58.5 3.80 4.63 3.33 12.81 10.00 0.625 3.33 4.142 10.07 1.077 3.33 0.063	26.4		94.6	9.69	2.40	15.66	6.67	23.26	16.67	6.461	6.67	24.23	16.67	10.40	6.67	23.809	16.67
64.4 0.00 11.92 3.33 17.39 26.67 3.258 3.33 11.80 26.67 6.157 3.33 56.2 14.30 8.29 10.00 10.93 33.33 1.291 10.00 5.116 33.33 2.561 10.00 52.9 0.00 3.21 3.33 2.14 33.33 0.457 3.33 1.518 33.33 0.700 3.33 59.8 0.00 8.02 3.33 11.59 30.00 1.213 3.33 5.248 30.00 2.395 3.33 53.1 0.00 6.52 0.00 7.37 10.00 0.640 0.00 3.236 10.00 1.117 0.00 58.5 3.80 4.63 3.33 12.81 10.00 0.625 3.33 4.142 10.07 1.077 3.33 0.063 0.00	25.1		8.76	84.6	76.80	13.75	6.67	24.05	23.33	8.762	6.67	21.91	23.33	12.72	6.67	23.412	23.33
56.2 14.30 8.29 10.00 10.93 33.33 1.291 10.00 5.116 33.33 2.561 10.00 52.9 0.00 3.21 3.33 2.14 33.33 0.457 3.33 1.518 33.33 0.700 3.33 59.8 0.00 8.02 3.33 11.59 30.00 1.213 3.33 5.248 30.00 2.395 3.33 53.1 0.00 6.52 0.00 7.37 10.00 0.640 0.00 3.236 10.00 1.117 0.00 58.5 3.80 4.63 3.33 12.81 10.00 0.625 3.33 4.142 10.07 1.077 3.33 48.2 0.00 -3.49 0.00 -0.72 3.33 0.117 0.00 0.607 3.33 0.063 0.00	23.9		94.7	64.4	0.00	11.92	3.33	17.39	26.67	3.258	3.33	11.80	26.67	6.157	3.33	14.611	26.67
52.9 0.00 3.21 3.33 2.14 33.33 0.457 3.33 1.518 33.33 0.700 3.33 59.8 0.00 8.02 3.33 11.59 30.00 1.213 3.33 5.248 30.00 2.395 3.33 53.1 0.00 6.52 0.00 7.37 10.00 0.640 0.00 3.236 10.00 1.117 0.00 58.5 3.80 4.63 3.33 12.81 10.00 0.625 3.33 4.142 10.07 1.077 3.33 48.2 0.00 -3.49 0.00 -0.72 3.33 0.117 0.00 0.607 3.33 0.063 0.00	21.5		93.7	56.2	14.30	8.29	10.00	10.93	33.33	1.291	10.00	5.116	33.33	2.561	10.00	7.223	33.33
59.8 0.00 8.02 3.33 11.59 30.00 1.213 3.33 5.248 30.00 2.395 3.33 53.1 0.00 6.52 0.00 7.37 10.00 0.640 0.00 3.236 10.00 1.117 0.00 58.5 3.80 4.63 3.33 12.81 10.00 0.625 3.33 4.142 10.00 1.077 3.33 48.2 0.00 -3.49 0.00 -0.72 3.33 0.117 0.00 0.607 3.33 0.063 0.00	18.1		93.6	52.9	0.00	3.21	3.33	2.14	33.33	0.457	3.33	1.518	33.33	0.700	3.33	1.775	33.33
53.1 0.00 6.52 0.00 7.37 10.00 0.640 0.00 3.236 10.00 1.117 0.00 58.5 3.80 4.63 3.33 12.81 10.00 0.625 3.33 4.142 10.00 1.077 3.33 48.2 0.00 -3.49 0.00 -0.72 3.33 0.117 0.00 0.607 3.33 0.063 0.00	21.3		93.7	59.8	0.00	8.02	3.33	11.59	30.00	1.213	3.33	5.248	30.00	2.395	3.33	7.575	30.00
58.5 3.80 4.63 3.33 12.81 10.00 0.625 3.33 4.142 10.00 1.077 3.33 48.2 0.00 -3.49 0.00 -0.72 3.33 0.117 0.00 0.607 3.33 0.063 0.00	20.3		92.1	53.1	0.00	6.52	0.00	7.37	10.00	0.640	0.00	3.236	10.00	1.117	0.00	4.476	10.00
48.2 0.00 -3.49 0.00 -0.72 3.33 0.117 0.00 0.607 3.33 0.063 0.00	19.0		93.7	58.5	3.80	4.63	3.33	12.81	10.00	0.625	3.33	4.142	10.00	1.077	3.33	7.050	10.00
	13.6		93.5	48.2	0.00	-3.49	0.00	-0.72	3.33	0.117	0.00	0.607	3.33	0.063	0.00	0.577	3.33

Table 4: Prediction equation for validation on disease incidence (Variety Simurali Gol Bhavna)

Weeks		Meteoro	Meteorological parameters	ameters			Percent	int			Transfor	Transformation Logit	±		Go	Gompertz	
	Max.	Min. Temp	Max. RH	Min. RH.	Rain	Foot rot	trot	Leaf rot	rot	Foot rot	rot	Leaf rot	rot	Foot rot	rot	Leaf rot	rot
	dulp.	dillo.			- B	Yest	Yobs.	Yest	Yobs.	Yest	Yobs.	Yest	Yobs.	Yest	Yobs.	Yest	Yobs.
-	35.3	26.7	88.6	64.3	23.8	43.87	0.00	31.60	0.00	4.74	00.00	33.99	0.00	9.51	0.00	34.52	0.00
2	35.9	28.1	89.4	61.3	00.00	46.44	0.00	32.26	3.33	5.92	0.00	38.32	3.33	11.20	0.00	36.46	3.33
3	36.9	26.7	89.5	62.2	4.5	41.58	0.00	23.76	6.67	3.21	0.00	22.46	6.67	9.58	0.00	24.89	6.67
4	34.6	27.2	90.4	2.69	38.0	46.30	00.00	32.24	3.33	6.56	0.00	36.80	3.33	10.14	0.00	35.99	3.33
Ŋ	32.1	26.3	94.8	80.3	113.8	47.77	3.33	28.40	3.33	9.45	3.33	30.20	3.33	9.05	3.33	31.30	3.33
9	32.5	26.4	94.1	74.7	10.1	47.46	3.33	29.00	3.33	8.85	3.33	31.10	3.33	9.18	3.33	31.90	3.33
7	32.4	26.6	93.6	77.6	45.7	48.16	3.33	31.20	13.30	6.59	3.33	35.10	13.30	9.43	3.33	34.90	13.3
8	34.0	26.6	93.0	73.1	57.8	45.66	0.00	26.40	6.67	6.42	0.00	27.10	6.67	9.44	00.00	28.70	6.67
6	33.2	25.9	97.3	80.0	164.8	45.08	0.00	17.60	16.7	6.48	0.00	15.90	16.70	8.58	00.00	18.50	16.70
10	32.5	27.1	95.4	79.1	39.4	49.09	6.67	28.40	10.00	10.41	6.67	31.90	10.00	10.00	6.67	31.90	10.00
=	32.7	26.0	0.96	74.4	123.8	46.20	3.33	22.80	20.00	7.64	3.33	21.90	20.00	8.72	3.33	24.30	20.00
12	30.9	25.8	96.2	85.4	65.30	48.26	0.00	27.90	6.67	10.90	0.00	29.00	6.67	8.45	0.00	30.70	6.67
13	31.1	25.9	95.1	82.3	86.70	48.37	3.33	30.20	16.70	10.84	3.33	32.60	16.60	8.66	3.33	33.40	16.70
14	33.1	26.3	96.3	77.8	86.00	46.22	0.00	21.40	13.30	7.350	0.00	20.70	13.30	90.6	0.00	22.90	13.30
15	33.5	26.4	94.9	76.1	36.00	45.82	3.33	23.40	26.70	6.838	3.33	22.90	26.60	9.13	3.33	25.10	26.70
16	33.6	26.4	94.6	9.69	2.40	45.70	6.67	23.50	33.30	6.65	6.67	23.10	33.30	9.13	6.67	25.20	33.30
17	31.8	25.1	97.8	84.6	76.80	45.40	6.67	19.00	26.70	7.55	6.67	16.70	26.60	7.75	6.67	19.70	26.70
18	33.0	23.9	94.7	64.4	0.00	40.60	3.33	17.40	33.30	4.11	3.33	13.20	33.30	6.55	3.33	16.80	33.30
19	32.7	21.5	93.7	56.2	14.30	35.30	10.00	12.80	30.00	2.36	10.0	7.92	30.00	4.55	10.00	11.10	30.00
20	32.1	18.1	93.6	52.9	0.00	28.00	3.33	3.96	33.30	1.10	3.33	3.17	33.30	2.50	3.33	4.16	33.30
21	32.2	21.3	93.7	8.65	0.00	35.60	3.33	14.10	40.00	2.54	3.33	8.52	40.00	4.45	3.33	12.30	40.00
22	32.7	20.3	92.1	53.1	0.00	32.50	0.00	12.40	20.00	1.72	0.00	6.85	20.00	3.74	0.00	10.10	20.00
23	29.0	19.0	93.7	58.5	3.80	34.98	3.33	18.40	10.00	3.16	3.33	9.63	10.00	2.99	3.33	3.64	10.00
47	61.3	13.0	90.0	40.7	0.0	0.03	00.0	00.0	5	0000	2						

The prediction equations will be best fitted if these equations were prepared by considering the other meteorological parameters like sunshine hours, vapour pressure, wind velocity and also microclimate within the plant population. Yet the prediction equations which were prepared were also showed some validation in predicting the disease incidence of betelvine.

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