

Phytosanitary Risk Analysis in Control of *Cercospora beticola* Sacc. (1876) in Sugar Beet in Context of Climate Changes

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Abstract

According to the European and Mediterranean Plant Protection Organization (EPPO), phytosanitary risk analysis (PSA) is the process of evaluating biological or other scientific and economic evidence to determine whether a pest should be regulated and the severity of possible phytosanitary measures that should be taken against it. The aim of this study is to emphasize the results of a study concerning the phytosanitary solutions for the control of the main diseases in sugar beet in context of climate changes. A multiple correlation coefficient equal to 0.892 ($R^2 = 79.60\%$) was obtained, the analysis of the regression line, $Y = 7.228 + 0.298X_1 + 0.972X_2$, demonstrates a greater influence of the rainfall regime on the degree of attack and a much greater influence lower thermal regime, similar to the situation recorded in the experimental year 2020. The highest degree of attack of *Cercospora beticola* Sacc. (1876) was located at the peak of its manifestation around the value of 42%, under the conditions of a rainfall regime starting from 170 mm and thermal from 20 °C.

Keywords: crop, fungi, pathogen, prevention measures.

1. Introduction

Determining the equivalence of phytosanitary measures depends on a number of factors. These may include: the effect of the measure demonstrated under laboratory or field conditions - review of the relevant literature on the effect of the measure, the results of experience in the practical application of the measure, factors affecting the implementation of the measure (e.g. contracting party policies and procedures).

The effect of phytosanitary measures implemented in a third country can be considered as a reference. The information on the measure is used by the importing contracting party to assess the contribution of the alternative measure to reducing pest risk to a level that provides the appropriate level of protection. When comparing

existing measures and measures proposed as equivalent, import and export contracting parties should assess the ability of the measures to reduce a particular harmful risk.

The proposed measures should be evaluated according to their ability to achieve the value of the importing contracting party adequate level of protection. In cases where the effects of both existing and proposed measures are expressed in the same way (ie the same type of response required), the effects can be directly compared for their ability to reduce pest risk. For example, a fumigation treatment and a cold treatment can be compared for their effects based on mortality.

Where measures are expressed differently, they may be difficult to compare directly. In such cases, the proposed measures should be evaluated

according to their ability to achieve the value of the importing contracting party an adequate level of protection. This may require the data to be converted or extrapolated so that customary units are used before comparison is possible. For example, effects such as mortality and a low area pest prevalence can be compared if considered relative to pest freedom at an agreed level of confidence (e.g. per haul or per year). When determining equivalence, a comparison of the specific technical requirements of existing and proposed measures may be sufficient.

2. Material and Method

Cercospora beticola Sacc. (1876), which produces cercosporiosis of beet, was conducted in an experimental location, on three plots, respectively Viișoara commune, Cluj County, in the years 2020 and 2021. The biological material used was represented by sugar beet, the Vanghelis variety. A mid-season variety that matures in 110-120 days. The pulp is not as rich in colour as that of other varieties but does not change color after boiling. The beet grows in a round shape and weighs about 150-250 g. From 1 m² of planting, you can get 4 - 5 kg of sweet fruits, which are subject to long-term storage. The culture itself can withstand sudden changes in temperature, is not capricious about soil parameters, and is also resistant to flower beds. The variety only requires the amount of sunlight when grown in the shade. The attack degree of the targeted pathogen was evaluated simultaneously with the evolution of climatic factors, in order to establish the changes produced in the attack degree of pathogens under the influence of the evolution of climate changes. The risk of attack by the main pathogens of potato

and tomato crops was carried out by establishing their attack path and the impact of climatic factors on the evolution of the attack degree.

Based on the obtained data, correlations were established between the attack degree of the main pathogens of sugar beet crops and the evolution of the main parameters characterizing the change in climatic conditions (temperature, precipitation).

Correlations were established between the manifestation and attack degree of potato plant pathogens and the individualized abiotic factors - temperature and rainfall regime.

The intensity of the correlation was established for each type of pathogen and potato variety, but also on the complex set of the interrelation between pathogen and abiotic factors. The evolution of the abiotic factors and the attack degree of the sugar beet pathogens monitored in the present study were processed statistically both individually, for each pathogen and abiotic factor of interest, as well as for the total attack degree and the totality of the abiotic factors that influence the manifestation diseases.

3. Results and Discussions

Strong degrees of intensity of the dependence of the attack degree of the pathogen of beet root rot *Cercospora beticola* Sacc. (1876) and the favorable abiotic factors, namely the temperature and the rainfall regime were revealed by the multiple correlation coefficients calculated in order to highlight these interrelations, in the three experimental fields monitored in the three plots in Viișoara commune, Cluj County, after testing the validity of the regression model (Tables 1 and 2).

Table 1. Testing the validity of the regression model

Experimental field	F	p
Plot 1	29.116	< 0.001
Plot 2	28.196	< 0.001
Plot 3	22.302	< 0.001

Tabelul 2. Multiple regression analysis of the attack degree of *Cercospora beticola* Sacc. (1876) in sugar beet depending on temperature and rainfall regime 2020 – 2021

Experimental field	Issue	Values
Plot 1	The coefficient of multiple correlation, R	0.920***
	The coefficient of determination, R ²	0.847
Plot 2	The coefficient of multiple correlation, R	0.908***
	The coefficient of determination, R ²	0.824
Plot 3	The coefficient of multiple correlation, R	0.983***
	The coefficient of determination, R ²	0.967

***, p < 0.001

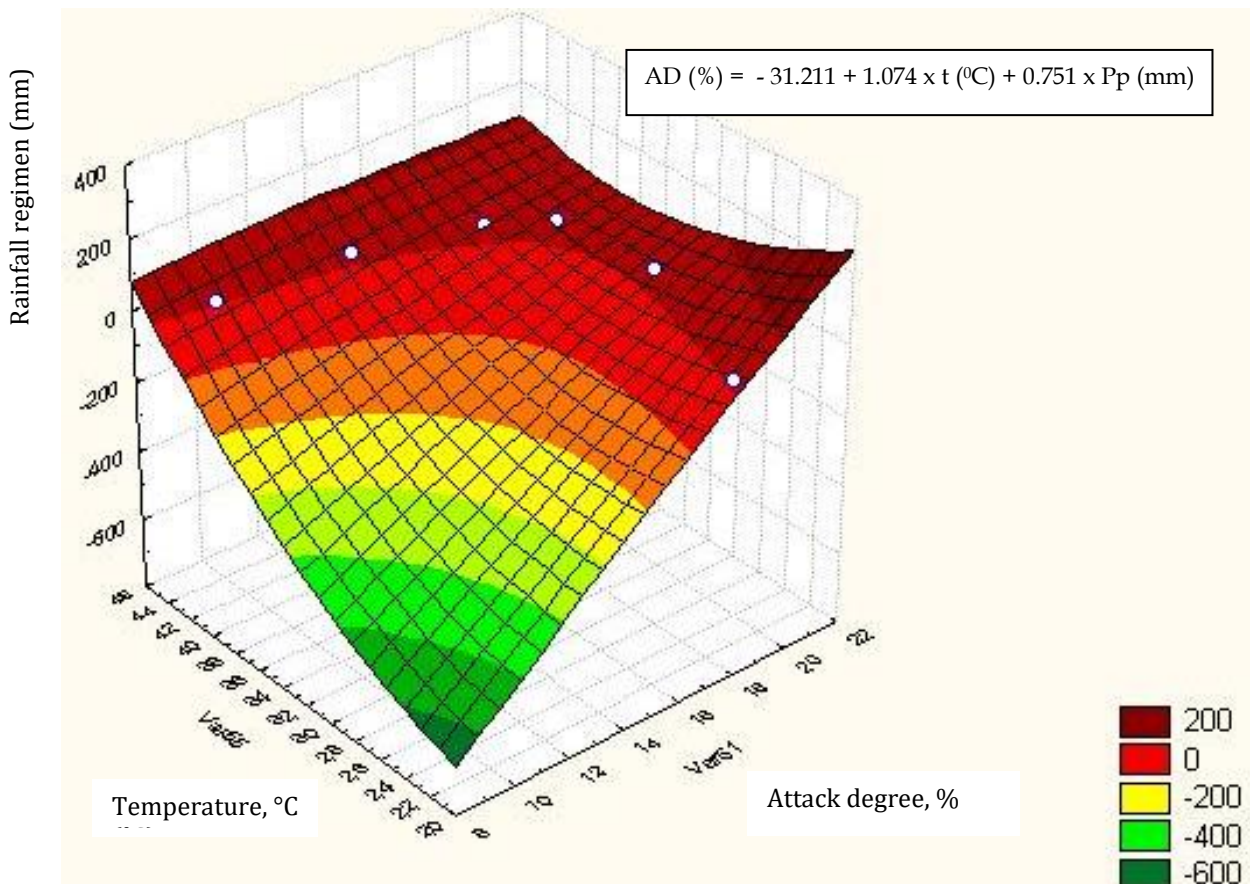
Values were obtained in the range of 0.876 in the experimental field located in Plot 1 (corresponding to a representativeness of 76.70%) and 0.935 in Cluj County, corresponding to a representativeness of 87.40%, considering the attack degree of *Cercospora beticola* Sacc. (1876) as the dependent variable (Table 2).

From the analysis of the regression lines drawn up in order to highlight the evolution of the interaction attack degree of *Cercospora beticola* Sacc. (1876) for sugar beet - temperature - rainfall regime, in the experimental year 2020 (Table 2), it is found, in all cases, the much greater influence of the term corresponding to the rainfall regime (Pp), compared to the one corresponding to the thermal regime (t). These findings are consistent with the fact that the attack degree of beet root rot is favored by lower temperatures and increased humidity.

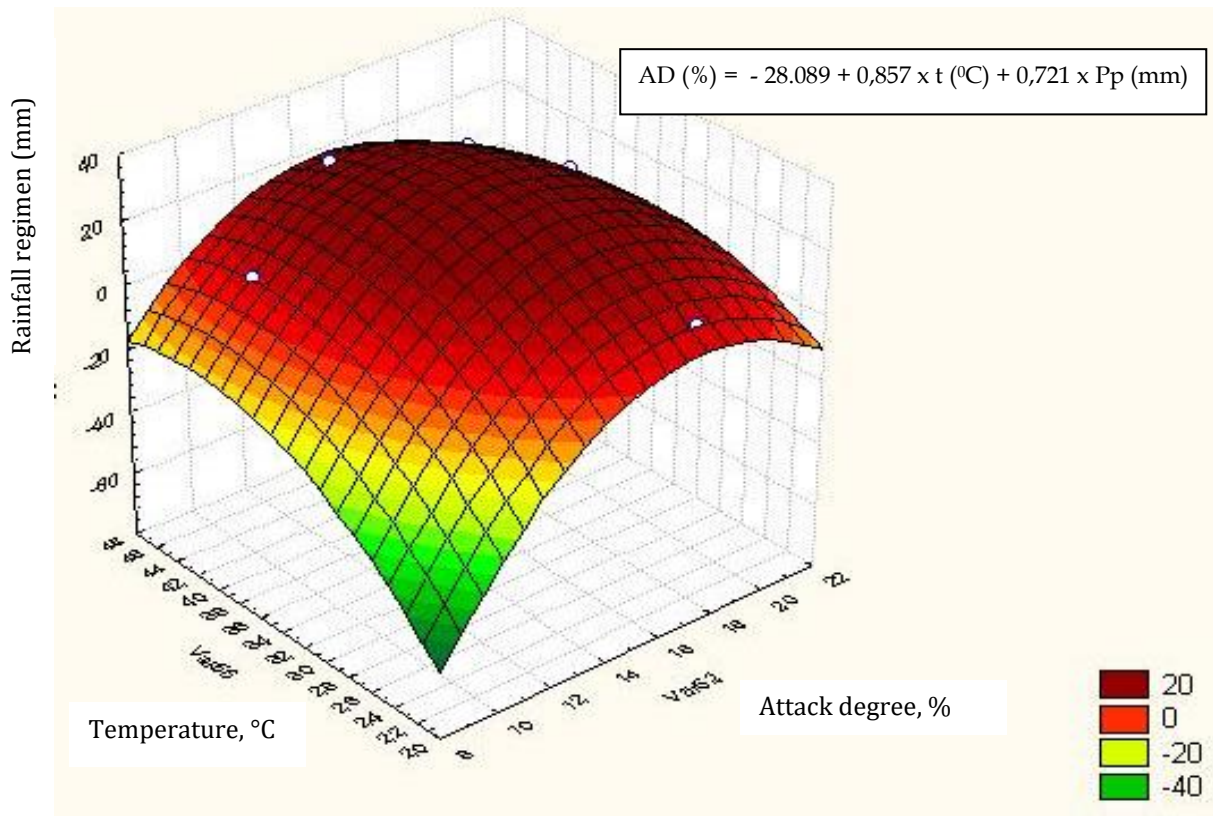
The thermal conditions of the experimental year 2020 were characterized by an average monthly temperature equal to 16.76 °C, lower than the monthly average in the period between 1900 - 2000, equal to 17.70 °C, but by a much higher rainfall regime (88.05 mm) of the one recorded in the same historical period, respectively 57.72 mm (Fig. 1 - a).

The interaction of these factors, under the conditions of the application of the usual conventional treatments, namely temperatures lower than the average and a higher pluviometric regime lead to an average attack degree that can reach the highest value, respectively 38% in the conditions of Plot 1, at a temperature of 22 °C and rainfall regime equal to 77 mm (Fig. 1 - b).

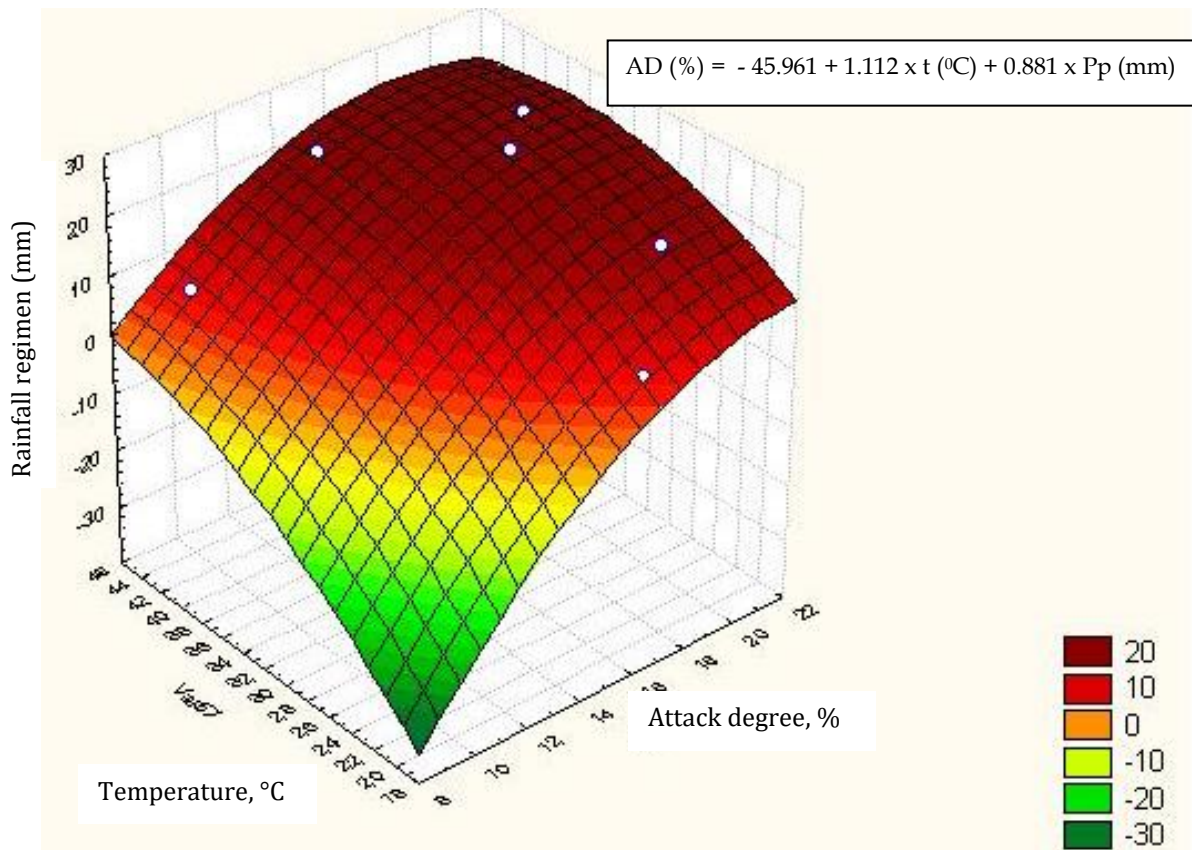
Those of Plot 3, are represented by the temperature of 22 °C and rainfall regime equal to 80 mm (Fig. 1 - c).



a - Plot 1



b - Plot 2



c - Plot 3

Figure 1. Evolution of the attack degree of *Cercospora beticola* Sacc. (1876) in sugar beet according to temperature and rainfall regime in the three plots monitored in Viișoara, Cluj County, Romania

4. Conclusions

Analyzing the value of the correlation coefficients between the rainfall regime recorded in the monthly interval April - September and the attack degree of the pathogen of the pathogen of beet cercosporosis *Cercospora beticola* Sacc. (1876) in the same period on all experimental fields monitored annually, during the experimental period (years 2020 and 2021), values were obtained that demonstrated in all experimental years a strong correlation between the two monitored parameters.

These values were included in the range of 0.801 - 0.909, having at the same time a high representativeness given by the coefficient of determination, which was located within the limits of 64.20% - 82.60% ($p < 0.001$). In the experimental year 2020, a multiple correlation coefficient was obtained equal to 0.929 ($R^2 = 86.30\%$), the analysis of the regression line, $Y = 27.097 + 2.566X_1 + 0.124X_2$, demonstrates a greater influence of the thermal regime above the attack degree and a reduced influence of the rainfall regime in contrast to the situation recorded in the previous experimental year, 2009.

The highest attack degree of *Cercospora beticola* Sacc. (1876) was located at the peak of its manifestation around the value of 44%, under the

conditions of a rainfall regimen starting from 110 mm, and thermal from 22 °C. In the experimental year 2021, a multiple correlation coefficient equal to 0.892 ($R^2 = 79.60\%$) was obtained, the analysis of the regression line, $Y = 7.228 + 0.298X_1 + 0.972X_2$, demonstrates a greater influence of the rainfall regime on the attack degree and a reduced influence of the thermal regime, similar to the situation recorded in the experimental year 2020. The highest attack degree of *Cercospora beticola* Sacc. (1876) was located at the peak of its manifestation around the value of 42%, under the conditions of a pluviometric regime starting from 170 mm and thermal from 20 °C.

References

- [1] Dumitru M., 2003, Cod de Bune Practici Agricole, vol.1, Editura Expert, București.
- [2] Mogârzan A., G. Morar, M. Ștefan, 2004, Fitotehnie, Editura „Ion Ionescu de la Brad”, Iași.
- [3] Muntean L.S., I. Borcean, M. Axinte, G.V. Roman, 2001, Fitotehnie, Editura „Ion Ionescu de la Brad”, Iași.
- [4] Pascu A., A.F. Badiu, 1996, Dicționar al culturii sfecelei de zahăr, Editura Fermierul Român, București.
- [5] Pastor I., 2002, Sistemul integrat de producere și industrializare a sfecelei de zahăr în Transilvania-Trecut și viitor-, Editura Tipomur, Târgu-Mureș.

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