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Original Article

Study upon the *Alternaria solani* Sorauer Attack Degree on Potato Cultures Function of Climatic Conditions from Transylvania

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Abstract

Literature and practice show that in order to make plant protection strategies, you need a very good knowledge of the mode of manifestation of main pathogens encountered worldwide. The pathogen *Alternaria solani* Sorauer in conjunction with the abiotic factors as temperature and rainfall regimen may produce important potato crop looses. The aim of this study is to demonstrate the possibility of using meta-models represented by the multiple correlation anaysis in emphasizing relationship between the climatic conditions and intensity alternariosis attack degree.Experiments were conducted in ten points, from April to September, during three consecutive years, 2009, 2010 and 2011. Vegetable private farms (where Roclas potato variety is cultivated), located within the 10 counties of Transylvania, have been selected. Temperature and rainfall regimen developments, throughout experimental period, were obtained from the county environmental protection agencies. Data processing was performed with STATISTICA v 6.0 version.There have been calculated the multiple correlations between the *Alternaria solani* Sorauer attack degree and abiotic factors. The interrelationships between *Alternaria solani* Sorauer attack degrees and temperature and rainfall regimen were within the range 0.939 - 0.866.By entire experimental three years period, the rainfall regimen had 23 folds higher influence on *Alternaria solani* Sorauer attack degree upon potato cultures, compared to temperature. Our trial shows the importance of using meta-models for anaccurate quantification of the relationship between the climatic conditions and intensity of alternariosis attack degree.

Keywords: alternariosis, Roclas, multiple correlation, regression line.

1. Introduction

Due to the extreme effects of climate change, with negative and also unexpected repercussions, world experiences, mainly on agriculture, plant protection challenges. The information available over the past decades, both in literature and in practice have led to the finding that in order to make plant protection strategies, you need a very good knowledge of the mode of manifestation of main pathogens encountered worldwide [4, 6].

The farmers from Transylvania region, who have as their main area of interest in potato production, face the *Alternaria solani* Sorauer threat [2, 5, 6]. This pathogen produces alternariosis, and this important potato disease, in conjunction with the abiotic factors (i.e. temperature and rainfall regimen) may produce important crop looses. An important approach of managing the potato disease generally speaking, and alternariosis in particularly, is the use of meta-models [3].

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An important approach of managing the potato disease generally speaking, and alternariosis in particularly, is the use of meta-models [3].

This aim of this study is to demonstrate the possibility of using meta-models represented by the multiple correlation analysis in emphasizing the relationship between the climatic conditions and intensity alternariosis attack degree.

2. Material and Method

Experiments were conducted in ten points. Vegetable private farms have been selected, where potato cultivars were identified. They are located within the 10 counties of Transylvania:

- Alba, Răhău - 45^0 54' N, 37^0 11' E
- Bistriţa - Năsăud, Maieru - 47^0 24' N, 24^0 44'E
- Braşov, Draguş - 45^0 45' N, 24^0 26'E
- Cluj, Cojocna - 46^0 44' N, 23^0 49'E
- Covasna, Ilieni - 45^0 47' N, 25^0 46'E
- Harghita, Mereşti - 46^0 14' N, 25^0 27'E
- Hunedoara, Vălişoara - 46^0 44' N, 22^0 50'E
- Mureş, Grebenişul de Campie - 46^0 36' N, 24^0 18'E
- Sălaj, Românaşi - 47^0 06' N, 23^0 10'E
- Sibiu, Arpaşul de Jos - 45^0 43' N, 24^0 37'E

The monitoring of early blight attack degree was made after a diagonal cross schema [1], over an area of one hectare, which was installed a potato culture. Temperature and rainfall regimen developments, throughout experimental period, were obtained from the county environmental protection agencies.

For control, thermometers and pluviometers have been placed in each of the ten experimental fields. There have been calculated the multiple correlations between the *Alternaria solani* Sorauer attack degree and abiotic factors, temperature and rainfall regimen regimen. Roclas potato variety was used. It is characterized by a 65.90 t/ha potentially production. It has oval tuber, core and shell coloured in yellow and resistance to early blight. Data processing was performed with STATISTICA v 6.0 version.

3.Results and Discussions

In 2009, multiple correlation coefficient resulting from applying the specific algorithm of calculation (multiple regression analysis) demonstrate a strong multiple correlation among mentioned factors, R = 0.866 (R^2 = 78.50%), respectively. In 2010, a very strong dependencies between experimental three factors reflected by multiple correlation coefficient equal to 0.939, which has a representation R^2 = 88.20% (table 1), was reported, while in the last experimental year, 2011, namely, the multiple correlation coefficient (R = 0.901) was strong, representative in a share of 81.20% and demonstrates a bigger interaction between early blight attack degree and climatic factors (rainfall regimen and temperature) compared to the first experimental year 2009 when it was R = 0.866, and almost similar with the second experimental year 2010 (R = 0.939), due to more similar climatic conditions.

The regression line emphasizes, in all analyzed cases, the positive influence of both climatic factors upon the increase of *Alternaria solani* Sorauer attack degree.

If we analyze the interaction between *Alternaria solani* Sorauer attack degree and climatic conditions, namely rainfall regimen and temperature, considering all fields together during all experimental period, April – September 2009 – 2011, respectively (table 2), a highly representative (80.70%) strong multiple correlation of 0.898 is reported statistically very significant ($p < 0.001$).

From the plot of interrelations of attack degree - abiotic factors would result in a maximum intensity of *Alternaria solani* Sorauer attack by entire experimental period 2009 – 2011 (considered from April until September) around 22%, which is recorded under a regime rainfall regimen beginning from 40 mm, and heat beginning with 20 ^{0}C (fig. 1).

The regression line demonstrates that by entire experimental period, *Alternaria solani* Sorauer attack degree is less influenced by temperature (with an almost neglectable coefficient of 0.085), while rainfall regimen has very important contribution (fig. 1).

Table 1. The multiregression analyze of the *Alternaria solani* Sorauer in potato function of temperature and rainfall during the experimental period April - September 2009, 2010, and 2011 by the monitored experimental fields located in all ten counties of Transylvania

Experimental year	Issue	Values
2009	F	104.451
	p	0.0001
	Cofficient of multiple correlation, R	0.866
	Coefficient of determination, R^2	0.785
	Regression line	$Y = 23.546 + 0.124X_1 + 1.473X_2$
2010	F	213.531
	p	0.0001
	Cofficient of multiple correlation, R	0.939
	Coefficient of determination, R^2	0.882
	Regression line	$Y = 24.739 + 2.322X_1 + 0.076X_2$
2011	F	123.053
	p	0.0001
	Cofficient of multiple correlation, R	0.901
	Coefficient of determination, R^2	0.812
	Regression line	$Y = 7.062 + 0.202X_1 + 0.833X_2$

Table 2. The multiregression analyze of the attack degree of *Alternaria solani* Sorauer in potato function of temperature and rainfall by entire experimental period (April - September 2009, 2010, and 2011) and all monitored experimental fields located in all ten counties of Transylvania

Issue	Values
F	370.106
P	0.0001
Cofficient of multiple correlation, R	0.898
Coefficient of determination, R^2	0.807

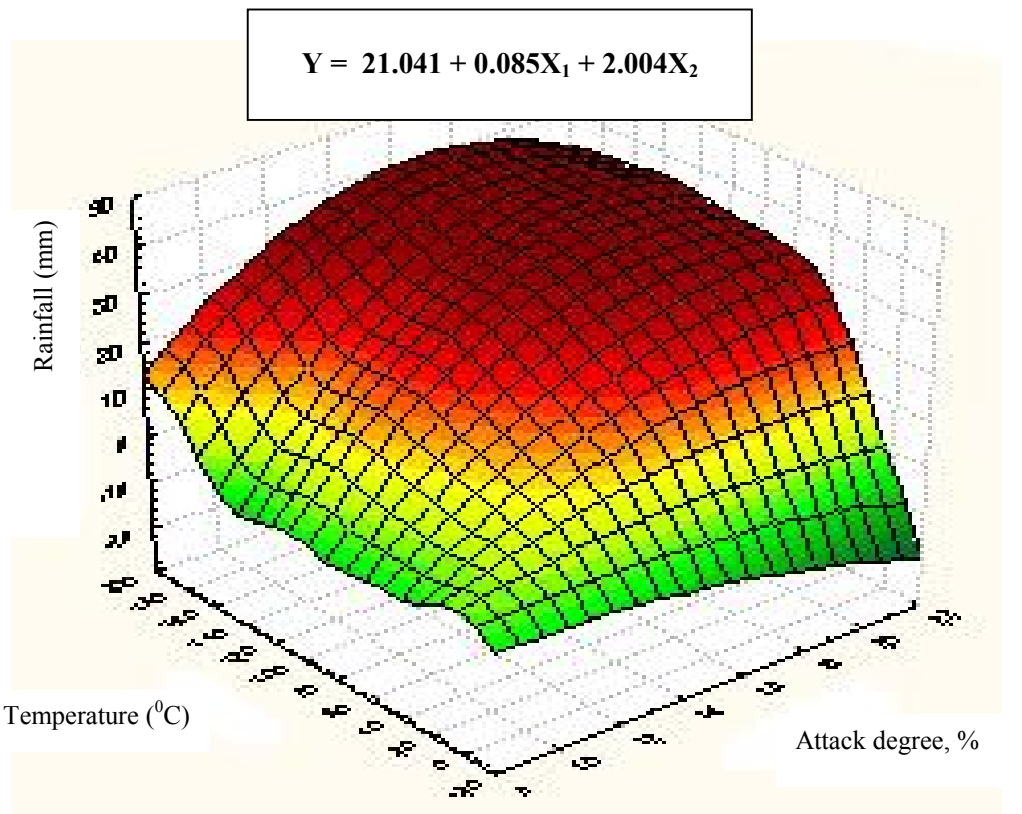

Figure 1. The prediction of the evolution of the attack degree of *Alternaria solani Sorauer* in potato (Z) function of temperature (X) and rainfall (Y) by all ten monitored experimental fields from Transylvania, based on regression line calculated by entire experimental period (2009 – 2011)

4. Conclusions

Monitoring of ten experimental fields, from April to September, during three consecutive years, 2009, 2010 and 2011, respectively has highlighted that the interrelationships between *Alternaria solani* Sorauer attack degrees and abiotic factors (temperature and rainfall regimen) were within the range 0.939 - 0.866.

These values are correspondent to the years 2010 and 2009, while in 2011 was obtained a multiple correlation coefficient of 0.901, all with high representativeness.

By entire experimental three years period, the results of our study demonstrate the importance of the rainfall regimen on *Alternaria solani* Sorauer attack degree upon potato cultures, compared to temperature, considering that is was by more than 23 folds higher.

It also confirms that using meta-models (multiple correlation anaysis) accurate quantification of the relationship between the climatic conditions and intensity alternariosis attack degree may be obtained.

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