



## **Biostatistical approach of alternariosis attack in potato within specific climatic conditions from Transylvania**

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## CONTENT

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INTRODUCTION

MATERIAL AND METHODS

RESULTS AND DISCUSSIONS

CONCLUSIONS

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# INTRODUCTION



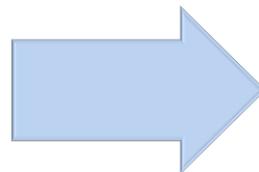
Due to the big importance of potato cultures as food source worldwide, the phytosanitary protection of this vegetal crop is an important component of all managerial practices

In this context, we have to mention that one of the most important threat against this culture, in wet climatic conditions especially is *Alternaria solani* Sorauer fungus attack.

In Transylvania region, located in the Western part of Romania, potato plays an important role in private farms production. For this reason, research on potato crops is largely focused on climatic conditions, of the above mentioned specific area.



The most important reason is the influence of temperature and humidity on the action of the most important fungi, which represent a threat for potato cultures, and among these, *Alternaria solani* Sorauer is of highest importance.



In this respect, we mention the well-known effect of humidity in favourizing alternariosis development.



Besides *Phytophthora infestans* Mont de Bary, *Alternaria solani* Sorauer is the second cause of potato crops deterioration in Transylvanian Plane, the identification of most important factors affecting fungus attack intensity and frequency is of major importance.

In this context we also have to mention the importance of appropriate phytosanitary management of the culture, which involves appropriate use of both fertilization and treatment.



Brown patches on potato leaves are the first sign of Late Blight disease.

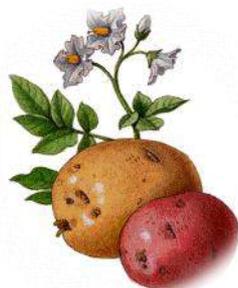


Late Blight quickly spreads from the leaves into the potato tubers.

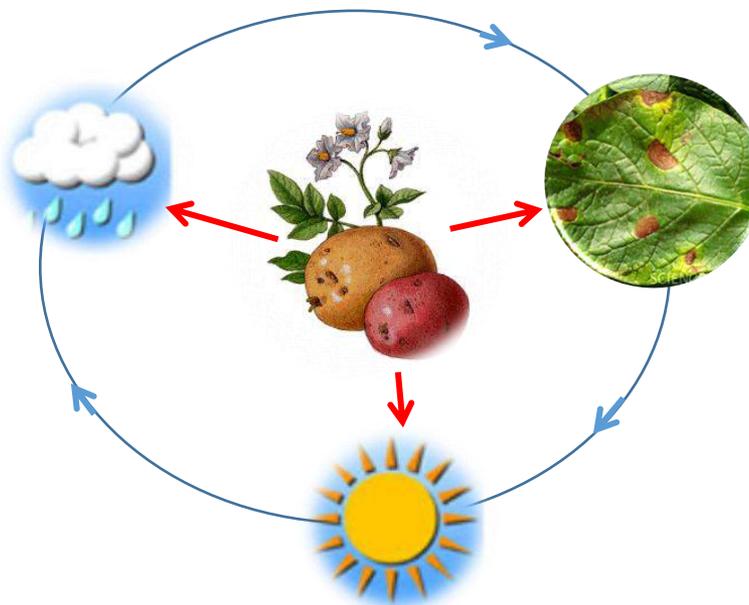
Several tools are available for analyzing conditions of disease manifestation, favorable factors, possibility of their mitigation, and also predicting the phenomenon evolution.

**SUCH A TOOL ARE THE  
BIOSTATISTICS**

It allows the accurate interpretation of the available data harvested from the field, using specific patterns.



The aim of our study is to emphasize the role of biostatistics in analyzing results of alternariosis control in potato cultures maintained in climatic conditions specific to Transylvanian Plane, which receive mineral fertilization, and treated with specific phytosanitary products.





# **MATERIALS AND METHODS**

## ➤ Experimental pattern

The trial was installed in a private farm located in Poieni village on a 1500 m<sup>2</sup> area, on argic chernozem soil. The climatic factors were daily recorded with a meteorological station placed on the experimental field. Because of their importance in alternariosis attack, only temperature and humidity were taken into account.

A bifactorial trial (3 x 2) was installed. The two factors were **fertilization** and **treatment**, respectively.

Three experimental plots, 500 m<sup>2</sup> each were organized (Fig. 1).

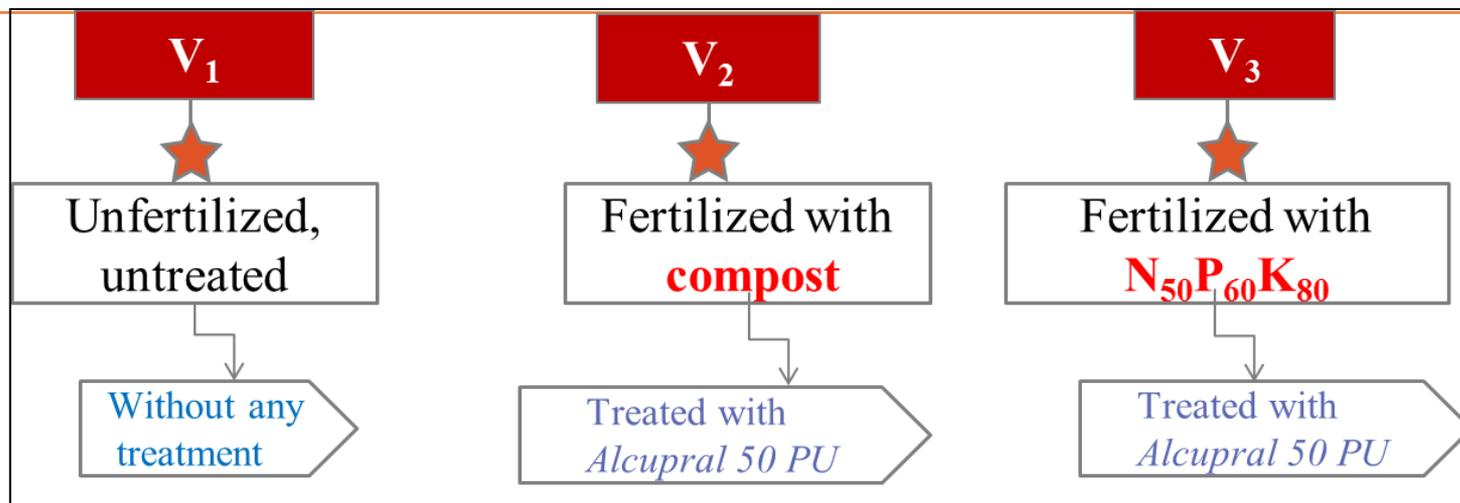


Figure 1. Experimental pattern



## ✓ **Biological material**

Resdec potato variety was cultivated on experimental plots. It is a semi tardive variety, which exhibits moderate resistance against alternariosis. It was delivered by the Station of Research and Development Targu Secuiesc, the variety creator ([www.roinno.ro](http://www.roinno.ro)).

## ✓ **Treatments and fertilization**

Treatments were performed with Alcupral 50 PU from Alchimex. The active substance is metallic copper as copper oxichloride – 50%. The administration dose is 5 kg/ha. Mineral fertilization was performed with mineral fertilizer  $N_{50}P_{60}K_{80}$  from commerce, and organic fertilization with compost prepared on farm.

## ✓ **Statistics**

With the aim of emphasizing the role of scientific analyze of alternariosis attack reported in potato cultures, we used specific tools. STATISTICA 7.0 v. program was implemented in order to assure the basis of biostatistical approach of data interpretations. The estimated parameters aims to both basic statistics (averages, dispersion parameters, Skewness, Kurtosis), and multiple regression tools (regression lines, multiple correlations, variance analysis).



# RESULTS AND DISCUSSIONS





**Table 1:** Basic statistics for *Alternaria solani* Sorauer attack degrees within each fertilization variant, temperature (°C), and humidity (%) during experimental period, April – September 2014

Issue	AD(%)1	AD(%) 2	AD(%)3	t (°C)	H (%)
N	24	24	24	183	183
Mean	16.74 <sup>a</sup>	7.03 <sup>ab</sup>	5.36 <sup>ab</sup>	16.89	74.00
Standard error of mean	0.36	0.99	0.09	0.31	0.70
Standard deviation	1.80	2.13	0.45	4.22	9.55
Coefficient of variability	10.92	30.25	8.43	24.99	13.78
Skewness	1.10	1.28	0.26	0.18	0.27
Kurtosis	1.27	0.51	1.23	0.58	0.26
ANOVA	p < 0.001	p > 0.05			

Note 1: AD(%)1 – attack degree recorded in Variant 1 unfertilized and untreated; AD(%)2 – attack degree recorded in Variant 2 N<sub>50</sub>P<sub>60</sub>K<sub>80</sub> fertilized and treated with Alcupral 50PU; AD(%)3 – attack degree recorded in Variant 3 organic fertilized and treated with Alcupral 50PU.

Note 2: a – p < 0.001; b – p > 0.05.

Basic statistics shows that, in conditions of no fertilization and no phytosanitary treatment, was reported the biggest *Alternaria solani* Sorauer average attack degree, 16.74%, by entire experimental period, April – September 2014, respectively.

The smallest *Alternaria solani* Sorauer average attack degree, 5.36%, was recorded in variant fertilized with N<sub>50</sub>P<sub>60</sub>K<sub>80</sub> mineral fertilizer and treated with Alcupral 50 PU (V3), while in variant (V2) fertilized with organic fertilizer, compost the *Alternaria solani* Sorauer average attack degree was of 7.03%.

**Table 2:** The analyze of variance applied to fertilization variants V1, V2, and V3 used in experimental design

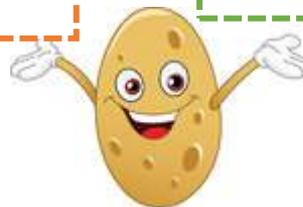
Source of variation	SS	DF	MS	F ratio	p value
Between fertilization variants	2.382	2	1.191	10.259	0.047
Within fertilization variants	13.780	3	4.593		
Total	16.163				

Note 1: Variant 1 – unfertilized and untreated; Variant 2 –N<sub>50</sub>P<sub>60</sub>K<sub>80</sub> fertilization and treatment with Alcupral 50PU; Variant 3 – organic fertilization and treatment with Alcupral 50PU.

Note 2: SS - Sum of squares; DF - Degrees of freedom; MS - Mean square.

The *F* ratio of 10.259 significant at 5% significance level, suggests a difference between fertilization variants as regards the value of the *Alternaria solani* Sorauer attack degree in potato cultures, within climatic conditions of Transylvanian Plane (Table 2).

This assessment is consistent with basic statistics outputs, and results of significance of differences testing, which emphasized very significant differences

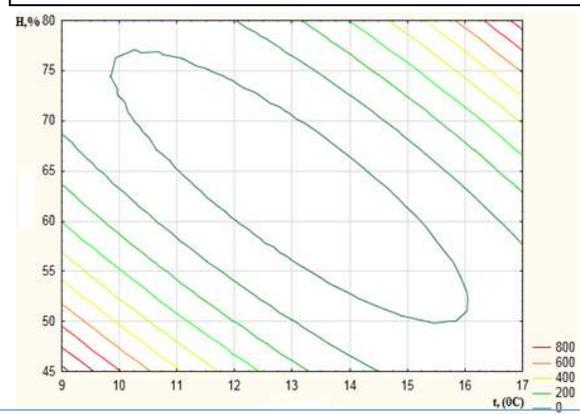


The results of multiregression analyze show that the biggest correlation between the *Alternaria solani* Sorauer attack degree in Redsec potato variety, temperature, and humidity recorded in experimental field located in Transylvanian Plane, was identified in variant fertilized with compost and treated with Alcupral 50 PU,  $R = 0.950$ , representative for 90.40% of sample (Fig. 2b). The smallest correlation was reported in variant 3, fertilized with N50P60K80 and also treated with Alcupral 50 PU,  $R = 0.383$ , representative only for 14.70% of sample (Fig. 2c), while in control variant not fertilized and not phytosanitary treated, intermediary values resulted,  $R = 0.687$ , representative for 47.20% of sample (Fig. 2a).

RESULTS AND DISCUSSIONS

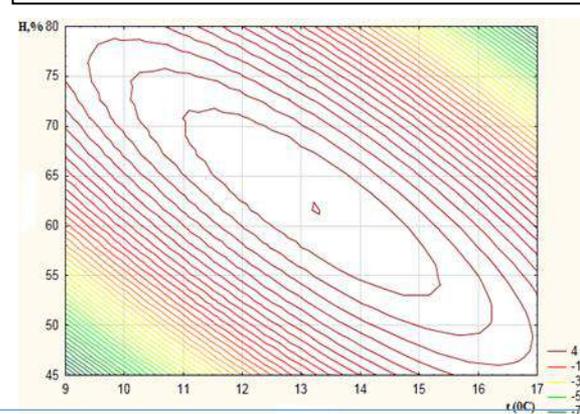
$$AD (\%)_1 = 33.469 - 1.061 t(^{\circ}C) - 1.194 H(\%)$$

$$R = 0.687, R^2 = 0.472$$



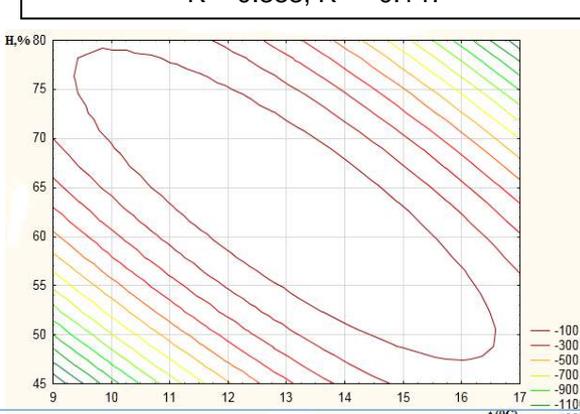
$$AD (\%)_2 = 6.002 + 0.397 t(^{\circ}C) - 0.597 H(\%)$$

$$R = 0.9507, R^2 = 0.904$$



$$AD (\%)_3 = 4.512 + 0.671 t(^{\circ}C) + 0.546 H(\%)$$

$$R = 0.383, R^2 = 0.147$$



- Note 1:** a – response area graph concerning interaction between attack degree recorded in Variant 1 (unfertilized and untreated), average temperature and average humidity of experimental period (April – September 2014).  
b – response area graph concerning interaction between attack degree recorded in Variant 2 (organic fertilized and treated with Alcupral 50PU) average temperature and average humidity of the experimental period (April – September 2014).  
c – response area graph concerning interaction between attack degree recorded in Variant 3 (N50P60K80 fertilized and treated with Alcupral 50PU) average temperature and average humidity of the experimental period (April – September 2014).

**Figure 2 a - c:** The response area patterns concerning interaction between attack degrees recorded in experimental variants, average temperature and average humidity within experimental period, April – September 2014



Thus, the use of biostatistics and meta-models involved, as shown by previous research performed in this area (Mălinaş et al., 2013), led to valuable output, with important consequence on practice.



Our research shows that best results, in fight against *Alternaria solani* Sorauer attack upon potato cultures in climatic conditions of Transylvanian plane, were obtained when fertilization was performed with mineral fertilizer and phytosanitary treatment was performed with Alcupral 50PU.



This assessment is confirmed not only by the lowest attack degree reported, 5.36% (Table 1) but also by the weak multiple correlation with climatic factors taken into consideration of 0.383 (Fig. 2c), which emphasize the smallest influence of these factors upon fungus attack and enhanced efficacy of this management solution.





# CONCLUSIONS

The implementation of biostatistical tools demonstrate the importance of using this method, due to synthetic and accurate results.

**1** They emphasize, in a concise and accurate manner, the superiority of treatment with Alcupral 50 PU in cultures fertilized with mineral fertilizer  $N_{50}P_{60}K_{80}$ .



**2** Thus, in specific climatic conditions of the year 2014, characterized by high average atmospheric humidity within analyzed area (74%), which advantages *Alternaria solani* Sorauer attack, the lowest average attack degree was reported in above mentioned experimental variant, potato culture treated with Alcupral 50 PU in cultures fertilized with mineral fertilizer  $N_{50}P_{60}K_{80}$  – 5.36%, while the biggest attack, as expected was identified in untreated and unfertilized control – 16.74%.





**THANK YOU FOR YOUR ATTENTION!!!**

