EFFICACY OF FUNGICIDE PROGRAMMMES TO CONTROL POTATO LATE BLIGHT (*PHYTOPHTHORA INFESTANS*) IN ROMANIA

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Abstract. Late blight caused by *Phytophthora infestans* (Mont.) de Bary remains the greatest potential disease in the Romanian potato crop. Late blight can destroy foliage prematurely and in a very short time, reducing production, while the tuber infections associated with rots can cause important crop losses during storage. There are years when the disease is epidemic, causing great loss of production and have a negative effect on the quality of tubers, making more difficult the processing and the storage. The current European legislation requires from member states to promote a policy of disease control using less chemicals in an integrated plant protection management.

Keywords: potato, late blight, fungicide, control program

INTRODUCTION

Is the case for late blight were used relatively resistant varieties in combination with low doses of fungicides, experiences that have been successful in reducing the attack on foliage (Fry, 1978, Nielsen 2004, Naerstad et al., 2007, Bain et al., 2011).

Recent studies based on PCR analyzes show that on average 10% of seed potatoes in Europe are latently infected with blight and as such, the inoculum can be found in the field. (Zellner et al., 2011)

If only 1% of these plants produced infected tubers (Powelson et al., 2002), this means approximately 40 outbreaks per hectare (assuming a density of 40,000 plants / ha)

Changes in the biology of the fungus is focused on diversifying the forms of attack, more aggressive and producing oospores. The researchers analyzing the implications of oospores had anticipated that late blight will occur earlier, which will increase the number of treatments by 50% if environmental conditions will be favorable. (Zaag and Turkesteen, 1994)

In the spring, blighted tubers, which provides the most important way of transmission of the fungus from one year to another, generating plants from which the fungus reaches the soil surface. These plants represents primary infections from which start the disease.

The most important sources of initial inoculum are the blighted potatoes left in the field (Zwankhuizen et al., 1998) and the infected seed potatoes (Marhsall and Stevenson, 1996).

Fungicides used against blight influence tuber infection in several ways. One way is to prevent or reduce the sporulationfrom the foliage, which means reducing the number of spores that may reach the tubers. Other fungicides reduce directly or indirectly the viability of spores and in other cases by repeated spraying of the foliage, fungicides reach the ridge stopping spores germination or preventing zoospores mobility. (Manuela Hermeziu and Hermeziu, 2006)

Aims: to compare the control efficacy of fungicides using a disease management program so to save 1 out of 3 sprays during the growing season.

MATERIALS AND METHODS

Location of the field trial: NIRDPSB Brasov

Size of plots: 25 m^2

Lay out of the plots of the field trial: randomized complete block design with 4 replicates Planting was made in 23nd April 2013 and in 31st March 2014. In both cases, cultivation and maintenace was in line with current good agricultural practice

Potato cultivar: Chriatian (Romanian potato variety), moderately susceptible to *Phytophthora.*

First symptom of late blight observation: daily check for all plots after emergence till first sympotm observed in one of the plots. Trials relied on natural infection, late blight appeared in 2013, June 21st and in 2014, June 17th

Late blight assessment: plots are assessed for the extent of blight spots on the leaves. Each plot is assessed as a whole for percentage disease severity using a standard accepted severity key. (Anonymous, 1947, Cruickshank G. et. al., 1982)

Yield assessment: two rows in the center of each plot were harvested mentioned the number and the weight of tubers with blight (blighted tubers assessments are usually based on a sample of 100 tubers per plot. When is neccesary the tubers are cut to examine the flesh.)

Effectiveness of spray program was judged in comparison with untreated plot.

The studied fungicides in both years were: Revus 250 SC (dose 0.6 l/ha), Infinito 687,5 SC (dose 1.4 l/ha), Bravo 500 SC (2.0 l/ha) and Shirlan 500 SC (0.4 l/ha).

Dose, volume, method and timing (time of first spray and interval between subsequent sprays in the programme) of application reflect the proposed label recommendations. The interval between sprays usually depends on disease risk. Seven to fourteen day intervals are used most commonly.

Observations on foliage were done, in accordance with late blight Protocol, in the same day:

2013: 25.06; 2.07; 9.07; 16.07; 26.07; 5.08

2014: 20.06; 27.06; 5.07; 14.07; 22.07; 30.07; 6.08

RESULTS

Sprays must to be applied before the risk of blight becomes significant. In Brasov area spraying usually begins in June. The first spray is traditionally done before the canopy closes on the rows when the plants are about 15 cm high. This is to protect the lower leaves which cannot be reached later when the foliage becomes too dense.

Late blight incidence depends on environmental conditions. Treatment is required before long periods of humidity (rain, fog) accompanied by moderate temperatures (15-20ºC)

Fungicides are most effective when they are applied to foliage before infection occurs or when the disease is in very early stages of development and cannot be detected yet by the human eye. Later applications are helpful in reducing the rate in which the disease spreads but are not nearly as effective as early applications.

In 2013 June rains accompanied by relatively high temperatures conducted to the presence of late blight in the second part of the month (21st June). In the treated plots late blight reached the epidemic level at the end of July. The climatic conditions of this summer were very favorable for late blight development (Fig. 1).

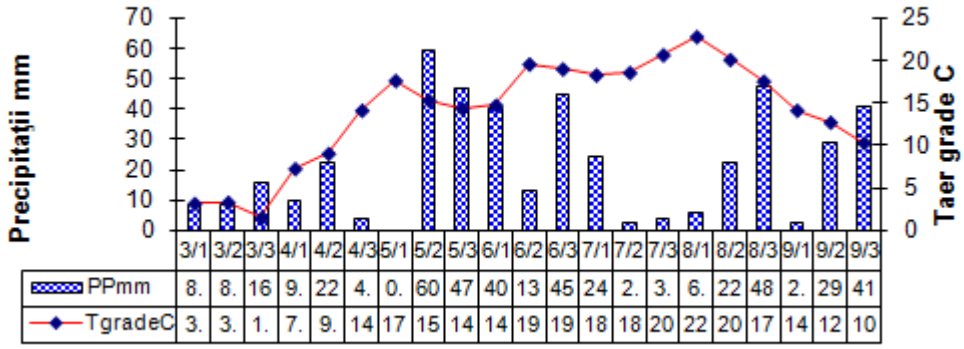

Fig. 1. The average temperatures and the rainfalls amount during the growing season (Braşov 2013)

In 2014 the high frequency of rainy days, 19 days in June and 18 days in July with optimum temperatures have favored, besides the development of plants, the blight attack, whose control was relatively difficult (Fig. 2). Late blight appeared a few days earlier (June, 17th 2014) than in 2013.

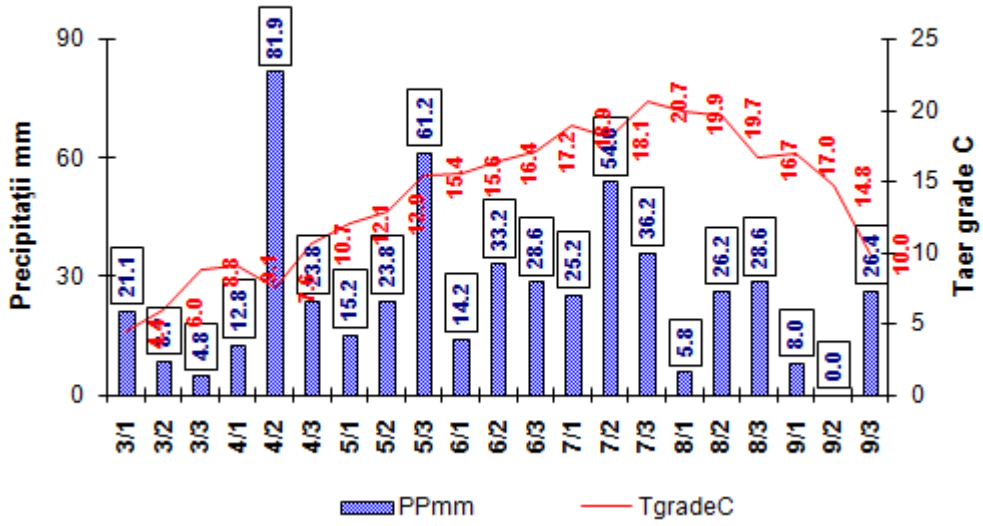

Fig. 2. The average temperatures and the rainfalls amount during the growing season (Braşov 2014)

The percent of foliage blight for the different treatments at the end of the growing season is given in fig. 3. All fungicide treatments resulted in good disease control and significantly reduced the incidence of blight on foliage at the end of the season compared with the untreated (control) plot. The sistemic products (Revus 250 SC and Infinito 687.5

SC) have ensured a level of attack by 30% respectively 32,5% beside 40% respectively 42% that was registered to contact fungicides (Shirlan 500 SC and Bravo 500 SC).

Applying 6 treatments on the season was assured a slow and constant evolution of attack compared to the evolution in the untreated (control) plot where at the last assessment (August, 5th 2013) was recorded a maximum of 90%, which means that all the foliage was destroyed.

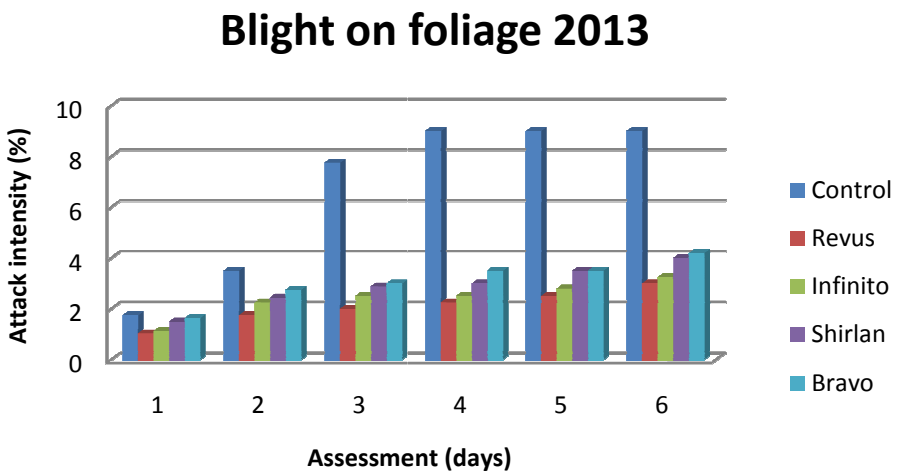

Fig. 3. The development of foliar blight in Brasov 2013

All test products significantly delayed disease on-set, reduced the level of foliage and tuber blight and increased marketable yields compared with the untreated control.

The lowest level of foliage blight at the end of the growing season was recorded to Revus 250 SC treatment. This was not significantly better than Infinito 687.5 SC, but significantly better than Bravo 500 SC and Shirlan 500 SC (Fig. 3).

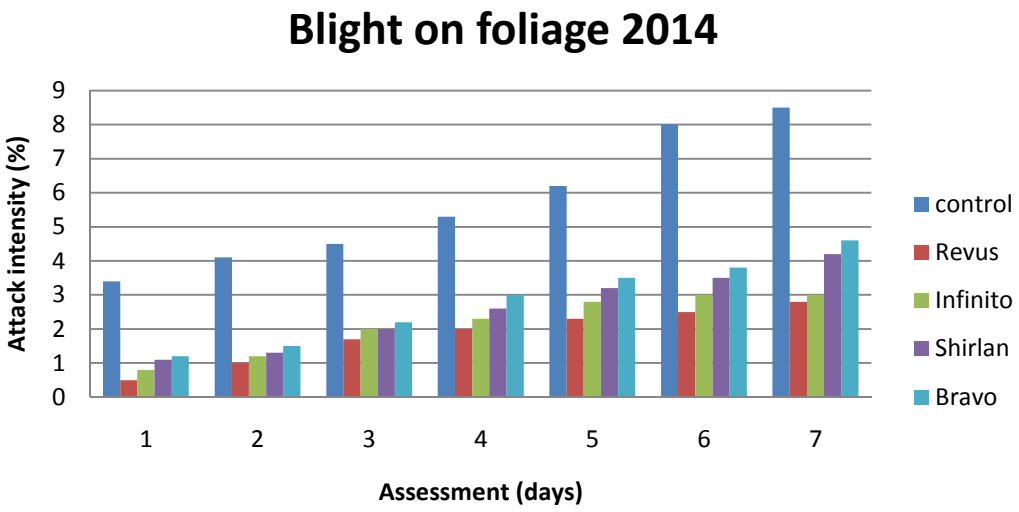

Fig. 4. The development of foliar blight in Brasov 2014

The best average control was recorded following the Revus 250 SC treatment, but Infinito 687,5 Sc , Shirlan 500 Sc or Bravo 500 Sc were significantly better than the control (untreated) variant over the growing season.

In 2014 the sistemic products (Revus 250 SC and Infinito 687.5 SC) have ensured a level of attack by 28% respectively 30% beside 42% respectively 46% that was registred to contact fungicides (Shirlan 500 SC and Bravo 500 SC).

Applying 7 treatments on the season was assured a slow and constant evolution of attack compared to the evolution in the untreated (control) plot where at the last assesment (August, 6th 2014) was recorded a maximum of 85%, which means that the plot is predominantly brown nor green (Fig. 4).

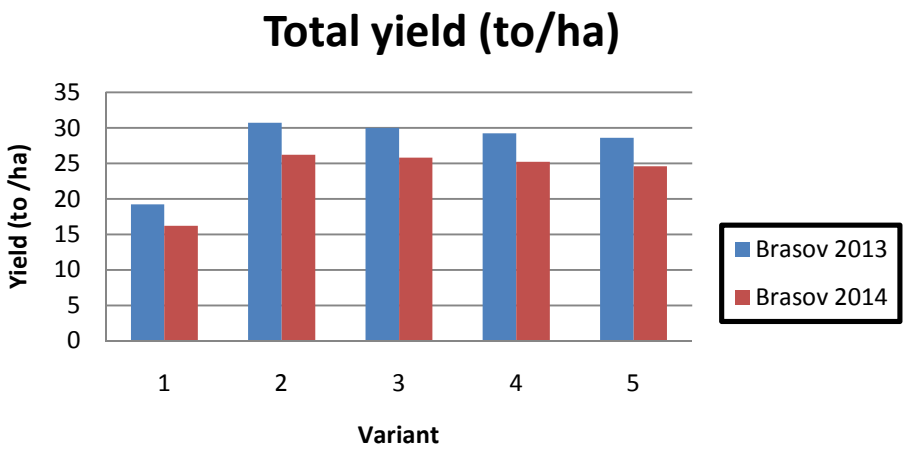

Fig. 5. Treatments effect on marketable yield

Looses caused by late blight can be quantified seeing the differences in yield between untreated (control) and fungicides plots (Fig. 5). There was an average increase of 10,40 t/ha in total yield from the use of a fungicide programme in 2013 and an increase of 9,25 t/ha in 2014. The difference in yield between treated and untreated plot is significant to all variants.

In 2013 the untreated plot had only 19,2 t/ha yield and the variant treated with Revus 250 SC 30,7 t/ha. Also to the other fungicides the yield was high, 30,0 t/ha to Infinito 687,5 SC , 29,20 to Shirlan 500 SC and 28,60 to Bravo 500 SC.

We compared the fungicides in 2014 when the untreated variant gives 16,2 t/ha yield and variant with Revus 250 SC looks performance of 26,2 t/ha yield.

CONCLUSIONS

Apart from efficacy, other factors will always be taken into account in making a decision to use a fungicide, including the variety, tuber resistance, disease pressure and treatment cost.

All tested fungicides (Revus 250 SC, Infinito 687,5 SC, Bravo 500 SC and Shirlan 500 SC) gave good control of foliage blight.

All fungicides resulted in higher marketable yields when compared with the untreated control.

No phytotoxic effects were observed with any of the test fungicides.

Research indicates that fungicide applications are most successful if they start when the canopy begins to close within the row. Applications should continue throughout the growing seson. Protectant fungicides should be used before the disease development. If late blight is present, protectant and systemic/eradicant fungicides should be used in alternation.

In future, an integrated control management which combines selective use of fungicide with varieties resistance, cultural practices, methods of forecasting and cultural practices will prove to be the most effective option.

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