

Potato late blight in Lithuania

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Summary

Potato late blight caused by *Phytophthora infestans* is one of the most destructive potato diseases worldwide. This disease causes serious losses in Lithuania, too. Having analyzed the articles and reports previously published by other researchers the authors of this paper tried to link global warming issues with an increasing late blight problem in Lithuania. Also, we attempted to find out if there are any signs of diseases and pests which have not been known before or their influence has been insignificant so far. After reviewing previously done works and analyzing weather data we have concluded that late blight does not appear earlier in the potato growing season. This is primarily due to the lack of rain at the end of spring and first months of the summer. Other reasons are that potato production area has dwindled by half over a 10-year period. Currently potato production is concentrated in the farms practicing intensive crop protection. All these facts reduce the possibility of early occurrence of late blight. But high temperatures and drought in the first months of potato growing season favours the occurrence of early blight (*Alternaria solani*) and Colorado beetle (*Leptinotarsa decemlineata*).

Keywords

Phytophthora infestans, late blight, climate change

Introduction

Late blight of potato (*Solanum tuberosum*), caused by the oomycete pathogen (*Phytophthora infestans* Mont. de Bary) is considered to be the most devastating disease of potato worldwide. This disease causes serious losses in Lithuania, too (Stuogienė, 1987; Valskytė *et al.*, 2003; Ronis and Tamošiūnas, 2005). Late blight is a disease driven primarily by weather conditions. Climatic observations in Finland in the 20th century and especially since 1980 show increasingly warm springs (April and May), slightly warmer summers (June to August), and reduced diurnal range of temperatures. In Scandinavia and Finland, the reduced range is related to increased cloudiness and to the strengthening of western air flow (Hannukkala *et al.*, 2007). In Lithuania, climate has been warming since the 18th century and, as projected by forecast climate models, by the middle of the 21st century it will have warmed up by 1.5 – 1.7 °C (Bukantis, 2001). These climate trends mean more favourable weather for potatoes in the early growing season, but also more conducive to late blight.

Changes in pathogen population, migration of new pathogenic genotypes and especially global climate change increased awareness about much severe attacks of currently known diseases and/or possible introduction of a new ones (Boland *et al.*, 2004; Platt, 2006). Number of published works in other crops as well in potato already proved that severe diseases attacks are the result of global warming (Chakraborty *et al.*, 2000; Rosenzweig *et al.*, 2000; Hannukkala *et al.*, 2007).

Some authors note that global warming will have significant effect on the insect word (Hansen, 2005). In the spring of 2007, we observed 2 – 3 Colorado potato beetles (*Leptinotarsa decemlineata*) per plant shortly after potato emergence. The same situation was observed in the neighbouring Latvia. By previous studies it is determined that heavy attacks of Colorado beetles are primarily linked to mild winters and hot springs (Šurkus, 1995).

The aim of our research was to evaluate the effects of global warming on the occurrence of potato diseases in Lithuania over the past decade.

Materials and methods

In this study we observed and analyzed the articles and reports that had been previously published by other authors. Also, the amount of rainfall of the sites under study is presented. Statistics about the acreage of potato crop are available online (www.stat.gov.lt).

The results of the first late blight outbreaks in Dotnuva (central part of Lithuania) and Elmininkai (approx. 100 km from Dotnuva to the Northeast) are taken from fungicide efficacy, potato cultivar and other trials carried out by the different projects. Also, the specialists of the State Plant Protection Service assess for the first late blight outbreaks across the country annually. They data are available online (www.vaat.lt). Booklets about the situation with pests and diseases in the country are published annually.

Results

The first late blight onset is usually recorded by the specialists of the State Plant Protection Service (*Figure 1*). The specialists look for the first disease outbreaks throughout the country, and the first disease symptoms are usually spotted in small scale gardens. Such places are usually one of the primary disease focuses (Plant protection ...1998-2006). Late blight was detected earlier at the Elmininkai research station than in Dotnuva.

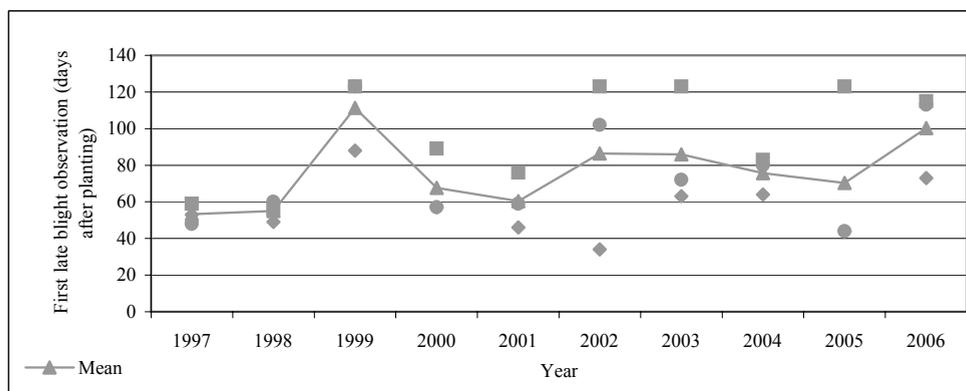


Figure 1. First late blight symptoms after potato planting (1 May) in small scale gardens (♦), Elmininkai (●) and Dotnuva (■).

At the Elmininkai research station potato late blight occurrence and damage to the crop varied from small to serious losses. In 1998, the disease occurred early (at the end of June) and a 4- time fungicide application program was not sufficient to retain healthy plants. In the next season, late blight occurred at the very end of potato growing, but another disease – early blight, caused the biggest losses over this ten year period. Early blight occurred in the fields in the 2006 season too, but in the second half of August heavier rain favoured the occurrence of late blight. In the year 2000, it was observed that late blight significantly dispersed on the haulm of potato. Earlier, haulm damage was not so obvious at this site. Also heavy haulm damage caused the rotting of tubers in the soil before harvested. That season was memorable, because due to the late blight the potato yield was the lowest over the century. In 2002, due to high temperature and drought potato foliage was healthy but the yield was not high. In Dotnuva site, late blight occurrence and damage to the crop varied like in Elmininkai. In this area, late blight usually was recorded about 56 – 89 days after potato planting, *i.e.*, from the end of June to the end of July. In four years out of ten, the disease was spotted at the very end of potato growing. Late blight is a disease driven primary by weather conditions. In some cases the disease appears early in the season but causes relatively small damage to the crop and vice versa. For instance in 2006, the first symptoms of late blight were detected on 23 August in Dotnuva. After 10 days unprotected potato foliage was completely destroyed. Yield losses due to the disease were about 75 percent in the cultivar Fasan (unpublished data).

In 1997 and 1998, late blight was spotted very early in three different places within two weeks. This is due to the heavy rain which occurred in the first months of the potato growing season. In June of 1997 rainfall amounted to 149.5 percent from mean value and in May of 1998 to 150.2 percent in Dotnuva site. Also, the year 1998 was very favourable for the disease outbreak because the amount of rainfall in July amounted to about 275 percent from the mean value.

Discussion

Hannukkala (2007) determined that the outbreaks of the epidemics begin 2 – 4 weeks earlier in Finland. This is due to the climate change and newly emerged populations of *Phytophthora infestans* which are more aggressive on potato than the old clonal lineage (Carlisle *et al.*, 2002). No research on the population and mating type structure of late blight pathogen in Lithuania has been carried out yet.

Volunteer potatoes which are common in warmer regions (Zwankhuizen *et al.*, 1998) became a problem in our country as well. It was observed that mild Lithuanian winters could favour overwintering of volunteer potatoes for two seasons. Our observations also suggest that obviously warmer winters and earlier springs favour better overwintering of late blight pathogens. Volunteer potatoes could be not only foci of late blight outbreak, but also an early “pasture” for Colorado beetle.

According to the data presented in *Figure 1*, the disease outbreak in Lithuania tends to occur later, presumably because of reduced area devoted for potato production (*Figure 2*). However, more potato is grown on intensively-managed farms using plant protection and other measures in order to prevent pest damage.

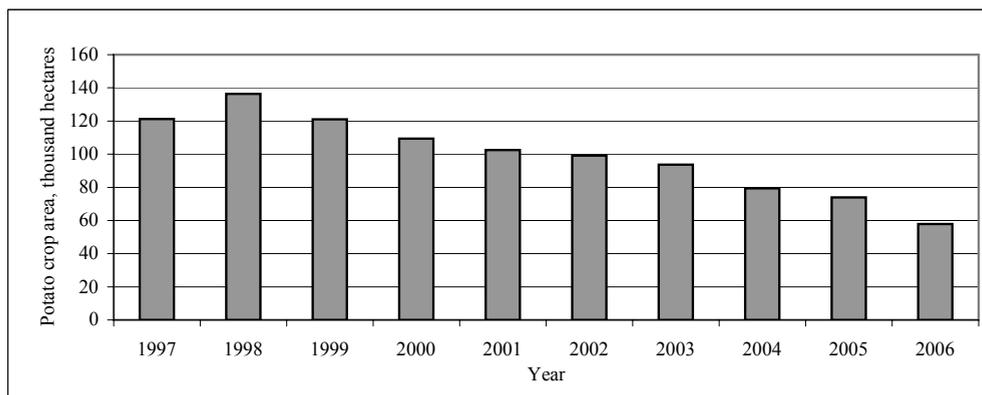


Figure 2. Potato crop area (thousand hectares) in 1997 – 2006.

In non irrigated plots potato growing is under risk. Dry years are not favourable for the late blight, but other disease – early blight (*Alternaria solani*) and lack of moisture in the soil could be detrimental for potato. In Figs. 3 and 4 it is shown that only in two out of 10 years the amount of rainfall was above the average at Dotnuva site, whereas at Elmininkai site rainfall in six years was above the average. Sufficient amount of rainfall led to earlier occurrence of late blight.

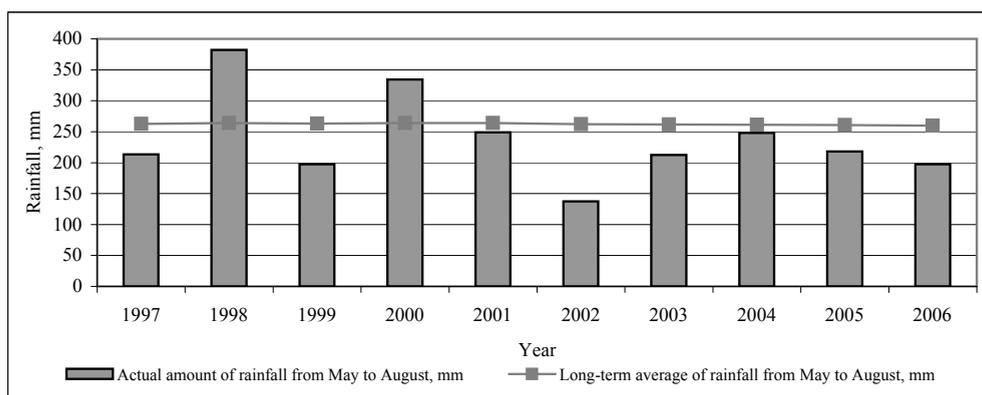


Figure 3. Actual and mean values of rainfall from May to August in central part of Lithuania (Dotnuva) over 1997 – 2006. Source: Dotnuva weather station

In some cases serious attacks of late blight are the consequences of using modern potato cultivars. Tubers of these cultivars grow much faster, which leads to cracking of the soil surface. Exposed tubers can be infected by zoospores of late blight if rain occurs.

In previous studies researchers discussed more about potato diseases such as late blight, rhizoctonia cancer (*Rhizoctonia solani*), common scab (*Streptomyces scabies*), black leg (*Erwinia carotovora*) and virus diseases (Šurkus and Valskytė, 1998). Nowadays, they are increasingly concerned with early blight disease (Ronis and Tamošiūnas, 2005).

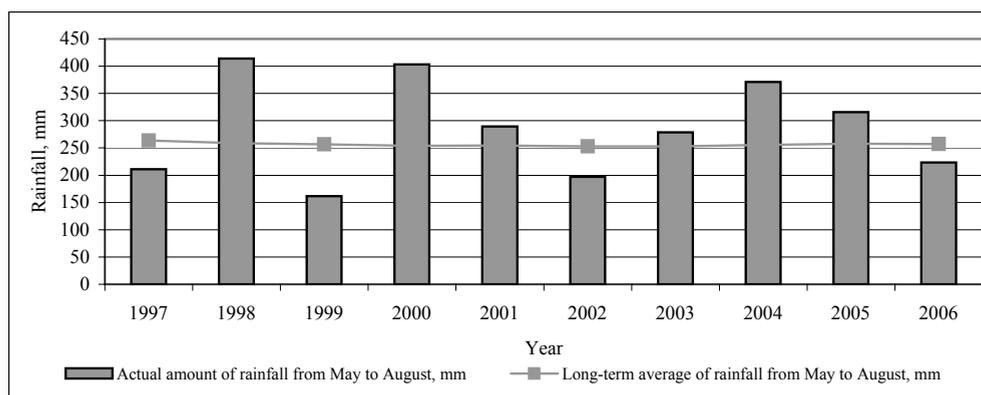


Figure 4. Actual and mean values of rainfall from May to August in Elmininkai research station during 1997 – 2006. Source: Elmininkai weather station.

Conclusions

Late blight does not occur earlier in the season because: (i) climate change causes hot springs and summers without sufficient rainfall, (ii) more potato is grown on intensively-managed farms and, (iii) reduced potato acreage.

Hot summers occur every two or three seasons. This leads to emergence of a new potato disease – early blight (*Alternaria solani*). This disease did not cause any significant losses a decade or more ago. During 1999, 2002 and 2006 early blight caused considerable losses in some places.

In order to avoid serious yield and quality losses potato breeders should develop new cultivars which would be more resistant to both early and late blights.

Potato growers have to use appropriate crop rotation, certificated seed, irrigate fields and use chemical protection.

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