

Strengthening Management of New Late Blight Genotypes in the North Central USA

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SUMMARY

Due to the appearance of a new *Phytophthora infestans* genotype, US24, a regional program was implemented in the north central region of the USA to strengthen late blight management. The new genotype first appeared in 2009 and replaced the US8 genotype in which had been dominant since 1995. Our 2011 management plan was an integrated approach with multiple components that included grower and industry education, early detection, late blight forecasting, fungicide trials and development of resistant varieties. The participants included growers, potato commodity groups, allied industries, government agencies, and universities. Late blight disease appeared late in the growing season and was not found in sentinel plots or retail tomatoes in commercial outlets. The disease became widespread in the region, and growers applied protective fungicides early in the season and generally continued on a 5-7 day schedule to maintain control. Special attention was given to organic, home gardeners and local markets to manage late blight. In 2011, 321 families of 544 families created (59%), included late blight resistance breeding. Despite our collective efforts to control late blight, some late blight infected tubers were found in seed tubers in storage, and it is anticipated that late blight may be present early in the 2012 growing season. The need for a seed treatment to reduce the spread of late blight during seed cutting was identified as a need by the industry. Continue vigilance and teamwork will be necessary to manage this community disease in 2012.

KEYWORDS

Phytophthora infestans, US24 genotype, forecasting, resistant varieties, USA late blight history

INTRODUCTION

Late blight is a periodic, rather than endemic disease in the north central region of the USA, in part due to the occurrence of cool, wet weather favoring disease epidemics. Late blight was generally absent, or at very low levels in the north central region of the USA, during the five year period of 2003-2008, but there was a resurgence of late blight by new genotypes of *Phytophthora infestans* in the US and Canada, and in our region, beginning in 2009. Because of the importance of potato production in our region, and the appearance of new genotypes, we began a regional program to strengthen and improve our regional late blight management program. Potatoes are an important crop in our region. In 2009, ND planted 83,000 acres of potatoes with a value of 175 million

dollars; MN planted 47,000 acres of potatoes with a value of 160 million dollars. The program we implemented was conducted in cooperation with the potato commodity groups in the states of North Dakota (ND), Minnesota (MN), and the province of Manitoba (MB), the state governments of ND and MN, and the entire potato industry of ND, MN and MB - growers, processors, allied industries. This report tells the history of our late blight from 2009-2011, our accelerated plan for late blight management, and the outcomes of our work.

LATE BLIGHT HISTORY IN THE NORTH CENTRAL REGION OF THE USA

From 1850-1991 late blight was sporadic and caused by the old A1 US1 genotype. In 1992 new genotypes were introduced from Mexico and a mixture of genotypes and mating types were found from 1993-1995. In 1995 the US8 A2 genotype became dominant and prevailed until 2008. The US8 genotype was more aggressive, caused more tuber rot, was able to survive more adverse weather conditions and was resistant to the fungicide mefenoxam, which was used for late blight control prior to the arrival of the US8 genotype. US8 was a complex race with many virulence genes. Unexpectedly in 2009, three new genotypes of Pi, US22, US23 and US24, were discovered throughout the US and our region. The overall objective of this project is to evaluate the impact of these new genotypes in our region and strengthen our management plan to maintain control of late blight.

Late blight in 2009

There was a localized outbreak of late blight in our region found in mid-August which was the first significant late blight in five years. In ND it was limited to one county in processing potatoes and garden tomatoes. Due to the widespread epidemic of late blight on the east coast, several premium fungicides were scarce, including Gavel, Revus Top, Curzate, Ranman. The late blight was caused by a genotype new to our region, US24 A1. There were few storage issues due to this new genotype.

Late blight in 2010

Late blight was found on tomatoes in retail stores in Manitoba in early June and detected in ND potato field June 24, the earliest it has been found since 1994. It was reported in MB potato fields June 30 and in MN potato fields July 21, and became widespread in region during the season. The genotype was identified as US24 A1 in ND, both US23 and US24 in MB, and US24 in Montana (MT), an important seed producing state bordering on western ND. This was the first report of late blight in MT in many years. Late blight severity values accumulated early and continued to climb all season, and the early appearance late blight caught growers by surprise. The early appearance suggested seed-borne or cull pile source(s) of inoculum from the previous year. An organic field in central ND acted as a source of inoculum in mid-season, became a political problem that was eventually resolved. Many conventional growers near the organic field wanted the field condemned. There was a shortage of some fungicides during the season and tuber infection was found at harvest and in storage. Based on our 2010 observations, we knew we needed to get ready for late blight in 2011.

Late blight in 2011

Early in 2011 we held several meetings and told the growers they would have late blight this year. We emphasized that late blight is a community disease and the industry needed to work together to manage late blight. To this end, we strengthened a unified multi-state late blight management plan for 2011 for our regions. The participants included growers, potato commodity groups, allied industries, government agencies, and universities.

MATERIALS AND METHODS

Our 2011 management plan was an integrated approach with multiple components that included:

- Grower and industry education
- Early detection
- Late blight forecasting
- Fungicide trials
- Development of late blight resistant varieties

Grower and industry education

Several meetings were held to educate growers about the understanding and managing late blight. University educators spoke at the Manitoba Potato Days January 26, coordinated a late blight symposium at the International Crop Expo in Grand Forks, ND February 17, spoke at the MN Area II Potato Growers meeting March 1, and at a grower only meeting April 21 in Hoople, ND. A late blight update was given at the NPPGA field day meetings August 25. For these meetings, lunch is always served, and additional literature and sources of information are distributed. In cooperation with the Departments of Agriculture in ND and MN and North Dakota State University, we wrote and electronically distributed to wide audiences, a Plant Disease Alert for organic growers, home gardeners and farmers markets entitled “Late Blight: A Plant Disease That Impacts the Community” (PP1565, NDSU Extension Service). Part of the plan was to urge growers to communicate late blight findings with extension and regulatory personnel in order to know location of infected fields, and to submit samples to our lab for verification and typing. Some growers are reluctant to submit samples, as they feel it will affect seed sales or marketing.

Early detection

Sentinel plots, blocks of 50 potato plants with no fungicide applications were planted early to act as a biological trap and early notification for any late blight in the area. Ten locations in ND, including Potato Research Farm, NDSU campus, consultant offices and field sites, fungicide distributor sites, grower fields, were planted with the late blight susceptible variety Red LaSoda. Additional sites were planted in MB. The sites were planted early and monitored frequently. If and when late blight found, potato plants are destroyed and late blight reported on the NDSU Blightline. A retired extension potato specialist (Duane Preston) was hired to monitor sentinel plots, to monitor retail tomato plants for late blight at large retail stores, and to scout fields for late blight.

Late blight forecasting

The North Dakota State University Blightline operated from June 1 – August 30 to forecast weather conditions favorable for late blight, forecast presence of late blight in the field, and provide fungicide recommendations. The Blightline was operated by the authors, and is the main source for late blight information for the region. It uses data from 29 North Dakota Agricultural Weather Network weather stations to forecast late blight severity and favorability. A new report is issued every Monday, Wednesday, and Friday with late blight locations and disease control recommendations. Reports are available by phone, email, and the NDSU website.

Fungicide efficacy trials

Trials are planted at the NDSU Prosper research station near Fargo annually to evaluate efficacy of registered, experimental and biological fungicides for control of late blight. These trials are inoculated with a mixture of three current late blight genotypes collected in the region. Parallel trials were planted in the Manitoba production area. Fungicide treatments in 2011 included 5-10 “real life” grower fungicide programs that producers actually use. Both foliar and tuber late blight infection are rated in the trials. A non-field late blight seed treatment trial was conducted. Cut seed

of the late blight susceptible cultivar Red LaSoda was tumbled with a mixture of late blight infected seed and lab prepared inoculum. The trial consisted of 18 fungicide treatments selected on the basis of foliar late blight efficacy. The rates for seed treatment were estimated based on foliar rates. The trial was designed as 4 replications with 25 seed pieces/replication. After inoculation and treatment, the seed was stored four weeks in paper bags at 12°C, and evaluated for late blight.

Development of late blight resistant varieties

As part of the NDSU potato breeding program, headed by Dr. Asunta Thompson, a dedicated crossing block with late blight resistant parents was established in 2000 to develop late blight resistant varieties. In 2011, approximately 9000 seedlings from 90 crosses were tested using a detached leaf assay procedure in the new NDSU greenhouse. From each cross, 100 seedlings were tested to identify families with high levels of late blight resistance for field selection. Selections are made in the field based on agronomic traits from families with highest levels of resistance. We continued to search for new late blight resistant parents to use in this program in future years; an example is the Patagonia variety from Chile, which may be a new source of resistance. We also plant field trials at the NDSU Prosper site of new and advanced selections from the NDSU potato breeding program for late blight resistance, and the National Late Blight Trial to test advanced selections from multiple US potato breeding programs for resistance to late blight.

RESULTS AND DISCUSSION

What happened in 2011?

Due to prolonged wet weather, there was widespread late planting of potatoes and other crops. Surprisingly, based on the presence of inoculum in the seed and the wet conditions, late blight did not appear until the end of July, about 60 days after planting. Only the US24 A1 genotype was found. It appears that this new genotype has replaced the aggressive US8 A2 genotype that was prevalent from 1995-2008. The US24 genotype is moderately resistant to the fungicide mefenoxam. US8 was resistant to mefenoxam. There was a widely scattered, low incidence of late blight August – September; some fields with high levels. Because we do not have good commercially acceptable varieties with resistance to late blight, growers sprayed early and often until August. Producers applied fungicides on a 5-7 day schedule full season, which was very costly. The months of August and September were unusually dry, with virtually no rain, and growers stopped fungicide applications to save money and mistakenly thought the late blight would not persist. Unfortunately, the late blight did persist resulting in some tuber infection end of the season.

Education results

Education to the growers and industry very well received, good attendance, lots of questions – growers want to learn. Approximately 40 samples of late blight were received from growers, agronomists and consultants. Many phone calls were received to answer questions about late blight and to provide management recommendations.

Early detection results

No late blight was found in either the sentinel plots or retail tomato plants. It may be better to use larger blocks of sentinel plots to provide longer periods of wetness for infection in order for sentinel plots to work.

Late blight forecasting results

The NDSU Blightline was an effective communication device with the industry and was widely

used. This year, most growers began spraying fungicides early before threshold severity value of 15 was reached and continued on a 5-7 day regular schedule. Early fungicide application was due to several factors, including a high threat of late blight, seed borne late blight, favorable weather, large acreages that take several days to spray, and because growers do not want to get behind if late blight appears. Because we have few resistant varieties, frequent fungicide applications are necessary.

Fungicide efficacy trial results

Fungicide trials were planted, but the trials were lost to flooding due to excessive rain. Differences between experimental seed treatment fungicides for control of seed-borne late blight were found, and the results communicated to the industry. Several fungicides were identified that reduced the spread of late blight during seed cutting and handling, including zoxamide, phosphorous acid, ametoctradin, mancozeb dust, fluopicolide and mandipropamide. The results were communicated to the industry, and it is anticipated that these trials will be continued, as there is great interests in this trial from all parts of the potato industry.

Development of resistant varieties results

Overall, only 5% of families tested had >60% of the 100 seedlings with resistance to late blight in detached leaf assays, as defined by a reading of 0 or 1. In 2011, 321 families of 544 families created (59%), included late blight resistance breeding.

Due to excessive flooding, the late blight resistance field trials were lost in 2011. New genotypes affect cultivar resistance, and continuous screening will be necessary to develop resistant varieties.

CONCLUSION

Late blight is a serious and continuing disease and finds a way to cause disease despite our best integrated management strategies and tactics we develop for control. Using this grant as a pattern, we anticipate continuing to actively manage late blight in future years to collectively reduce losses in our region.

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