

The impact of fungicide resistance on early blight disease management

The Situation

Early blight caused by *Alternaria solani*, and brown leaf spot (caused by *A. alternata*) are very common diseases of potato found in most potato-growing regions of the US. Brown leaf spot is often confused with early blight as its symptoms are very similar. The pathogens causing these two diseases are very closely related and to make things more complicated both pathogens are often present on diseased plants, which makes it difficult to distinguish how much disease is caused by one pathogen or the other. In some areas of the US such as Michigan, brown leaf spot is more common than early blight. In these areas the disease is referred to as early blight/brown leaf spot complex.

Traditionally in Idaho, early blight control has primarily depended on multiple fungicide applications throughout the growing season. The strobilurin fungicides (e.g. pyraclostrobin [Headline] and azoxystrobin [Quadris]) are often favored because they offer broad spectrum protection against a wide range of fungal diseases.

In 2008, many Idaho growers reported the failure of the traditionally effective strobilurin fungicides to control early blight. Loss of fungicide efficacy is usually associated with the development of fungicide resistant isolates of a pathogen. Fungicide resistant isolates of *A. solani* have been reported in Idaho and are common in other potato growing regions (e.g. Wisconsin). However, these problems may also be due to misdiagnosis of brown leaf spot as early blight. Unlike *A. solani*, the brown leaf spot pathogen, *A. alternata*, is inherently more resistant to strobilurins and has never been well controlled by this class of fungicides.

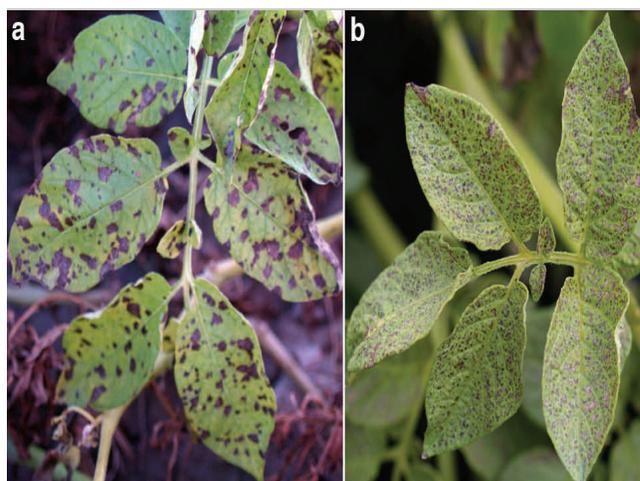


Figure 1. Typical symptoms of early blight (a) and brown leaf spot (b) on potato foliage.

Our Response

To determine whether loss of fungicide efficacy was due to the presence of resistant isolates of early blight or the presence of brown leaf spot, the Idaho Potato Commission (IPC) funded a study in 2009 to investigate the problem. With startup funds, the Potato Pathology program at the Aberdeen Research and Extension Center, purchased a spiral plating robot that is used to carry out fungicide resistance screening. Preliminary disease surveys were carried out in the potato growing regions of Idaho in 2009 and 2010. Diseased leaves with symptoms of early blight or brown leaf spot were collected and returned to Aberdeen R & E Center. Fungal isolates were taken from the lesions on the diseased leaves. These isolates were then identified to determine whether they were *A. solani* or *A. alternata*. Once the fungal isolates had been identified, they were tested for resistance to a range of fungicides commonly used in Idaho, includ-

ing the strobilurins, and the carboxamide fungicide boscalid (Endura).

Results from the disease survey showed that *A. solani* was the dominant pathogen causing early blight-like symptoms in Idaho. In all the locations surveyed in southern Idaho, from Parma in the southwest to Rupert to Aberdeen, all of the diseased plants collected had typical early blight disease symptoms and none had typical brown leaf spot symptoms (Figures 1). Typical brown leaf spot symptoms were only observed on potatoes growing in Bonners Ferry, ID. These observations were confirmed by isolations from diseased leaves. *Alternaria solani* was the only pathogen isolated from diseased leaves collected in southern Idaho with typical early blight symptoms. *Alternaria alternata* was the only pathogen isolated from leaves collected in Bonners Ferry displaying brown leaf spot symptoms. *Alternaria solani* was isolated from leaves collected in Bonners Ferry displaying typical early blight disease symptoms.

Screening of early blight isolates collected in 2009 showed that there was widespread resistance to azoxystrobin and 15 percent of isolates were found to be resistant to boscalid. All isolates tested were still sensitive to pyraclostrobin. These results were confirmed in 2010 when a larger number of isolates were tested and 62 percent of those tested were found to be resistant to boscalid. In addition, these results confirmed earlier findings indicating that *A. alternata* is generally more resistant to the strobilurin fungicides, with up to 50 percent of *A. alternata* isolates from Bonners Ferry showing resistance to the strobilurins.

The discovery of boscalid resistant *A. solani* isolates was a very important find as this is the first report of resistance to boscalid in *A. solani* on potatoes in the US and Canada. As such, after confirmation of the 2009 results with the results from 2010, the research was submitted to the journal *Plant Disease* and was accepted for publication in September 2011.

Program Outcomes

- These results suggest that azoxystrobin is losing efficacy as a potato early blight control agent in southeastern Idaho as it has done in other areas of the US where resistant isolates of *A. solani* have developed. Further testing is needed of more isolates from more locations in Idaho, more stages of disease development during the growing season, and more years to accurately estimate the current frequency and future potential of azoxystrobin resistance in Idaho.
- Resistance to boscalid (Endura) has not been reported in *A. solani* previously. The discovery of resistant isolates suggests that Endura should be considered at high risk for resistance development. Boscalid insensitivity *in vitro* may not translate directly to commercial production, and to

date, there is little evidence to suggest that Endura has failed to control early blight in Idaho. Fungicide spray trials carried out at the University of Idaho show it to still be one of the most effective fungicides for controlling early blight and white mold. Nevertheless, growers need to be aware of the importance of rotation strategies to discourage the selection for resistance to Endura.

- The discovery of boscalid resistant isolates of *A. solani* is worrying as several new fungicides with similar chemistries and modes of action to boscalid have been developed and are due to be released in the next one to two years. As a result of this discovery we have been testing these new products in cooperation with the companies against these boscalid-resistant isolates. The good news is that results so far have shown that these new products are still 100 percent effective, even against the resistant isolates.
- With continued support from the IPC we are now also testing additional fungicides for their efficacy against not only *A. solani* isolates but also *A. alternata* isolates. This will enable us to make recommendations about which fungicides are effective for the control of both diseases and suggest effective fungicide rotation strategies.

FOR MORE INFORMATION

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