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G2112

Zebra Chip Disease of Potatoes in Nebraska

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Zebra Chip is a new disease affecting potatoes in Nebraska and impacting marketability.

Introduction

Potatoes have been grown in Nebraska for more than a century, with production acres peaking at approximately 100,000 acres in the 1930s. Production has now stabilized, averaging about 20,000 acres, and the crop is produced throughout all regions of the state. Production includes both seed and table stock and is exported to all areas of the country. Potatoes are still an important industry in Nebraska, bringing revenue from other states and contributing income to local economies of an estimated $100 million.

In fact, the first plant disease studies conducted by the University of Nebraska in western Nebraska in 1909 concerned the potato. In the summer of 1909 (prior to the establishment of the Scotts Bluff Experimental Substation in 1910), with the help of special legislative funds, a potato disease lab was set up in Alliance to study storage diseases of potatoes, including tuber dry rot. In 1930, an experimental farm was established by the Experiment Station near Alliance (later known as the NW Agricultural Lab) in cooperation with Box Butte County for the primary purpose of studying potatoes under dryland conditions, providing further evidence of the potato's contribution to Nebraska agriculture.

A Serious New Disease

A new disease of potato with symptoms consisting of leaf yellowing, purpling, and distortion was first observed around Saltillo, Mexico, in 1994. The tubers, when sliced, displayed a brown vascular discoloration (*Figure 1*). Potato chips made from affected tubers displayed dark stripes and streaks (*Figure 2*), thereby providing the justification for naming the disease "zebra chip" (ZC). As a result of these characteristics, affected chipping potatoes with these symptoms are unmarketable and reputedly inedible. This disease also causes marketing issues for other table stock as well.

In the United States, the disease was first noted in 2000 in south Texas near Pearsall and the lower Rio Grand Valley, where it caused losses, to both producers and processors, estimated in the millions of dollars in 2004-2005. The disease has now spread throughout Latin America and has been reported from at least eight U.S. states, including Nebraska.

Figure 1. Vascular discoloration of tubers, characteristic of zebra chip (ZC).

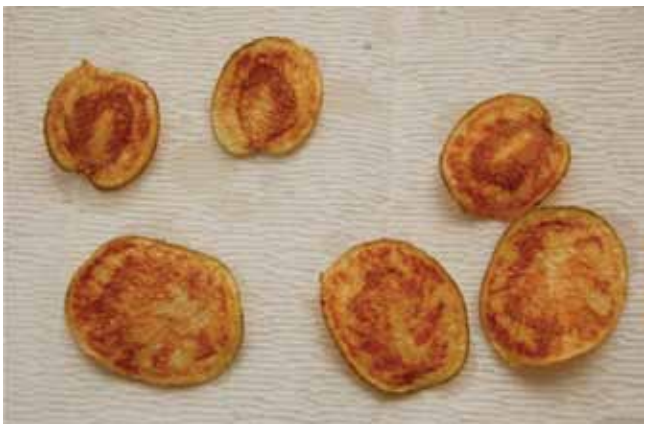

Figure 2. ZC symptoms from infected tubers after frying. Origin of the name of the disease comes from the striping — zebra chip.

Figure 3. Upward curling of leaves, characteristic of psyllid yellows or ZC.

Figure 4. Foliar symptoms of ZC consisting of swollen nodes and resulting in a zigzag pattern of stems.

Figure 5. Foliar symptoms of ZC consisting of aerial tubers and a proliferation of axillary leaf buds.

Figure 6. Foliar symptoms of ZC consisting of scorching and death of foliage.

Symptoms

ZC-infected plants can exhibit a wide range of symptoms, including foliar symptoms resembling psyllid yellows (yellowing and upward leaf curling) (*Figure 3*). Other documented aboveground symptoms include swollen nodes resulting in a zigzag orientation of stems (*Figure 4*), proliferation of axiallary buds and aerial tubers (*Figure 5*), and leaf scorching (*Figure 6*). Tuber symptoms are characterized by enlarged lenticels (*Figure 7*), purple to pink "belly-button" (attachment site of stolon to tuber) (*Figure 8*), brown discoloration, necrotic flecks in vascular rings (*Figure 9*), and dark streaking of the medullary rays (*Figure 10*).

Pathogen and Disease Cycle

There has been a considerable amount of confusion regarding the actual causal organism of ZC. However, the most recent research strongly suggests the involvement of the phloem-limited, fastidious bacterium '*Candidatus* Liberibacter solanacearum'. The term "*Candidatus*" is used to indicate it has not yet been proven possible to artificially grow the organism in culture. Detection of the pathogen is currently based on molecular-oriented techniques. The term "fastidious" is used for certain bacteria that are difficult to culture, unlike most other known bacterial plant pathogens.

Due to a similarity of ZC symptoms with those of other insect-transmitted fastidious bacteria, initial work concentrated heavily on identifying a potential vector. Recent studies have now correlated the association of the ZC disease with the potato-tomato psyllid, *Bactericera cockerelli*. There is still some confusion due to the insect's ability to induce similar yellowing symptoms on foliage (*Figure 11*) and discolored tubers even when the pathogen is not present. This has been postulated to be caused by a toxin produced and inserted into plants during psyllid feeding, and is often referred to as "psyllid yellows." (See NebGuide G2113, *The Potato/Tomato Psyllid.*)

Because of the propagative nature of potatoes, this tuber-affected disease has been of particular concern to seed growers. However, it appears now that infected tubers are not an important means of spread, due to the fact that they rarely sprout or do not produce strong, vigorous surviving plants. Thus the spread within and among fields is now attributed primarily to infected psyllids. It also has been determined that the bacterium can infect and be harbored in numerous solanaceous weeds and crops, but this is not thought to be an important source of infection for subsequent spread and distribution.

Conclusions

Although the disease has been identified from Nebraska, it has not caused substantial losses as it has in Texas. The

Figure 7. Tuber symptoms of ZC consisting of enlarged lenticels.

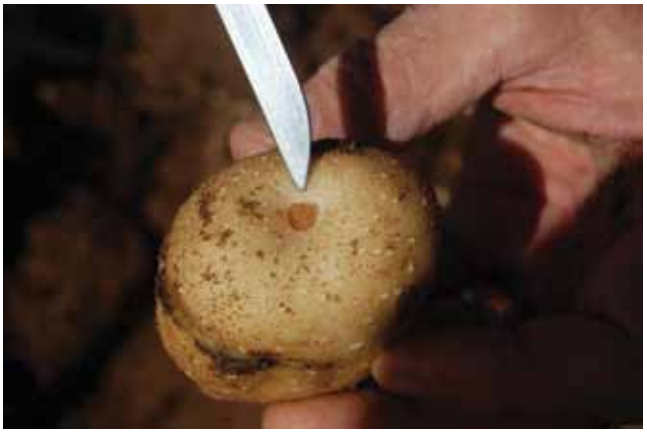

Figure 8. Tuber symptom of ZC consisting of pinkish-purple site of attachment of stolon to tuber.

Figure 9. Tuber symptoms of ZC consisting of discoloration of vascular rings.

Figure 10. Tuber symptoms of ZC consisting of discoloration of medullary rays.

Figure 11. Foliar symptoms of psyllid yellows.

reason for this is not known for certain but may be due to the growth stage of plants when inoculated and time of arrival of infected psyllids. They are not thought to survive over the winter in Nebraska, but have to be introduced yearly from fields in Mexico and south Texas. Many other details about the spread of disease and vector-pathogen relationships are either poorly understood or completely unknown.

Management

- At this time, there are no known disease-resistant potato cultivars, but there should be an effective tool after breeding research identifies or produces new cultivars.
- Vigorously scout and target psyllid populations with aggressive chemical applications.
- Quarantine tubers from infected fields.
- Treat greenhouses periodically to avoid serving as an overwintering source for the psyllid.

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