

DIAGNOSING FIELD PROBLEMS

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Growth and productivity of potato can be affected by a wide range of management and weather-related factors, for example, seed piece health, planting conditions, frost and hail, irrigation amount and timing, fertilization practices, insects, diseases, and weeds. Any one or a combination of these factors may cause seed piece decay, poor emergence, plant stunting, chlorotic leaves, root or stem rot, etc. resulting in reduced yield, poor quality or plant death. Some problems can be remedied before serious damage or yield loss occurs. However, in some situations a problem cannot be immediately remedied, but information can be obtained that can be used to prevent or minimize a second occurrence.

A SYSTEMATIC APPROACH TO DIAGNOSING PLANT PROBLEMS

Several plant problems may have similar symptoms. Consequently, it is essential to use a systematic approach to determine the actual cause of a problem seen in a field. Conducting an Internet search of educational sites (<http://www.searchedu.com/>) using search words such as “plant diagnostic troubleshooting field,” will reveal many informational sources that use similar approaches with instructions on using a systematic approach to diagnose field problems. Readers are encouraged to study bulletins such as those listed at the end of this article for more details on using a systematic diagnostic approach.

The information in this article was presented during a workshop at the University of Idaho Potato Conference, but a similar method can be used for any crop. A systematic plant diagnostic approach should include the following.

1. Determine the cultivar and age of the plants. Not all cultivars perform the same nor show the same symptoms. Also, different cultivars may appear visually dissimilar at various chronological ages. For example, a 90-day potato cultivar would certainly look different at 80 days into the growth cycle compared with a cultivar that needs 120 days to reach maturity.
2. Inspect all plant parts including the roots, stems and leaves. Determine the age of affected tissue and what percentage of the plant is affected. Determine if it is older or younger plant tissue that is affected. For example, yellowing of older leaves could be a nitrogen deficiency, whereas yellowing of newer leaves could be caused by lack of iron. Don't look only at the exterior of the stems and roots, but also examine internal tissue for signs of damage. Consider all possible causes for symptoms including insects, nutrient deficiencies, herbicide damage or environmental effects.

3. Pattern of observed symptoms in a field can greatly aid in determining possible causes. Following are patterns of problems with examples of possible causes.
 - Linear or repeated – a mechanical problem caused by a malfunctioning planter or sprayer.
 - Scattered single plants – seed piece decay or a virus carried in seed pieces.
 - Located on field edge with diffuse border – insects such as Colorado potato beetle, herbicide drift or diseases spread by wind.
 - Spots within a field with well defined borders – soil-borne insect problem such as cutworms.
 - Spots within a field with diffuse border – plant disease such as late blight.
4. Look for signs of causal agents such as fungal structures, insect life stages, bacterial ooze, etc. Many signs are only visible through magnification (hand lens or microscope), so if you are unsure take a sample to a laboratory that can conduct further tests.
5. Don't focus your attention solely on the crop in question, but also observe plants surrounding a problem field. Most diseases and insects are host-specific. Consequently, if only the potato crop is affected, then the cause may likely be a disease or insect, whereas if other plants (weeds) within the field or along the border are affected, then symptoms are likely related to environment, nutrient deficiency or herbicide damage.
6. Gather as much information as possible from a reliable source about the field history such as cropping sequence, planting date, soil temperature at planting, irrigation and fertilization amounts, cultural practices, etc. Also, ask if the problem has occurred before or if this is a one-time occurrence. The more information collected the more likely you will be able to reach a definitive conclusion. However, realize that some problems may never be completely resolved.

When going to a field to identify a problem, go equipped with a diagnostic kit. Some items you may want to have in the kit include: sample bags, hand lens, knife, trowel or shovel, ruler, pruning shears, note pad, pencils and pens, rubbing alcohol to sterilize tools, calculator, camera and business cards. Also be willing to employ additional tools such as aerial photographs, infrared images, soil surveys, etc., and utilize other resources like local experts, plant diagnostic laboratories, pesticide residue laboratories, etc.

USING A SYSTEMATIC APPROACH TO DIAGNOSING PLANT PROBLEMS – EXAMPLE 1

Not every field problem has an obvious diagnosis and sometimes the most obvious answer is not correct. An example of the latter scenario occurred when a grower reported an unusually high incidence of decay in potatoes coming out of a field. An initial evaluation confirmed their report, with the incidence of decay ranging from 1 to 10 percent. Most of the decay was typical soft rot, but a few tubers also had symptoms that looked like Fusarium dry rot. We could have stopped there, assumed the grower had

overwatered the field sometime as the plants matured or after vine kill, and recommend the potatoes not be stored very long. We would have also recommended that end of season irrigation management practices be re-evaluated for the future. However, we decided to look further for patterns of symptom occurrence in the field that would confirm we were dealing with typical soft rot. Unfortunately, no pattern fit the diagnosis. Low spots and other locations where soil conditions should have been wettest did not have a higher incidence of symptoms. In fact, the only pattern we could identify was that more damage was apparent in fields along the northwest edge of the farm. That pattern fit more with a wind-dispersed disease or insect, not soft rot.

So we went back to our diagnostic tool kit and decided to look further at the symptoms and for signs of a causal agent. The potatoes did indeed have typical symptoms of soft rot (creamy white decay, diffuse border between healthy and rotted tissue), and our pathologist confirmed there were bacterial cells associated with the decay. However, further examination found that almost all the rotted tubers also contained insect maggots. It is common for rotting potatoes to attract flies that will lay eggs, but this situation was unusual due to the high incidence of maggots. We employed the expertise of an entomologist who determined the maggots belonged to an insect called the “onion bulb fly” (*Eumerus strigatus*). The adult flies resemble bees, and are found hovering around flowers. The maggots are known to infest a number of bulb crops, including onions, but are more common on flower crops like tulips and daffodils. Maggot feeding has been associated with secondary bacterial and fungal decay.

Now we had another potential cause of the problem, but which came first – the soft rot or the maggot? To answer this question, we went back to the pattern of occurrence along the northwest edge of the farm and looked for a source of the insects. An aerial photograph showed that there was an abandoned greenhouse operation just to the north of the infested fields. We concluded that the greenhouse operation likely had served as the source of flies, and that the rot occurred after the maggots had begun feeding.

USING A SYSTEMATIC APPROACH TO DIAGNOSING PLANT PROBLEMS – EXAMPLE 2

A second case involved the occurrence of leaf spots following a fungicide application to a potato field by chemigation for the control of early blight. Shortly after the application, small, circular spots began appearing on the upper leaves. The description and distribution of the leaf spots were similar to what has been described for a disease known as brown leaf spot caused by *Alternaria alternata*. When the problem was first reported, current information available was that only a single fungicide had been applied by chemigation prior to the leaf spot occurrence.

The grower was concerned that the brown leaf spot would be detrimental so another fungicide application was planned. However, leaf samples were sent to a diagnostic laboratory and *Alternaria alternata* was ruled out as a cause of the leaf spots. Further questioning of the grower led to the discovery that multiple fertilizers had also been added to the chemigation tank. This information had not been included in the first report

because these same fertilizers had been applied in the past without any reported problems. When the person who mixed the products was questioned, it was found that some of the applications rates were unknown for this specific application.

The final diagnosis was leaf burn caused by a combination of fertilizers. As a result of this correct diagnosis, the grower was able to avoid making additional, unnecessary fungicide applications.

Information Sources:

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