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Sampling for Herbicide Injury in Potatoes

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Supplies

- ❍ Pen or marker
- ❍ Disposable gloves
- ❍ New gallon size zip-top bags with holes poked through in several places to provide aeration (ventilated bag) or paper bags
- ❍ Cooler with ice
- ❍ Submission form for laboratory of choice

Dicamba injury on upper leaves of potato plant (A. Robinson, NDSU/UofM)

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Quick Steps

1. **Take photographs of the injury symptoms and record GPS location. Write down the date you first noticed symptoms, what the symptoms are, and where in the field you observed it. Keep this information in your records.**
2. **Use a new pair of disposable gloves for each sample bag you collect.**
3. **Pull off leaves from the most symptomatic areas (about five to 10 plants) and place them in a ventilated zip-top or paper bag. Gather about a pound of leaves, which will fill up the bag. Dig up one to two tubers from each plant sampled and place in a separate bag. Repeat this process for any other areas in the field you would like to sample.**
4. **Gather leaves and tubers from an unaffected area and place them in separate bags.**
5. **If you are concerned about residue in seed tubers, dig up 10 to 12 mother seed pieces and place them in a separate ventilated or paper bag.**
6. **Label each of the bags with date, time and what it is (sample ID).**
7. **Place samples on ice in a cooler.**
8. **Out of the field, gently clean any debris or soil off the tubers and place in a new ventilated zip-top or paper bag.**
9. **Store the samples in a refrigerator until you can ship them.**
10. **Fill out the sample submission form for the laboratory of choice, being sure to include the requested herbicide test to be completed. Keep a copy of this form for your records.**
11. **Pack the sample in an insulated box with ice and use next-day shipping to the laboratory of choice.**

When potential herbicide injury appears, understanding what is wrong with your crop is important to make the right management decisions for that field. Herbicide injury can cause problems in potato growth and subsequent tuber yield and quality. Technology today allows us to test plant material in specialized laboratories and detect extremely low levels of chemicals. An herbicide test either confirms or denies the presence of an herbicide. This data can help you make proper decisions for those fields. Using the following detailed steps will ensure accurate results and records are kept.

Document everything

When an herbicide injury occurrence happens, immediately document the injury. A slow response could mean missing the height of injury and symptoms key to determining the herbicide causing the damage. Injury can even become less apparent over time to the point of no longer being visible, but yield and tuber quality could still be affected.

It is important to document the date injury was first observed, map the area affected (with GPS coordinates), and take photographs of injury including above and below ground symptoms and external and internal tuber symptoms. Patterns and other important factors can be detected with photographs of the affected area from multiple viewpoints on the ground and from overhead. See Documentation for Suspected Herbicide Drift Damage, NDSU Extension publication WC751, for more details on documentation. Record how symptoms vary in severity throughout the area or field. Additionally, document non-affected plants as a comparison. Good documentation of injury will help identify potential causes, detect patterns and document the field area that was originally affected when symptoms become less apparent. These records are essential when contacting parties involved, insurance companies and the state department of agriculture.

Chain of custody

Documenting the chain of custody can be important, especially if litigation could occur because of the herbicide injury. Chain of custody is the chronological order of each entity or individual that takes possession of the sample. Some laboratories have a chain of custody documentation template that can be utilized. A third party can also be used to verify where and when samples were taken as well as who received the samples at each point.

Sampling

Time is of essence because plants work rapidly to remove herbicides. If too much time elapses, symptoms may still be apparent, but herbicides may not be found as they are broken down into secondary compounds. A sample size of one pound of material is typically sufficient. Check with the laboratory for sample size required for a given test or multiple tests. Record GPS location of samples to be able to return to the sample location if needed for yield checks or more sampling (Figure 1).

Figure 1. Label sample bags for foliage and tubers.
(A. Robinson, NDSU/UofM)

Good sampling starts with clean gloves and an unused bag. This will ensure that residues do not cross-contaminate. Residues on bare hands or on unchanged gloves can easily contaminate subsequent samples. Remember, testing procedures can find parts per billion or parts per trillion. A part per billion is equivalent to a pinch of salt in 250,000 tons of potato chips (or a pinch of salt in 31 million – 1 oz bags of chips). Even the slightest residue could cause a false-positive result. Use disposable latex gloves and a paper bag or ventilated plastic bag. If a plastic bag is used, remember that potatoes need to breathe. If a plastic bag is sealed without holes, it can allow the sample to degrade, become soupy and not testable when it arrives at the laboratory

When sampling the injured area, sample tissue that is showing the greatest damage to ensure that the suspected chemical causing the injury is found. For example, if the injury is expressed in upper leaves, sample the most injured leaves (Figure 2). Select five to 10 plants randomly in a grid or zigzag pattern and pick off the most injured-looking plant tissue. Place all plant material in one bag (sample 1). Collect one to two tubers from each plant sampled from and put in another bag

(sample 2) (Figure 3). If tubers are small, collect more to ensure a sample size adequate for the laboratory analysis. Additionally, sample a few plants (sample 3) and tubers (sample 4) from the non-affected areas as a comparison to ensure the injury symptoms are only in the identified area.

Figure 2. Glyphosate injury to upper leaves.
(A. Robinson, NDSU/UofM)

Figure 3. Tuber injury from picloram. (A. Robinson, NDSU/UofM)

Gently wash tubers with clean water and air dry or use a clean, soft brush to remove the soil from the tuber. This is a good time to take pictures of any tuber injury (Figure 4). If your bag is dirty from the field, place samples in a new bag and relabel the bag. This will ensure that soil on the tuber or in the bag will not cause a false-positive result. If samples need to be stored overnight, place samples in refrigeration until they can be shipped. Ship samples to the laboratory in an insulated box with ice using next-day shipping to keep sample integrity.

Figure 4. Washed sample of seed tubers with glyphosate injury. (A. Robinson, NDSU/UofM)

Seed tuber samples

At times, potato seed tubers that are purchased for planting can appear to have herbicide injury and you may want to have a residue test completed. In this scenario, select about a dozen tubers that appear to have the greatest symptoms (sample A); typically, malformations or cracking is observed. As a check also sample about a dozen good-looking tubers (sample B). Gently wash soil from tubers and allow to air dry. Place tubers in a bag with the date and sample identification. Contact the laboratory prior to shipping to ensure they can perform the requested test in a time frame that will allow a decision to be made before planting that seed lot. Fill out the laboratory's sample submission form and ship the sample. If time permits, select about 50 malformed tubers and 50 good tubers, and grow them in a greenhouse or office to see if any herbicide injury symptoms are visible. If possible, find the same variety from a different lot and grow out 50 tubers as a check.

What test to request

Herbicide injury can often be perceived, but selecting the right test can be the most challenging decision. There are hundreds of compounds that can cause chemical injury, and many have a different testing methodology. Narrowing down the most likely herbicide to test for will save time and money. Once specific test(s) are determined, fill out the laboratory's sample submission form. If unsure of what to sample for, there are multiple compound testes available that can be requested.

When trying to select what herbicide to test for, look for symptoms caused by specific modes of action. Utilizing an herbicide mode of action chart can help, such as Herbicide Injury in Potatoes, NDSU Extension publication A1949, or discuss the problem with Extension personnel, an agronomist or a consultant. Test for the most likely compound and if that comes back negative, request another test (this is one reason why the sample size is large, providing material for subsequent testing).

Analyses results

After analyses, the laboratory will generate a report indicating whether an herbicide is detected and at what quantifiable amount. A positive detection confirms the presence of that compound, while a result below the level of detection indicates the herbicide tested for was not present in the sample or was below the level of detection. The numerical values of a positive detection are difficult to associate with yield loss but confirm the presence of the herbicide.

Occasionally, symptoms are observed but no detectable herbicide residue is found in a sample. This could happen because the correct chemical test was not performed, the herbicide compound was broken down because sampling occurred too late, or poor handling of the sample occurred. However, sometimes no positive herbicide results are found because plant symptoms were a physiological response to a non-herbicide stress.

Sampling for herbicide injury in potato plants is important to protect the integrity of the potato crop and grower. Following the outlined steps will ensure the most accurate diagnosis.

Soil residual imazapyr injury on potato roots, tubers, and leaves.
(A. Robinson, NDSU/UofM)

For more information on this and other topics, see www.ndsu.edu/extension