Technical Note TN638

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Diagnosis of Herbicide Damage in Potatoes

Summary

- **Potatoes are sensitive to damage from herbicides which are not approved for the crop.**
- **Damage can result from spray drift or through sprayer tank contamination.**
- **Some herbicides, notably glyphosate, can cause problems which may only manifest themselves in the progeny crop after translocation to daughter tubers.**
- **Glyphosate contamination has significant implications for the potato seed industry.**
- **Other non target herbicides such as sulfonylureas are widely used on cereal crops, which are often grown around potato fields and which persist in spray tanks if incompletely washed out. Cross contamination at very low levels in the mother plant can, like glyphosate, affect the progeny. The progeny often show cracking, thereby increasing the risk of soft rots.**
- **Some grassland herbicides such as clopyralid and aminopyralid are very persistent and can bind to organic matter, pass through the gut of an animal and contaminate manure which may then be applied to the potato crop.**

Introduction

Glyphosate is widely used in cereals crops as a harvest aid, to control couch grass, as a desiccant in oilseed rape and to clean up stubbles and fallow land to name but a few uses. It has a label for pre-emergence weed control in potatoes and to control volunteer potatoes. However, where it comes into contact with a growing potato crop, either from spray drift or sprayer contamination, it can be lethal at high doses to the growing crop but even low doses can contaminate daughter tubers. Where this occurs undetected in seed crops it can result in huge financial losses. Contamination of the potato crop with other herbicides such as the sulfonylureas and the pyridines clopyralid and aminopyralid, can have devasting effects both on yield and quality leading to financial loss. In most cases damage from non target herbicides is accidental but in a few documented cases has been deliberate. It is important not to jump to hasty conclusions. Unraveling the cause of an unknown symptom is not straightforward and may require wider investigation.

1. Glyphosate

The use of glyphosate has increased dramatically in recent years as a harvest aid in cereals, a desiccant in oilseed rape crops and to a lesser extent to control weeds in fallow or setaside. This increased use, at a time when potatoes are actively growing, can lead to contamination through spray drift or contaminated sprayers. This can occur most frequently if potatoes are grown on rented land where there is little or no control over adjacent crop management. Whilst landowners renting land for potatoes may be unaware of the risk of contamination, nonetheless, there is a duty of care to inform all neighbouring parties before application of glyphosate. The most frequent timing for spray drift to result in contamination of developing daughter tubers coincides with the desiccation of oilseed rape but evidence has shown it can occur at ant time during development of the potato crop. Drift from sprayers when spraying adjacent non potato crops is the most common source of low level

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glyphosate contamination which can which can lead to patterns of damage in the potato crop depending on wind spead, wind direction and air temperature. Sprayer contamination often leads to higer levels of contamination in the potato crop and more distinct patterns of foliar symptoms.

Physiology and Symptoms of Glyphosate Contamination in Potatoes

Glyphosate is a systemic herbicide which when applied to the leaves is readily transported to daughter tubers which act as a sink for assimilates produced by the leaves. Once residues of glyphosate are absorbed into the daughter tubers it remains stable for 7-8 months. When dormancy break occurs, the glyphosate in the daughter tubers moves to the developing sprouts where it inhibits meristematic development, the tissue that develops into new shoots in the daughter crop. Secondary sprouts may develop but the meristematic tissue of these may also be affected.

Glyphosate contaminated mother plants may show damage symptoms, such as stunting and yellowing of newly developing foliage, which may develop into complete foliage kill at high concentrations of glyphosate. At very low concentrations of contamination the mother plant may not show symptoms at all making diagnosis difficult. This is particularly true from contamination early in the season during periods of rapid growth, However, even where no foliar symptoms are present glyphosate can concentrate in developing tubers at levels high enough to cause growth distortion and “blanks” in the daughter crop.

Symptoms in the daughter tubers after dormancy break will depend on the dose of glyphosate contamination in tubers. At very high concentrations, those above the limit of detection, there may be a complete absence of sprout growth irrespective of conditions conducive to growth. At lower concentrations multi- or cauliflower-sprouting may occur. With lower concentrations still, weak shoots develop and other symptoms occur such as prolific production of fibrous roots below soil level, distorted stems and an unusual secondary stem. Contaminated seed tubers often show non-emergence or delayed emergence and poor vigour. At very high concentrations of glyphosate contamination spliting of daughter tubers can occur although in most cases glyphosate damage is as a result of drift and this symptom is not seen.

2. Sulfonylureas

Sulfonylurea herbicides are widely used in cereals to control broad leaved weeds and are generally active at vey low rates of active ingredient. The most common are metsulfuron-Methyl, thifensulfuron and tribenuron. As most potato farmers grow cereals and most potato crops are grown in proximity to cereals, there is a potential risk of cross contamination either as drift or through poor sprayer hygiene. Sulfonylureas, especially the older dry flowable formulations, can become caked into deposits in sprayer lines, tanks and nozzles which may then be dissolved by highly wetted products such as insecticides during spraying of potato fields. The improved SX formulations are an improvement over the dry flowables but good sprayer washout is never-the-less essential prior to spraying potatoes.

Glyphosate damage in foliage showing yellowing of leaf margins in the foliage leading to necrosis. The first picture shows low levels foliar symptoms, the second more severe.

Glyphosate damage in tubers showing degrees of cauliflower and multi sprouting

Physiology and Symptoms of Sulfonylurea Contamination in Potatoes

Sulfonylureas are translocated to the meristematic tissue and new growth. Symptoms are a paling of the new top growth and cracking of the tubers usually in star shaped pattern. Rhizoctonia can also cause cracking as can rapid changes in water supply. However these symptoms are usually single cracks. Unlike Glyphosate sulfonylureas do not affect the viability of the daughter tubers.

Sulfonylurea damage in the tubers showing typical cracking

Sulfonylurea symptoms in the foliage showing yellowing of young leaves

3. Clopyralid & Aminopyralid

Clopyralid is sold as the straight product Dow Shield for use in a wide range of arable, vegetable, grass and ornamental crops as well as in co-formulation with grassland herbicides such as Pastor and the oilseed rape herbicide Galera. Aminopyralid is similar to clopyralid, marketed as Forefront for use on grass. Residues of both active ingredients are relatively stable in organic matter and can affect potatoes through carry over in crop residues from previously treated crops or manure used as organic matter applications to potatoes.To mitigate this, products containing these active ingredients have very restrictive labels which should be read thoroughly before use. For example only cereals or grass may be drilled in the season following application to grass.. It is also possible that contamination may occur through spray drift from neighbouring fields or contaminated tanks due to poor washout procedures.

Physiology and Symptoms of Clopyralid/Aminopyralid damage

Both clopyralid and aminopyralid symptoms are similar. They produce hormonal type symptoms with twisting, cupping and elongation of leaves and stunting of plants giving them a fern like appearance. Aminopyralid can translocate into the progeny tubers causing abnormalities in daughter tubers.

Clopyralid/Aminopyralid damage in potatoes showing fern like symptoms

Aminopyrlid symptoms

Clopyralid Symptoms

Diagnosis of Herbicide Damage in Potatoes

Diagnosis of potential herbicide contamination of the potato crop and the extent of damage, particularly if a seed crop, can be a time consuming business. There are many environmental, physiological and agronomic factors that can mimic herbicide damage. There are diagnostic rules that can be applied to all cases of potential contamination of herbicides into the potato crop that can eliminate environmental, physiological or other agronomic causes. Each case of contamination is different but it is worth following a set pattern of examination.

1. Look for a pattern of symptoms in the field starting in the headlands and signs of weed kill around fences or hedges.
2. Establish position of neighbouring crops that may have been sprayed with a sensitive herbicide. If so when and what were the weather conditions at spraying, wind speed and direction but also temperature. For example glyphosate spray droplets can volatilise and drift 100s of metres.
3. Establish extent of visual symptoms in field and mark out. Are there any patterns of damage in the field? Allow for a large margin for the extent of non visual symptoms. Look for signs of weed symptoms on weeds in the field.
4. Obtain the farm spray records to eliminate sprayer contamination for a particular sprayer.
5. Ask for the records of farm yard manure applications and previous cropping. This is important to eliminate clopyralid and aminopyralid damage.
6. Examine sister crops planted in different fields.
7. Take foliage samples for laboratory analysis and if possible specify what active ingredients to test for. This is important with the sulfonylueas as there are many types and each has a different extractant method. It is also important to mark in the field the point of sampling.

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