Herbicide Injury

Herbicides are products designed to control non-desirable plants in a safe and effective manner. Many herbicides are selective in activity, controlling weeds while not affecting the crop. Even so, there is a potential for crop damage whenever herbicides are applied, especially when applied to crops under non-ideal conditions. Plant injury can also result from other factors that may look similar to herbicide injury such as drought, frost, nutrient deficiency, insects, nematodes and diseases. Frequently, there is a pattern associated with herbicide injury, often occurring in just a portion of the field (areas of overlapping application, high and/or low spots, edges of fields). Herbicide label instructions should always be followed to minimize the chance of any potential crop injury. The following are some of the factors that can cause herbicide injury.

Improper Application

Herbicides should be applied at recommended rates, as specified on the label. Over-application occurs when a higher than recommended rate of herbicide is applied. Faulty spray equipment can result in uneven pressure along the boom, causing under-dosing at the ends and overdosing along the middle of the boom. Overdosing can also occur as a result of boom overlap, defective nozzles and fluctuating tractor speeds. Insufficient mixing of water and herbicide can result in overdosing, then under-dosing as the tank empties (Figure 1). Fields may contain variable soil textures. Incorrect assessment of varying soil textures in a field can result in overdosing on sandy and gravely areas. Improper sprayer calibration is also one of the major factors contributing to herbicide over-application.

Figure 1. Blueberry injury following over-dosing by improperly mixed dicamba/2,4-D ester treatment.

Contamination can result from improperly cleaned spraying equipment (Figure 2). Damage becomes evident in areas which were sprayed first; and becomes less noticeable as spraying proceeds. Herbicide residues on previously sprayed stubble and other trash can damage emerging crop seedlings upon contact. If animals are given feed that contains certain herbicide residues, their manure can contain these residues.

Figure 2. Cranberry injury following spot application with glyphosate residue in tank.

The application of many herbicides is recommended within precisely-defined stages of the crop's growth. Failing to make the application at the proper stage may result in plant damage (Figure 3). Correct application timings are outlined on the label. Pre-harvest intervals, as listed on the label, give the required time after application to harvest the crop. Some crop cultivars are more sensitive than other cultivars to particular herbicides. For example, Kent strawberries are more sensitive to terbacil than most other strawberry varieties. Within potato production, metribuzin should not be applied early post-emergence on Shepody, Tobique, Belleisle, Sante, Tolaas, Atlantic, Eramosa, Superior, Norchip, red-skinned varieties or early market plantings. Incompatible tank mixes can be damaging to crops (Figure 4) and not all herbicides can be mixed together. Label instructions should always be followed.

Figure 3. Barley injury from phenoxy herbicide applied later than the label recommends.

Figure 4. Temporary blueberry injury from a tank mix of mesotrione and a graminicide, with extra surfactant added.

Spray Drift and Weather Conditions

Spray or vapour drift can occur under windy conditions and can cause damage to neighbouring crops. However, in still conditions temperature inversions may also cause off site droplet movement particularly when spraying is done at high pressures with small droplets. Spray or vapour drift is also possible when spot-applying or wiping herbicides that are applied selectively but can have an adverse effect on the crop species (Figures 5, 6). Damage from vapour drift is also possible when using volatile ester formulations of various herbicides, most commonly 2,4-D ester (Figure 7).

Figure 5. Raspberry injury following glufosinate application for primocane suppression.

Figure 6. 2,4-D ester injury to cranberry following a wiping application.

Weather conditions play a large role in herbicide damage. The occurrence of exceptionally warm weather soon after the application of a pre-emergent soil-acting herbicide can lead to rapid crop growth and uptake of herbicide with subsequent crop damage. Large amounts of rain following an application of a soil-acting herbicide could wash the product down into the rooting area of the crop (Figure 8). Crops suffering from stress due to drought or infection by other pests on the roots are more likely to be injured by soil herbicide residues than healthy crops. Plants affected by early frosts are more susceptible to damage from foliage-applied herbicides, although moderately low temperatures may induce dormancy, making them more tolerant. Prolonged water stress can thicken the leaves' waxy layer and increase leaf hairiness, resulting in less herbicide penetration. During extended periods of cloudy, humid weather leaves develop less of a waxy layer and are therefore more susceptible to damage from foliage applied herbicides. Wind damage to the leaf's waxy layer will also increase susceptibility to herbicide damage. If drying conditions are poor following application, more herbicide may penetrate into the leaf causing damage. High relative humidity generally leads to more rapid penetration by the herbicide into leaves followed by translocation within the plant. Herbicide labels may contain weather restrictions during application and these limitations should be respected to avoid potential crop injury.

Soil Conditions

Soil types and organic matter influence the movement and availability of herbicides within the soil. For some soil applied herbicides the label will recommend different rates of application based on the soil type. If inappropriate rates are applied (i.e. high rates on sandy soils with low organic matter) crop injury may result (Figure 9). Some soil-acting herbicides are persistent and residues can remain active for months. In many cases, a minimum time period must pass before replanting susceptible crops, as outlined on the

Figure 7. Grape injury following vapour drift of 2,4-D ester.

Figure 8. Blueberry injury from hexazinone after a heavy rain washed product lower into the soil.

Figure 9. Strawberry injury from high rate of terbacil applied on sandy soil.

herbicide label. Planting before the end of this waiting period may result in crop damage (Figure 10). In exceptionally dry seasons, even moderately persistent herbicides may still be present in the soil beyond the usual waiting period and affect the next crop. Chemical breakdown can be influenced by soil pH. Simazine, for example, is not recommended for use on strawberries if the pH of the soil is 5.6 or over. In low pH soils, simazine breaks down more readily, thereby increasing strawberry tolerance.

Figure 10. Snap-bean injury from herbicide residues in the soil.

Soil compaction may also influence herbicide injury. When using a soil acting herbicide, crop damage can occur if downward root development is restricted by soil compaction just below seeding depth. Soil compaction results in a concentration of roots just below the surface of the soil, and excessive uptake of herbicide may occur. Seeding depth may also contribute to herbicide damage. Shallow seeding into the herbicide zone may result in excessive chemical uptake and subsequently cause damage. Damage to a crop that has been deep seeded may occur due to shoot uptake of the herbicide.

Conclusion

Herbicides are effective tools to manage weeds, but they must be used in the proper manner. Product labels outline the best use for herbicides and should be followed for every application. More information on herbicide injury, including examples of different injury symptoms on many crops can be found at the IPM Image database.