ROUNDUP READY PLUS.
CROP MANAGEMENT SOLUTIONS

Understanding Growth Regulator Herbicide Injury

What You'll Learn...

- Plant growth regulator (PGR) herbicide injury can occur by misapplication to crops, drift from adjacent fields, or from spray tank contamination.
- Intensity of PGR injury symptoms will depend on the herbicide, level of exposure, crop, growth stage, and environmental conditions.
- PGR look-a-like injury can be caused by other herbicides, viruses, insects, and environmental extremes.
- Best management practices are important to prevent PGR herbicide injury to crops and other broadleaf plants.

Plant Growth Regulator (PGR) Herbicides

PGRs include the following herbicide families and active ingredients:[1]

- **Phenoxy Acetic Acids** (2,4-D, 2,4-DB, MCPA, MCPP)
- **Benzoic Acids** (dicamba)
- **Carboxylic Acids** (clopyralid, fluroxypyr, aminopyralid, quinclorac, picloram, triclopyr)

There are many products and trade names with these active ingredients, including package mixtures.

PGR herbicides control weeds by the disruption of several plant growth processes, including protein synthesis, cell division, cell enlargement, and respiration. These herbicides are widely used to control broadleaf weeds in grass crops such as corn and wheat. They are usually applied to foliage, but can also be effective in the soil. The herbicides can move in both xylem and phloem to areas of new plant growth. As a result, these herbicides can be effective for the control of annual and perennial broadleaf weeds and brush.

PGR Herbicide Injury Symptoms

Crops can be injured by PGRs. Injury can occur by application of these herbicides to crops at the wrong time and rate, drift from adjacent fields, or from spray tank contamination.

Most PGR herbicides cause similar injury symptoms on broadleaf plants.[1] However, the intensity of symptoms can depend on the herbicide, level of exposure, crop, growth stage, and environmental conditions. Symptoms can range from slight at low exposure to complete death at high levels of exposure. Within a few hours of exposure, initial symptoms are twisting of stems and curling of leaves (Figure 1). New leaves can be stunted and distorted. At high levels of exposure, chlorosis can develop within a few days. Leaves can drop and shoot tips may die, followed by stem dieback. Symptoms include leaves becoming cupped, crinkled, puckered, strap-shaped, stunted, and malformed (Figure 2 and 3). Leaf veins can appear parallel rather than netted, and stems become bent, twisted, and brittle, with shortened internodes.[2] Plant growth can resume depending on the level of exposure.

Figure 1. Dicamba postemergence injury to newly emerged soybeans.

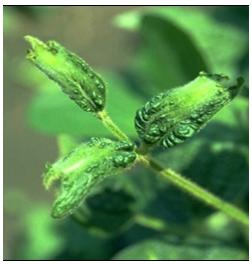

Figure 2. 2,4-D drift injury on soybeans. *Photo courtesy of Purdue University.*

Soybeans are more sensitive to dicamba than 2,4-D. Dicamba causes leaves to be turned up and cupped (Figure 3); whereas, 2,4-D will cause leaves to be more long and narrow, called strapping (Figure 2).

Figure 3. Dicamba drift injury on soybeans.

Understanding Growth Regulator Herbicide Injury (continued)

Cotton is more sensitive to 2,4-D which causes twisting and curling (epinasty) of stems and petioles with leaf strapping. Reddening of plant stems, petioles, and bracts is also common to injured cotton, and leaf or square yellowing may be present.[3]

PGRs can cause sugarbeet leaves to be flat on the ground within a few hours after exposure and leaves may remain more prostate than normal for the rest of the growing season if injury is severe. Exposure to early growth of sugarbeets may develop fused petioles and symptoms called "celery stalking or trumpeting". Dicamba can have sufficient residual in the soil to reduce emergence of sugarbeets and cause emerging seedlings to be severely stunted and twisted. Picloram applied the previous year can cause carryover damage in sugarbeets. Clopyralid is labeled for use on sugarbeets but can cause injury at high rates under warm and moist environmental conditions. More leaf strapping and rolling can be caused by clopyralid compared to the other PGRs.[4]

PGRs can cause injury to labeled grass crops with over-application or application at the wrong stage of development. Injury symptoms in corn include rolled leaves, stalk bending, fused brace roots, and missing kernels on ears. The potential for corn injury increases beginning around the V5 growth stage as plants enter into rapid growth, especially in conditions of high temperatures and good growing conditions.[5] Wheat is susceptible to PGR herbicide injury at jointing, heading, and flowering growth stages. Injury can also occur with fall applications to tillering winter wheat. Late applications on wheat can lead to injury that causes kernel abortion and blank seed heads, ultimately reducing yield.[6]

PGR Look-A-Like Injury

Field diagnosis is important since there can be situations that mimic PGR injury and generate questions about PGR drift or spray tank contamination.[7] In soybeans, the avenues of exposure to PGR herbicides used in corn include physical drift during the application, vapor drift within a few days after application, and residues remaining on application equipment applied directly to soybean along with a postemergence soybean herbicide.[8] However, fields can also develop PGR injury symptoms in the absence of herbicide applications.

PGR look-a-like injury can be caused by other herbicides along with the additives, such as postemergence applications of PPO Inhibitors (flumioxazin, fomesafen, lactofen). Insects, such as aphids and thrips can cause PGR-like injury symptoms on broadleaf crops.[7] Viruses, such as bean pod mottle virus and beet curly top, can cause similar symptomology.[9,10] Adverse growing or environmental conditions, such as drought-stress, could also cause a physiological response in plants that produces abnormal growth symptoms similar to PGR herbicides.[8] An accurate diagnosis is important before jumping to conclusions about the source of PGR-like injury.

Best Management Practices

- Read and follow all herbicide label instructions.
- Use caution when applying PGR herbicides around broadleaf plants as desirable plants may be sensitive and injury may result.
- Take into account the proximity of sensitive crops.
- Do not spray when wind speed and direction are such that herbicide drift is likely to occur.
- Do not spray when air temperature and/or humidity is high or is expected to be high.
- Make sprayer adjustments to minimize drift.
- Choose herbicide formulations with low volatility potential.
- Triple rinse and clean sprayers thoroughly after PGR herbicide applications to minimize tank contamination problems.

Sources:
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