AGRONOMIC Spotlight

Technology Development by MONSANTO

Minimizing Potential Herbicide Injury on Susceptible Hybrids

Hybrids have different levels of tolerance to various herbicide classes. Because extreme environmental conditions, misapplication, and variable soil pH or organic content are often unforeseen; application of some herbicides to sensitive hybrids is not recommended. Using a safener is not likely to consistently provide adequate crop safety to a sensitive crop. Proper herbicide and hybrid selections are important to maximize performance of each.

Timing of Herbicide Application

Crop growth stage can affect herbicide activity. Many detoxification or metabolism mechanisms in plants are tissue or age specific and activated when there is a need. Therefore, applying a herbicide before a crop has the capacity to metabolize a herbicide can result in crop injury.

Emerging corn shoots may be in contact longer with soil-applied herbicide if seed was deeply planted. In the case of shallow planted corn, herbicide may have more contact with sprouting seed. Biological activity of ALS-inhibiting herbicides, is great enough that low concentrations in the soil can still cause a negative plant response. On older corn plants, the growing point and/or whorl often show injury symptoms due to foliar applications of ALS-inhibiting herbicides.

Injury from soil-applied pigment inhibitors can be seen in new growth without chloroplast reserves. Seedlings uptake the chemical, and bleaching occurs when leaves are exposed to sunlight.

Safeners

A safener is a chemical that reduces the toxicity of a herbicide to a crop without reducing weed activity. Some safeners have been used to widen application windows for specific herbicide and crop combinations, however, the efficacy of a safener depends on the existing ability of the crop to metabolize the herbicide. Corn should already be moderately tolerant of the herbicide to be safened. An effective safener reaches the site of action and accelerates detoxification before the herbicide arrives at the site of action. Plant cuticles or transport mechanisms could delay safener activity, resulting in stunted plants or corn ear malformation.

Check with your local seed representative or retailer regarding hybrid sensitivity to various herbicide families.

Figure 1. Tolerant and susceptible corn with early post application of a pigment inhibitor (left). Pigment inhibitor bleaching symptoms on corn seedlings (right).

Pigment Inhibitor Herbicides.

This type of herbicide reduces chloroplast development in weeds. Tolerant hybrids have the ability to rapidly metabolize this type of herbicide compared to sensitive hybrids. Corn injury symptoms from isoxaflutole, a soil-applied pigment inhibitor herbicide, can be characterized as stunting and bleaching of leaf tissue (Figure 1).

Activity of soil-applied pigment inhibitor herbicides can be affected by how strongly the herbicide is held to soil. The herbicide can be more active in coarse soils with low organic matter. Injury to certain hybrids is possible when heavy precipitation follows soon after application. Soils

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that remain wet and cool also slow corn metabolism and can cause plants to be exposed to the herbicide longer in the soil environment.

ALS-Inhibiting Herbicides

This herbicide group includes sulfonylurea (SU) herbicides and inhibits the ALS enzyme in weeds. Several SU herbicides are commercialized and have slightly different weed control spectrums. Similar to isoxaflutole, hybrid sensitivity to SU herbicides is primarily determined by the ability to metabolize the herbicide. A single recessive gene has been identified as the source of sensitivity in hybrids.

Dry or humid conditions accompanied by hot temperatures can create an environment that can lead to corn injury from SU herbicides. A hot, dry environment that puts stress on the crop often slows metabolism and herbicide detoxification. If the ALS enzyme was slightly inhibited by SU herbicides under hot, humid conditions, the newly developed tissues during rapid growth would lack the necessary amino acids produced by the enzyme.

Summary

Safeners work by increasing the hybrid or variety's inherent ability to metabolize the product. Sensitive hybrids have much less of this inherent ability hence the safeners have less to work with and the end result may be unacceptable crop response. Corn with early symptoms of herbicide injury may grow out of it, but may have delayed growth stages or yield loss in some cases. Delayed tasseling or pollination has been observed when SU herbicides have been applied to sensitive corn lines. Depending on conditions, isoxaflutole has negatively affected corn yield in some soils. Rapid emergence and early growth are key to corn development and should be remembered when selecting weed control. Herbicides should protect, not compromise, crop health.

Check and visit with your local seed representative or retailer before applying these chemistries to determine that the hybrids you are planting have the appropriate tolerance.

Figure 2. Chlorotic leaf collars (left) and wrapped leaves (right) due to post applications of sulfonylurea herbicides on sensitive hybrids.

Sources:

L. Steckel, F.W. Simmons, and C.L. Sprague. 2003. Soil Factor Effects on Tolerance of Two Corn (Zea mays) Hybrids to Isoxaflutole Plus Flufenacet. Weed Technology 17:599-604.

J. Green and J. Ulrich. 1993. Response of corn (*Zea mays* L.) inbreds and hybrids to sulfonylurea herbicides. Weed Science 41:508-516.

J. Bunting, C. Sprague, and D. Riechers. 2004. Physiological basis for tolerance of corn hybrids to foramsulfuron. Weed Science 52:711-717.

K. Bradley, et. al. 2009. Practical weed science for the field scout: corn and soybean. University of Missouri. [Online] http://extension.missouri.edu (verified 16 March 2010).

G. Wicks et. al. 2007. Effect of planting depth and isoxaflutole rate on corn injury in Nebraska. Weed Technology 21:642-646.