Cases of Possible Herbicide Injury in Corn

Typically, herbicides are safe to the crops they are labeled in when used according to directions on the label. A large amount of effort in the form of research is put into assuring that they are safe. However, all the variables that our crops come up against can’t always be reproduced in field research and either by application error or specific conditions products that are usually safe can sometimes cause injury.

Recently several samples from different locations were submitted at the Plant & Pest Diagnostic Lab that showed similar symptoms that could be connected to active ingredients found in Lumax. In addition we have received numerous calls regarding minor injury caused by acetochlor (Degree, Harness, Topnotch). It should be noted that two samples do not make an epidemic, but it can be interesting. Lumax is a premix of
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mesotrione (Callisto), s-metolachlor (Dual II Magnum), atrazine and a safener benoxacor.

Mesotrione is a member of the triketone class of herbicides. Triketones inhibit the function of the enzyme 4-HPPD. This causes problems with the making of carotenoids, a pigment in the plant. A symptoms that occurs in weeds and rarely in crops is a bleaching effect. Injury due to mesotrione would be chlorosis to bleaching of the leaf similar to the symptoms seen below. Mesotrione is herbicide labeled in corn and controls several broadleaf weeds such as black nightshade, lambsquarters, pigweeds, velvetleaf, and waterhemp. Some of the corn showed symptoms called bleaching (Figure 1). It should be noted that we rarely see injury from soil applied mesotrione.

The other symptom observed in the samples was the inability of the leaves to unfurl (Figure 2, 3 and 4). This symptom is often associated with chloroacetamide injury from herbicides such as s-metolachlor, acetochlor, flufenacet (Define) and dimethenamid (Outlook). In some cases, the leaves can’t pull free from the whorl and form a “ladder” like plant. The chloroacetamides inhibit the making of fatty acids, lipids, proteins, isoprenoids and flavonoids. S-metolachlor is a preemergence herbicide that has activity on annual grasses, black nightshade, pigweeds and waterhemp.

Why Can These Herbicides Occasionally Injury Crops.

When we consider the number of acres these herbicides are used on with good weed control and no crop response, it is not surprising that in rare cases conditions may be right to produce a negative crop response. Lumax is typically very safe on corn. Our very own Weed Control Guidelines rate Lumax as ‘good’ for crop tolerance. In research conducted at Purdue University, studies that collected injury responses reported no more than 8% bleaching and 3% leaf malformation, often not significantly different than the check. In most cases no injury was reported. However, in 2005 Bill reported 17% stunting with a spring application of Lumax at 3 qt/A on a sandy soil. But the corn recovered and no injury was observed by 6 weeks after treatment.

Both active ingredients are detoxified in the corn plant by different methods. In cool soil and weather conditions, corn metabolism is slowed reducing the speed at which these herbicides can be detoxified in the corn plants. Stressed corn plants may not be able to rapidly detoxify the herbicides. Heavy rain after applications can also influence potential for injury.
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Although a light rainfall after a preemergence application of a herbicide can be beneficial, a heavy rainfall or standing water can lead to either the seed soaking up the herbicide or young shallow roots taking up to much of the herbicide. In a study conducted in Minnesota, corn injury from metolachlor was higher in wet soil conditions within a two week period after application. Rainfall was recorded ranging from 1.25 to 3.6 inches during the two week period after planting. Cooler temperatures also increased injury. No yield effect was reported in treatments that showed injury earlier in the season. In this study, metolachlor treatments that contained the safener benoxacor did not have any injury as compared to the untreated check. Benoxacor increases the rate of metolachlor metabolism in corn, making the use of metolachlor safer. Lumax has benoxacor in its formulation leading to typically low levels of injury due to metolachlor.

Many things can lead to a crop response to a herbicide that for the most part is safe. These things can include tank contamination, increased rates due to misapplication, hybrid selectivity, environmental conditions, soil characteristics and drift of non-labeled products. In many cases, a combination of these things can not only increase potential, but in some cases make diagnosis of the problem far more difficult. This can be more so in what I like to call ‘messy years’. Years when we are rushed, under pressure or the growing season is off to a difficult start and plants are under stress. If you have used a product that has traditionally done well and you are experiencing problems, look at the symptoms, the patterns, and what may have been unique about this year. Often it’s in the details.

Other Things That Might Cause Similar Looking Symptoms

In conditions where a soil surface can form a crust corn can sometimes show similar injury. Seedling corn plants trying to emerge can hit a soil crust and will leaf out underground. In some cases the seedling never emerges and small plants can be dug up with distorted leaves. In other cases the plant can break the soil surface but have similar symptoms on small plants. Some fields have had conditions that can produce soil crusting such as heavy rain right after tillage. Other herbicides, such as growth regulator herbicides can induce growth abnormalities similar to the ones seen by chloroacetamides. In many cases the later and chloroacetamide injury are difficult to pull apart. In those times field history, pattern and sprayer history is required to provide clues as to the cause.