Fomesafen injury on corn

Fomesafen is a group 14 herbicide (PPO inhibitor), and the active ingredient in Reflex, Flexstar, Prefix, Marvel and other products. It differs from other group 14 herbicides used in soybean in that it occasionally injures rotational corn. The long half-life and soil availability are the factors that lead to problems with the residual properties of fomesafen (Table 1). Carryover is typically associated with applications made after late June or when the season turns dry following application.

Table 1. Characteristics of Group 14 herbicides used postemergence in soybean.

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>½ life (days)</th>
<th>$K_{oc}$-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>acifluorfen (Blazer)</td>
<td>14</td>
<td>113</td>
</tr>
<tr>
<td>fomesafen (Reflex)</td>
<td>100</td>
<td>60</td>
</tr>
<tr>
<td>lactofen (Cobra)</td>
<td>3</td>
<td>10,000</td>
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*K_{oc} describes absorption to soil colloids. The higher the value, the less available the herbicide is to plants.

The primary symptom of fomesafen injury is striped leaves due to chlorotic or necrotic veins on the leaves. In cases of minor injury a small section in the center of the leaf exhibits the symptoms, whereas with higher levels of injury the entire leaf may display the striping. Some of the leaves may fold over midway due to loss of integrity of the leaves midvein.

Other factors can cause striping on leaves, but fomesafen injury on corn is somewhat unique in that the veins are affected rather than interveinal tissue (Figure 1). Symptoms of other photosynthesis inhibiting herbicides (group 5, 6, 27) typically are characterized by interveinal chlorosis and necrosis (Figure 2).

I suspect the reason for the difference in expression of injury (veinal vs interveinal) is primarily due to corn being a C4 plant, whereas we typically see injury from photosynthesis inhibiting herbicides on C3 plants (e.g. soybean). One difference between C3 and C4 plants is the Kranz anatomy typical of C4 plants. In C4 plants, chloroplasts are concentrated in bundle sheath cells that surround the vascular system. In corn, fomesafen absorbed by the roots would move from the xylem directly into the bundle sheath cells. Disruption of photosynthesis results in destruction of the bundle sheath cells and apparently adjacent vascular tissue. In C3 plants, chloroplasts are distributed throughout the leaf. Herbicides translocated in the xylem move passively with the transpirational flow and accumulate in interveinal regions

Frequently when fomesafen carryover occurs only two or three corn leaves are affected and injured plants recover quickly. In this scenario, the damage is similar to where hail causes 25-50% reduction in foliage. Studies have shown early-season defoliation such as this usually doesn’t impact yield. However, at other times there can be stand loss or more serious defoliation. The only way to determine the potential impact is to determine the percentage of plants affected and closely monitor the rate of recovery.

Figure 1. Veinal necrosis typical of fomesafen

Figure 2. Interverinal chlorosis and necrosis typical of root-absorbed photosynthesis inhibiting herbicide (Pramitol applied under dripline of tree).

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