Corn Ear Injury Risk with Off-Label Glyphosate Applications

Importance of Following Pesticide Labels

IT IS A VIOLATION OF FEDERAL LAW TO USE THIS PRODUCT IN ANY MANNER INCONSISTENT WITH ITS LABELING

Pesticide labels are legally enforceable. Therefore, the statement above can be found on all pesticide labels. THE LABEL IS THE LAW and MUST be read and followed before the pesticide can be used. Pesticide product labels provide critical information about how to handle and use pesticide products safely and legally. Failure to follow pesticide labels can result in fines and in some cases imprisonment.

Improper use of herbicides, or any use other than those described by the label, may cause injury to the crop to which they are being applied, to nearby crops, or to other non-target plants. Additionally, herbicide labels provide information to protect the health of humans, livestock, and pets. Handling or using the herbicide inconsistent with this information may cause injury.

For herbicides, the label provides the timing of applications and the product rates to be used to safely manage weeds in a targeted crop or non-crop area. Application timing or rates inconsistent with the label can result in poor weed control, crop injury, or off-site plant injury. The over-the-top glyphosate applications to Roundup Ready® Corn 2 corn products can be applied from emergence through the V8 growth stage (8 leaves with collars), or until corn plant height reaches 30 inches (freestanding), whichever comes first. Use drop nozzles for optimum spray coverage and weed control when corn plant height is 24 to 30 inches. When corn plants are 30 to 48 inches tall (freestanding), apply the glyphosate product using **ONLY** ground equipment fitted with drop nozzles aligned to avoid spraying into the whorls of the corn plants.

This information can be found on the labels for products such as Roundup PowerMAX® 3 Herbicide.

Late-season glyphosate injury to glyphosate-resistant corn may occur if glyphosate is applied to a neighboring glyphosate-resistant soybean field or if accidental drift occurs when glyphosate is spot sprayed to a fence row for weed control. Environmental conditions that affect corn growth, such as compaction, drought, or flooding, may cause individual corn plants within a field to be in various growth stages. This could result in some plants being beyond label timing if a glyphosate product is applied. Though glyphosate resistant corn plants generally show high tolerance to glyphosate rates, plants that are double dosed with an overlap may show injury.

Potential Injury Symptoms of Late-Applied Glyphosate

- Sporadic kernels on the ear may be clear or opaque and fail to develop.
- As affected kernels shrink, adjacent kernels swell and become bubble shaped (Figure 1).

Figure 1. Bubble kernels resulting from off-label, late applied, over-the-top glyphosate application. Picture courtesy of Mike Vose, University of Illinois, Orr Research Center. Permission to use granted by Dr. Emerson Nafziger, University of Illinois.

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Since glyphosate is systemic within a plant, it moves freely to sink tissues such as the roots and shoots.[1] Included in the shoot tissue is the reproductive or seed component of the plant, which in corn is the ear. What helps make glyphosate a successful herbicide to manage many weeds is the lack of metabolic breakdown of the glyphosate molecules within plant cells.[2] This is true in glyphosate resistant corn products as well.

Corn genetics play an important role in glyphosate resistant corn products. To produce a glyphosate herbicide resistant corn product, two different parents are involved; one provides the pollen (male) and the other provides the seed (female). The two parents are referred to as the F1 generation, of which one parent may be glyphosate resistant and the other non-resistant. The green plant produced from the F1 seed is glyphosate resistant. However, the seed or F2 generation produced by the resistant plant segregates because of the heterozygous parents. Because of this segregation, about 75% of the fertilized kernels have a level of glyphosate resistance and about 25% are glyphosate susceptible. It is the susceptible kernels (embryos) that can be damaged should glyphosate be active within the plant during reproductive growth stages.

Academic Experiment Results

In 2008, an experiment was conducted by the Purdue University Crop Diagnostic Training & Research Center to evaluate the impact of pesticides applied to corn at about the V14 growth stage (about 5 feet tall and 1 to 2 weeks prior to tasseling).[3] Glyphosate was included in the experiment.

- Compared to the control cob length (defined as 100%), glyphosate-only treated corn had an average cob length of 93%.
- The total number of kernels per 20 ears averaged 91% for the glyphosate-only treatment compared to the control.
- Abnormal ear development was 0% for the control treatment compared to 40% for the glyphosate-only treatment.
- When glyphosate was used with ammonium sulfate (AMS), cob length was 90%, kernels per 20 ears was 77%, and abnormal ear development was 100% compared to the control.
- Abnormal ear percentage for the other treatments was 30% for glyphosate + 2,4-D; 30% for 2,4-D only; 10% for a non-ionic surfactant (NIS); 20% for crop oil concentrate (COC); and 15% for AMS.
- The study also demonstrated that adjuvants and surfactants alone can impact ear and kernel development.

Summary

It is important to read and follow pesticide labels for crop safety and for the safety of humans, livestock, and pets. Late-season glyphosate injury to glyphosate-resistant corn may occur if glyphosate is applied to a neighboring glyphosate-resistant soybean field or if accidental drift occurs when glyphosate is spot sprayed to a fence row for weed control. Off-label applications to corn are unlawful.

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Sources:

[1]Hetherington, P.R., Reynolds, T.L., Marshall, G., and Kirkwood, R.C. 1999. The absorption, translocation and distribution of the herbicide glyphosate in maize expressing the CP-4 transgene. Journal of Experimental Botany, Vol. 50, No. 339, pp. 1567-1576.

[2]Pollegioni, L., Schonbrunn, E., and Siehl, D. 2011. Molecular basis of glyphosate resistance: Different approaches through protein engineering. The FEBS Journal. Vol. 278, Issue 16.

[3]Nielsen, R.L. (Bob), Wise, K., and Gerber, C. 2008. Arrested ears resulting from pre-tassel applications of pesticide & spray additive combinations. Corny News Network Articles. Purdue University. https://www.agry.purdue.edu/ext/corn/news/articles.08/ArrestedEars-1209.html

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Bayer Crop Science. Roundup PowerMAX® 3 Herbicide Label.

Legal Statements