



Enlist® herbicide tolerance and soybean symptomology – Get the facts

Many farmers have utilized Enlist® herbicides with Colex-D® technology on their Enlist E3® soybean and PhytoGen® Enlist® cotton acres this season, and industry demand for Enlist E3 soybeans is expected to have grown to greater than 30 percent market share in 2021. Some questions have been raised about leaf malformation (often referred to as “leaf cupping”) on Enlist E3 soybeans in some fields this summer. This advisory statement reviews the testing record for the Enlist E3 soybean trait and provides resources for help in identifying symptomology that may be seen on Enlist E3 soybeans, soybeans from other trait platforms, or conventional soybeans.

The Enlist® weed control system is the most advanced herbicide-tolerant system on the market, providing an effective, on-target weed management solution. Corteva Agriscience stands behind our technology and the rigorous testing process used to bring it to market.

Based on years of thorough study and corroborated by multiple university weed scientists, we are not aware of any data in existence supporting these speculations:

- **Speculation:** Enlist herbicide exposure cups soybeans.
- **Fact:** Enlist E3 soybeans and Enlist cotton have robust tolerance to 2,4-D choline, glufosinate and glyphosate, proven by more than a decade of testing. The Enlist E3 soybean trait was extensively tested since 2010 at rates equivalent to 2, 4 and 8 pints/A of Enlist One® herbicide applied pre-emergence, V2, V6 and R2 growth stages across the Midwest and southern United States. No leaf malformations from 2,4-D applications were ever reported in the hundreds of trials conducted at 1X, 2X and 4X rates of 2,4-D alone or with glyphosate or glufosinate.
- **Speculation:** Glufosinate and/or ammonium sulfate (AMS) exposure cups soybeans.
- **Fact:** The protein activity of *aad-12* is not affected by other herbicides, insecticides or fungicides. Extensive testing of Enlist E3 soybean tolerance with tank mixes of 2,4-D plus glyphosate, glufosinate, ammonium sulfate or other

herbicides, insecticides or fungicides has not resulted in leaf malformation from 2,4-D in Enlist E3 soybeans.

- **Speculation:** Typical Group 15 herbicide exposure is indistinguishable from auxin symptomology in soybeans.
- **Fact:** Non-dicamba-tolerant soybeans are extremely sensitive to dicamba. Crop sensitivity research from the University of Georgia shows that soybeans without the dicamba-tolerant trait may show symptomology from dicamba exposure at less than 1/800 of the standard spray rate.
- **Speculation:** Clopyralid carryover is widespread across the Corn Belt and specifically affects Enlist E3 soybeans vs. other trait platforms.
- **Fact:** The protein activity of *aad-12* is not affected by other herbicides, insecticides or fungicides. Extensive testing of Enlist E3 soybean tolerance with tank mixes of 2,4-D plus glyphosate, glufosinate, ammonium sulfate or other herbicides, insecticides or fungicides has not resulted in leaf malformation from 2,4-D in Enlist E3 soybeans.
- **Speculation:** Heat or drought stress makes some soybean genetics prone to cupping regardless of herbicide exposure.
- **Fact:** No environmental factors have been found to reduce 2,4-D tolerance in Enlist E3 soybean crops. Drought stress, temperature, saturated soils and iron chlorosis have been



tested and shown not to impact Enlist E3 soybean tolerance to 2,4-D choline. Tolerance studies were included in the petition for deregulation of the Enlist trait submitted to USDA.

- **Speculation:** Herbicide tolerance trait expression is “weak” in some Enlist E3 soybeans, leading to cupping.
- **Fact:** The *aad-12* protein in Enlist E3 soybeans and Enlist cotton metabolizes 2,4-D choline into a non-herbicide form, thus conferring 2,4-D choline tolerance in the plant. The gene is present and active throughout the entire life of the Enlist E3 soybean plant. The gene is not “turned on and off”; it is always active.

Dicamba off-target movement has been well-documented by universities and state pesticide regulatory agencies, and exposure to even very low levels can cause cupping of soybeans – symptomology distinct from other types of herbicide exposure. University resources corroborate cupping resulting from dicamba exposure:

- **2019 Observations from the Field: Dicamba** (University of Illinois)
- **Dicamba: What Does the Research Say?** (Iowa State University)
- **Environmental Factors that Influence the Success of Dicamba Applications** (University of Missouri)

Resources for identifying symptomology in Enlist E3® soybeans and other types of soybeans

Farmers and retailers have asked for resources to assist in identifying symptomology, including leaf cupping, in soybean fields. Corteva strongly urges an objective, data-based approach to diagnosing field situations – not speculation or rumors. Exposure to different herbicides – including dicamba, glufosinate, clopyralid, Group 15 products and 2,4-D – results in distinguishable types of symptomology on non-tolerant soybeans.

University resources are available to assist in symptomology identification:

- Understanding Growth Regulator Herbicide Injury (University of Nebraska)
- Herbicide Mode of Action (Kansas State University)
- Differentiating 2,4-D and Dicamba Injury on Soybeans (Purdue University)

Reporting suspected herbicide off-target movement

If farmers have questions about what they observe in the field, or they would like to report an allegation of herbicide off-target movement, they should contact their state pesticide regulatory agency.



You can find links to the university studies referenced in this article at: <https://groundwork.constantcontactsites.com/individual-articles/post/873302/get-the-facts>

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