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Dicamba in Arkansas – Frequently Asked Questions

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What Is Dicamba?

As growers in Arkansas and across the Mid-South wrestle with how to combat increasingly herbicide-resistant weeds, particularly Palmer amaranth in cotton, soybean and other major row crops, dicamba has been put forth by industry as a potential tool to help farmers manage these difficult weeds in newly developed genetically modified cotton and soybean varieties engineered to tolerate this herbicide.

Dicamba has been used as an herbicide for more than 50 years to manage 200 broadleaf weeds. It is a Weed Science Society of America Group 4 synthetic auxin – a plant hormone that causes plants to exhibit uncontrolled growth. Dicamba works by mimicking auxin, a plant growth hormone, thus disrupting cell division and altering normal growth patterns. Certain formulations of dicamba have historically had a high degree of volatility, especially in warmer weather, and this can lead to unexpected off-target movement. Volatility means that a herbicide, once applied, can convert from a liquid or solid into a gaseous form several hours after application and lift and move elsewhere to condense on plant or other surfaces.

University of Arkansas System Division of Agriculture weed scientists tested the Engenia® form of dicamba in 2015 and 2016 and concluded that it had reduced volatility compared to older dicamba products; albeit some volatilization was observed in a greenhouse trial, and movement of the herbicide occurred 30 minutes after application in the field. Whether the movement of Engenia® was a result of volatilization or suspension of fine droplets that evaporated after spraying during the warm, summer conditions under which the test was conducted, could not be determined.

Also, it was not possible for researchers conducting smaller-acreage drift research trials to mimic the potential for off-target movement of dicamba as a result of commercial spraying of thousands of acres of crops in the same area over a few days – as would occur in the spring and summer for large-scale crop management.

EPA approved federal registrations of Xtendimax® with Vaporgrip®; Engenia ®; and FeXapan™ during the late fall and winter of 2016-2017; however, state regulatory agencies such as the Arkansas State Plant Board have the responsibility for local registration and use, and these decisions were made just prior to the 2017 growing season in many states.

Crops With Dicamba-Resistant Trait

Soybean not engineered to resist dicamba are extremely sensitive to low amounts of the herbicide. This is also true for grapes, peanuts, tomatoes, watermelons, cantaloupes, peppers, certain trees and many other crop plants that may be grown near the new Xtend® cotton and soybean fields. These Xtend® cotton and soybean plants are bred with a dicamba-resistant trait. The combination of extreme sensitivity in nearby crops and gardens along with the potential for off-target movement

through volatility and drift associated with large-scale applications to Xtend® crops provides a difficult challenge for growers and applicators to use the new technology without injury to off-target crops and plants.

Xtend® technology was planted on 55 percent of cotton acres in 2016 without a dicamba herbicide labeled for use. It is believed that numerous illegal applications of older, more volatile formulations of dicamba were made on a portion of these acres leading to more than 30 dicamba off-target complaints. In late 2016, the Arkansas State Plant Board banned the use of all older formulations of dicamba herbicide between April 15 and September 15 in row-crop areas due to this off-target movement. At the same time and after extensive review and numerous meetings, the Plant Board approved a label for Engenia®, a new, less volatile form of dicamba herbicide that could be used in-crop after April 15 on soybean and cotton bred with the Xtend trait. This provided a single new formulation of dicamba to support farmers' "over the top" use on Xtend® crops in the state. The decision came a year after soybean and cotton varieties resistant to dicamba became available to farmers. Given the lack of independent testing under relevant Mid-South growing conditions for Xtendimax® with Vaporgrip® and FeXapan™, these new formulations were not approved for state use in Arkansas for 2017.

It was estimated that about 35 percent of Arkansas' 3.5 million acres of soybean and some 300,000 of the estimated 440,000 acres of cotton were planted in 2017 with Xtend varieties with the dicamba-resistant trait.

By mid-June 2017, the Arkansas State Plant Board fielded more than 100 complaints from farmers and others who said dicamba had moved from its intended application site and damaged their crops. Field inspectors from the Plant Board confirmed that almost all of the alleged complaints did show symptoms consistent with dicamba injury. As the number of complaints increased very rapidly, the Plant Board enacted an emergency rule on July 11, 2017, in Arkansas banning the sale and use of dicamba in row crops. By this time, the number of complaints to the Board had risen to 610 with claims that hundreds of thousands of acres of soybean, numerous gardens, several peanut fields and other crops had been damaged. The rule was to be in effect for 120 days. The Plant Board will review and make a long-term recommendation to regulate this new technology after the emergency rule expires. Gov. Asa Hutchinson has asked the directors of the state Agriculture Department and the State Plant Board to organize a task force to examine the issue and make recommendations to the Board.

Pasture and range use of dicamba herbicides is exempt from the ban as long as applications are made at least 1 mile away from soybean fields or other sensitive crops.

Soybeans showing the cupped leaves which are a symptom of dicamba injury.

As of July 20, 2017, an estimated 850,000 to 1 million acres of soybean in Arkansas had displayed symptoms consistent with dicamba injury. Fields with dicamba symptoms were heavily concentrated in eight counties east of Crowley's Ridge, from the Bootheel of Missouri southward through Phillips County. All told, soybean fields with dicamba symptomology could be found in most row-crop producing counties with 720 official complaints filed by this date.

The counties, ranked by order of number of complaints filed as of July 20, 2017:

- Mississippi County – 160
- Crittenden County – 125
- Poinsett County – 80
- Craighead County – 71
- Lee County – 60
- St. Francis County – 60
- Phillips County – 39
- Cross County – 37

Initial dicamba symptomology in these fields varied from limited symptoms with barely cupped uppermost leaves, to more severe symptoms with growing points/terminals turning yellow, stunting and blooms shedding. The pattern of symptoms across these early damaged fields was often consistent with physical drift; and in addition, injury from dicamba-impregnated dust and sprayer contamination from lack of proper cleanout were suspected in some cases. Many fields that sustained a single hit earlier in the year with suspected light rates of off-target dicamba have started to recover and resume growth. However, many others, especially in the eight-county area where injury was most prevalent, continue to show symptoms and remain stunted with reduced terminal growth. The pattern of symptoms associated with many of the fields in northeast Arkansas would indicate vast uniform damage suggesting volatilization or secondary movement of the herbicide within an inversion. Many of the fields

in this portion of the state have likely been exposed to dicamba from more than one off-target event and are most likely to result in heavier yield loss and the need for additional weed control measures because of the absence of an adequate canopy to suppress late-season Palmer amaranth emergence.

Dicamba and Soybean

University of Arkansas System Division of Agriculture researchers have conducted considerable field research involving control of resistant pigweed and herbicides containing dicamba; however, an opportunity for these researchers to test the new formulation developed by Monsanto, using VaporGrip® technology, in volatility or large field studies was denied by the company prior to 2017. Researchers in Arkansas and many states were able to test Engenia® herbicide in small experimental plots, for volatility and efficacy, in addition to somewhat larger field plot testing for drift and volatility for two consecutive years prior to launch.

Research has shown that yield reduction in non-traited soybean from dicamba injury depends on four factors:

- Growth stage of the plants
- Rate of dicamba exposure
- Number of times the plants come in contact with dicamba
- Environmental conditions following exposure

In testing soybean without the dicamba-resistant trait, Division of Agriculture researchers found the following:

- Dicamba symptoms on soybean may be most visible during vegetative growth stages, but yield loss from one exposure will be minimal unless rate of exposure is $^{1}/_{64}$X ($^{1}/_{8}$ ounce acid equivalent dicamba per acre or 8.75 grams acid equivalent per hectare) or higher.
- Yield loss from dicamba exposure is most likely to occur between late vegetative stages through R3.
- Application at $^{1}/_{64}$X of the recommended rate on R1 soybean can cause greater than or equal to 20 percent yield loss. This rate contains $^{1}/_{8}$ ounce acid equivalent dicamba spread over one acre.
- Application at $^{1}/_{1,000}$ of the recommended rate can cause 10 percent yield loss at the R1 growth stage – the appearance of first blooms. This rate contains 0.008 ounce of dicamba dispersed over one acre.
- Application at $^{1}/_{100,000}$ of the recommended rate can cause visible symptoms during vegetative growth but is unlikely to cause yield loss. This rate contains 0.00008 ounce of dicamba dispersed over one acre.

Consequences of dicamba drift on soybean without the dicamba-resistant trait include:

- Fewer seeds per pod (Kelley et al. 2005)
- Lower seed weight (Wax et al. 1969; Kelley et al. 2005; Lyon and Wilson 1986)
- Lowered seed quality (Wax et al. 1969; McCown et al. 2016)
- Delayed maturity (Wax et al. 1969; Kelley et al. 2005; Lyon and Wilson 1986)
- Pod malformation (Weidenhamer et al. 1989; Anderson et al. 2004; McCown et al. 2016)
- Reduced seed germination or lower rates of emergence of progeny from seed planted the following growing season (Wax et al. 1969; Thompson and Egli 1973; Auch and Arnold 1978; Lyon and Wilson 1986; McCown et al. 2016)
- Malformed seedlings from affected seed planted the next spring (Thompson and Egli 1973; McCown et al. 2016)

Based on these data, soybean seed production fields exposed to dicamba during later reproductive development would likely have dicamba-like symptoms on emerging seedlings after planting as well as reduced seed quality, vigor and germination.

A study done in Georgia reported peanuts – a legume like soybean – to be very sensitive to 1X use rates of dicamba (Prostko et al. 2011), with the greatest yield losses sustained when dicamba was applied 60 days after planting – or when the plants were at the R3-R4 growth stage.

Dealing With Damaged Soybean

If soybean plants have sustained damage, a producer may be considering whether or not to replant. The soybean plant's ability to recover is related to the growth stage at which it was affected, how many times it received injuries, the severity of the injuries, and the growing conditions following exposure. Based on a pair of studies done by the Division of Agriculture, replanting very late could have a greater yield reduction than keeping a minimally herbicide-injured soybean field, so it is always wise to have an experienced county agent or consultant provide specific advice after inspecting the affected field.

If injured fields are kept, the most important point is not to add any more stress to plants that are already stressed. It's likely to be worse for soybean with later planting dates. It is recommended that producers continue to scout these fields for insect and disease pressure, and spray the appropriate pesticide when economic thresholds are met for these pests.

Producers should irrigate in a timely manner to avoid drought stress.

In deciding whether to replant, growers can make use of the SOYRISK decision-making tool, one of several decision tools available for download here: http://agribusiness.uark.edu/decision-support-software.php#soymap.

Notes

Mention of trade names in this publication does not imply endorsement by the University of Arkansas System Division of Agriculture.

The University of Arkansas System Division of Agriculture can address issues related to research involving resistant pigweed and the limited scale research. The Division of Agriculture cannot speculate on future prospects for this weed control tool.

The Arkansas State Plant Board has regulatory authority over use of dicamba and other pesticides in Arkansas.

Resources

Dicamba Drift and Potential Effects on Soybean Yield: http://www.arkansas-crops.com/2016/07/07/dicamba-potential-soybean/

Dicamba Effects on Soybean and Offspring: http://www.arkansas-crops.com/2016/07/29/dicamba-effects-soybean/

Yield Recovery From Off-Target Herbicide Injury: Will Replanting or Foliar Products Help?: http://www.arkansas-crops.com/2017/07/07/herbicide-replanting-products/

The Arkansas State Plant Board's dicamba information is available here: http://www.aad.arkansas.gov/arkansas-dicamba-information-updates

Soybean growth stages: https://www.uaex.uada.edu/publications/pdf/mp197/chapter2.pdf

Text of the July 11, 2017 emergency rule may be found here: http://www.aad.arkansas.gov/Websites/aad/files/Content/6065042/Emergency_Rule_Ban_Sale_and_Use_of_Dicamba.pdf

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