# Registration Decision for the Continuation of Uses of Dicamba on Dicamba Tolerant Cotton and Soybean

Approved by: _____

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# I. Summary

This document announces that the U.S. Environmental Protection Agency (the EPA or the Agency) will be granting requests by Bayer CropScience (formerly Monsanto Company), Corteva (formerly DuPont), and BASF to amend their existing conditional registrations that contain expiration dates of November 9, 2018, and December 20, 2018, respectively. The existing registrations are for pesticide products containing the herbicide dicamba for use on cotton and soybeans that have been genetically modified to be tolerant to dicamba in the following states: Alabama, Arizona, Arkansas, Colorado, Delaware, Florida, Georgia, Illinois, Iowa, Indiana, Kansas, Kentucky, Louisiana, Maryland, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Virginia, West Virginia, and Wisconsin. Three registrations, EPA Registration Number 352-913, 524-617, and 7969-345, are impacted by this decision. The amendment applications include requests that the expiration dates be extended to December 20, 2020 along with requests to amend the terms and conditions of the registration as well as labeling restrictions to further minimize the potential for off-site movement of dicamba from the treated fields. As of the publication of this decision document, EPA has reviewed these applications as well as new information and data, and has decided to extend these registrations until December 20, 2020 adding changes to the registrations and labeling.

EPA first registered dicamba for applications post-emergent over-the-top (OTT) for soybean and cotton in 2016, as described in the document *Final Registration of Dicamba on Dicamba-Tolerant Cotton and Soybean* (available on regulations.gov, document ID: EPA-HQ-OPP-2016-0187-0959). EPA Registration Number 524-617 (M1768 Herbicide) was the only registration included in the 2016 decision; two additional OTT dicamba use registrations were approved after the publication of the 2016 decision (EPA Registration Numbers 352-913 and 7969-345). The restrictions for all OTT registrations of dicamba were amended in 2017 to include labeling restrictions to further minimize the potential for off-site movement of dicamba. The approved amendments in 2017 continued to include the 2018 automatic expiration dates. These registrations would have automatically expired, unless EPA acted to extend these dates on all three registrations for the use of dicamba for OTT applications to dicamba-tolerant soybean and dicamba-tolerant cotton. As noted above, as of the publication of this decision document, OTT registrations of dicamba are being extended by approximately two years.

During 2016-2018, EPA received numerous reports of crop injury alleged to be related to off-target movement of dicamba. EPA's examination of this issue included collaborating with a wide range of stakeholders. As part of this effort, EPA also made field visits to Arkansas, Iowa, Nebraska, Georgia, Mississippi, Missouri, and Tennessee to meet with growers, researchers, and state regulators. After considering all of this information, EPA and the registrants have agreed to additional label changes intended to further minimize the potential for off-site movement from the use of these registered products. Further details regarding the Agency's registration extension decision, required label updates, and the rationale for those mitigation measures can be found in this decision document.



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## II. Chemical Information

This registration decision refers to all current dicamba registrations for OTT uses on dicamba-tolerant soybean and dicamba-tolerant cotton. This includes three pesticide products (EPA Registration Numbers 352-913, 524-617, and 7969-345), as described below.

**Chemical Names:**
The three pesticide products covered by this decision contain a total of two forms of dicamba, as seen in Table 1 below:

Table 1. Chemical Name Identification for Dicamba

| Chemical Name | Alternate Chemical Name | Common Name | Chemical Abstract Service (CAS) Number |
|---|---|---|---|
| Dicamba (benzoic acid, 3,6-dichloro-2-methoxy-, aka 3,6-dichloro-*o*-anisic acid) | Diglycolamine salt of dicamba (3,6-dichloro-o-anisic acid) | Dicamba DGA salt | 104040-79-1 |
| Dicamba: N,N-Bis-(3-aminopropyl) methylamine salt of 3,6-dichloro-o-anisic acid | None | Dicamba BAPMA salt | 1286239-22-2 |

**Mode of Action:** Dicamba is in the Benzoic Acid family that is used post-emergence for selective control of broadleaf weeds. Like the phenoxy herbicides, dicamba mimics auxins, a type of plant hormone and causes abnormal cell growth by affecting cell division.

**Registrants:** BASF; Bayer CropScience (formerly Monsanto Company); and Corteva Agriscience (formerly E.I. du Pont de Nemours & Company, aka DuPont)

**Product Numbers:**

1. EPA Reg. #352-913: FeXapan herbicide Plus VaporGrip Technology
2. EPA Reg. #524-617: M1768 Herbicide (Xtendimax with VaporGrip Technology)
3. EPA Reg. #7969-345: Engenia Herbicide

**Summary of Product Information:**
The information from this chemical information section is summarized in Table 2 below:

Table 2. Master Table of Dicamba Products Registered for OTT Use

| EPA Reg. # | Product Name | Registrant | Form of Dicamba |
|---|---|---|---|
| 352-913 | FeXapan herbicide Plus VaporGrip Technology | Corteva | DGA salt |
| 524-617 | M1768 Herbicide (Xtendimax with VaporGrip Technology) | Bayer | DGA salt |



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| | | | |
|---|---|---|---|
| 7969-345 | Engenia Herbicide | BASF | BAPMA salt |

## III. Background

In January 2015, under the Plant Protection Act, the United States Department of Agriculture (USDA) deregulated the genetically modified dicamba-tolerant cotton and dicamba-tolerant soybean seeds. This seed was sold commercially in late 2015 and 2016 prior to the pesticide product registration. In late 2016, following a public comment period,[1] EPA registered dicamba for use with the dicamba-tolerant trait in soybean and cotton (see *Final Registration of Dicamba on Dicamba-Tolerant Cotton and Soybean*, on regulations.gov as EPA-HQ-OPP-2016-0187-0959). These registrations were time-limited with an automatic expiration date of either November 9 or December 20, 2018, depending on the registration, unless EPA granted an extension of this time limitation (EPA Reg. #352-913, 524-617, and 7969-345).

Prior to the 2016 registration actions for dicamba, dicamba uses on soybeans and cotton was limited to use on preplant and preharvest soybeans and on preplant and postharvest cotton. The new uses registered in 2016 under FIFRA section 3(c)(7)(B) expanded the current timing of dicamba applications to post-emergence OTT applications to dicamba-tolerant cotton and dicamba-tolerant soybean crops. Registrations for the OTT uses were granted only for the three formulations discussed in this document because the agency has data to show that these formulations demonstrate lower volatility when compared to other dicamba formulations. It is important to note that using registered dicamba products on dicamba-tolerant cotton or dicamba-tolerant soybean crops that are not registered specifically for post-emergence use on dicamba-tolerant cotton or dicamba-tolerant soybean crops is inconsistent with the pesticide's labeling and a violation of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

2017 crop injury and label updates for the 2018 season: In 2016, EPA began receiving reports of crop injury alleged to be caused by off-target movement from the use of dicamba on dicamba-tolerant cotton and soybeans. Because the registrations for OTT use had not yet been issued, these incidents were related to illegal use of previously registered dicamba pesticide products. In 2017, over 2,700 official cases of crop damage were reported to state departments of agriculture, estimated to be over 3.6 million acres of soybeans.[2] There is a lack of scientific consensus regarding the cause of these reported incidents. Input from state agencies, farm bureaus, associations, industry, farmers, and non-governmental organizations indicate that causes could include poor adherence to the label (*e.g.*, not following the label or use of an older more volatile formulation), physical drift, tank contamination, temperature inversions, and/or volatility. In response, the EPA worked with the pesticide registrants to strengthen the pesticide label application directions for the 2018 season to further minimize the potential for off-target movement.

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[1] FIFRA does not require a public comment opportunity for any proposed decision to register a pesticide. EPA took public comment on its proposed dicamba decision under its public participation policy (see: https://www.epa.gov/pesticide-registration/public-participation-process-registration-actions). The action taken under this decision document did not include a public comment opportunity, but EPA did receive over 120 comments from stakeholders and EPA considered the content of these submissions.

[2] *Dr. Kevin Bradley Univ. of Missouri, IPM,* https://ipm.missouri.edu/IPCM/2017/10/final_report_dicamba_injured_soybean/



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2018 incidents of crop injury: Information for the 2018 growing season provided by state agencies and others also included reports of crop injury alleged to be related to off-site movement of dicamba. All three registrants also submitted adverse effects aggregated reports to EPA as required by FIFRA section 6(a)(2). The Association of American Pesticide Control Officials (AAPCO) reported that approximately 1,400 official complaints of alleged dicamba injury were reported to the state regulatory authorities. Of the 34 states where OTT dicamba use is registered, only 16 states consistently reported incident information to AAPCO and EPA. Damage alleged to be related to OTT dicamba applications was reported not only for non-tolerant soybeans but also for neighboring trees, orchards, vineyards, berries, orchards, melons, tomatoes and other vegetable crops. As to reporting of crop injury in general, AAPCO, university researchers, and some growers believe that these complaints alleged of crop damage tend to be underreported. These reasons include: fear of losing crop insurance; a desire to maintain good relationships with neighbors; fear that a damaged crop will be considered adulterated and cannot be sold; fear that the grower will lose their organic certification; and grower perception that no action will be taken in response to filing a report.[3] Others believe that there may be issues of overreporting. These reasons include: damage blamed on dicamba but actually caused by other chemistries; and damage reports given in terms of acreage that reflects the size of an entire crop field and not just the portion of the crop field that is actually damaged.[4]

## IV. Stakeholder Feedback

EPA did not provide a formal public comment period prior to the current decision, but did receive a variety of comments from the public in the form of calls, emails, and letters concerning the registered uses for dicamba OTT on dicamba-tolerant cotton and soybeans. The feedback EPA received included comments both in favor of and opposed to the continued registration of dicamba OTT uses on dicamba-tolerant cotton and soybeans.

Included in these comments was correspondence from a variety of stakeholders seeking to share their experience with dicamba, including state agencies (nine commenters), farm bureaus (five commenters), trade associations and coalitions (42 commenters), industry (62 commenters, including farmers, seed companies, crop consultants, *etc.*), non-governmental organizations (888 commenters, including 9 organizations and 879 signatures included as part of a mass comment campaign), one written comment from academia, and five comments from individual concerned citizens. These correspondences can be found on regulations.gov (Docket ID: EPA-HQ-OPP-2016-0187). The information provided allowed the agency to consider different viewpoints from their unique perspectives, and EPA reviewed this feedback prior to issuing this regulatory decision.

Some of the topics that emerged from stakeholder comments and calls, in no particular order, included the following:

General Comments in favor of OTT registrations of dicamba:

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[3] Ford Baldwin, Practical Weed Consultants, LLC, Letter dated 2018

[4] Monsanto. 2018a. The Scientific Basis for Understanding the Off-Target Movement Potential of Xtendimax, MRID 50642701, received 3 Aug 2018.

- Requests to extend the registrations but add additional label restrictions in order to decrease the potential for damage from off-target movement.
- Requests to keep the labels as is with no additional restrictions, due to concern that additional label restrictions for dicamba would increase the regulatory burden for growers.
- Growers are experiencing challenges with weed resistance to other herbicides.
- Growers have experienced success using dicamba OTT technology in cotton and soybeans to control weeds with very little off-target movement
- Concerns regarding potential crop losses if the decision is made to not continue the registration.
- Claims that mandatory training has been helpful and enable users to follow the existing label with limited incidents of off-target movement.
- An assertion that with proper stewardship, application training, and education, damage from off-target movement of dicamba can be minimized.
- Claims that using a dicamba OTT herbicide system can result in increased yields for growers.

General Comments expressing concerns and/or opposition to OTT registrations of dicamba:
- Requests to let dicamba OTT registrations of dicamba expire, based on the argument that although dicamba works well on resistant weeds, the extensive reports of past damage and potential for future damage from off-target movement is too great to justify continuing the registrations.
- Other pesticide options are successful at controlling resistant weeds when used properly.
- Claims regarding the limits of training in limiting off-target movement of dicamba.
- Claims that using a dicamba OTT herbicide system does not result in increased yields for growers.
- Concern that dicamba OTT uses pose a threat to farms growing various non-dicamba-tolerant crops, and native flora and fauna.
- Some soybean growers report feeling pressured to purchase dicamba-tolerant seed as a protective measure to avoid dicamba off-target movement from their neighbors.
- They believe that damage from dicamba threatens farmers' right to grow crops of their choosing, such as specialty and organic crops.
- Concern that off-target movement of dicamba from OTT uses is responsible for injuring native habitats, forests, aquatic systems, flora, and fauna.
- Two poultry farms stated that reported dicamba damage to non-dicamba-tolerant soybeans was making it difficult for livestock operations to source non-GMO feed.

## V. Risk Assessments

### A. Human Health

The potential for human health risks from pesticide uses of dicamba was assessed in EPA's March 2016 document *Dicamba and Dicamba BAPMA Salt: Human- Health Risk Assessment for Proposed Section 3 New Uses on Dicamba-tolerant Cotton and Soybean* (available on regulations.gov, document ID: EPA-HQ-OPP-2016-0187-0009). This document was cited in the Agency's 2016 *Final Registration of Dicamba on Dicamba-Tolerant Cotton and Soybean* (available on regulations.gov, document ID: EPA-HQ-OPP-2016-0187-0959). As noted in these

documents, the toxicology database for dicamba is complete and sufficient for assessing the toxicity and characterizing the hazard of dicamba.

The Agency's human health risk conclusions for dicamba remain unchanged since the publication of the 2016 registration decision document for OTT uses on dicamba-tolerant cotton and soybean. The Agency has not identified a reason to update its 2016 health risk assessment for dicamba, and is, therefore, relying the findings in that 2016 assessment to support this decision. Because no human health risks of concern have been identified, the Agency is not proposing new human-health focused mitigation measures as part of this decision.

**B. Ecological**

A summary of the environmental fate and ecological effects, and potential environmental risks from the use of dicamba on dicamba-tolerant cotton and soybeans was previously provided in EPA's 2016 *Final Registration of Dicamba on Dicamba-Tolerant Cotton and Soybean* (available on regulations.gov, document ID: EPA-HQ-OPP-2016-0187-0959).

Additional ecological risk assessment information on dicamba can be found in the following Agency documents:

- *Ecological Risk Assessment for Dicamba and its Degradate, 3,6-dichlorosalicylic acid (DCSA), for the Proposed New Use on Dicamba-Tolerant Soybean (MON87708)* and
- *Ecological Risk Assessment for Dicamba DGA Salt and its Degradate, 3,6-dichlorosalicylic acid (DCSA), for the Proposed Post-Emergence New Use on Dicamba-Tolerant Cotton (MON 87701)*, and its addendums entitled,
- *Addendum to the Environmental Fate and Ecological Risk Assessment for the Section 3 New Use of Dicamba on Dicamba-Tolerant Soybean* and
- *Dicamba DGA; Second Addendum to the Environmental Fate and Ecological Risk Assessment for Dicamba DGA salt and its Degradate, 3,6-dichlorosalicylic acid (DCSA) for the Section 3 New Use on Dicamba-Tolerant Soybean* and
- *M-1691 Herbicide, EPA Reg. No. 524-582 (Active Ingredient: Dicamba Diglycolamine Salt) and M-1768 herbicide, EPA Reg. No. 524-617 (AI: Diglycolamine Salt with VaporGrip™) – Review of EFED Actions and Recent Data Submissions Associated with Spray and Vapor Drift of the Proposed Section 3 New Uses on Dicamba-Tolerant Soybean and Cotton.*
- *Summary of New Information on Analysis of Dicamba Use on Dicamba-Tolerant (DT) Cotton and Soybean Including Updated Effects Determinations for Federally Listed Threatened and Endangered Species*

These documents are in docket number EPA-HQ-OPP-2016-0187, available at regulation.gov.

EPA's 2016 registration action included a screening-level risk assessment for the use of diglycolamine salt of dicamba (dicamba DGA) on dicamba herbicide-tolerant cotton and an addendum to the 2011 Section 3 screening-level Risk Assessment for the use of dicamba DGA on dicamba herbicide-tolerant soybeans. Concurrent with these two actions, the agency issued three addenda to the risk assessments that refined the screening-level risk assessments to include species-specific assessments for threatened and endangered (hereafter referred to as "listed") species present within the 34 states included in the Section 3 registrations on dicamba-tolerant crops (Alabama, Arizona, Arkansas, Colorado, Delaware, Florida, Georgia, Illinois, Iowa,

Indiana, Kansas, Kentucky, Louisiana, Maryland, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Mexico, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Virginia, West Virginia and Wisconsin).

The screening-level risk assessments concluded that potential direct risk concerns could not be excluded for:

- mammals (chronic, from the soybean use only, due to residues from dicamba's metabolite, DCSA, rather than from parent dicamba);
- birds (acute from parent dicamba for both soybean and cotton uses; chronic from DCSA residues only in soybean but not in cotton), considered surrogates for reptiles, and terrestrial-phase amphibians; and
- terrestrial plants (soybean and cotton uses)

In the screening-level risk assessments, indirect effect risk concerns for all taxa were possible for any species that have dependencies (e.g., food, shelter, and habitat) on mammals, birds, reptiles, terrestrial-phase amphibians, or terrestrial plants.

Additionally, the screening-level assessment showed that direct risk levels of concern were not exceeded for:

- mammals (acute) and (chronic—for the cotton use only);
- birds, reptiles, and terrestrial-phase amphibians (chronic from parent dicamba or DCSA degradate from use on cotton);
- terrestrial insects (acute and chronic);
- freshwater fish (acute and chronic);
- aquatic-phase amphibians (acute and chronic);
- estuarine/marine fish (acute and chronic);
- freshwater invertebrates (acute and chronic); estuarine/marine invertebrates (acute and chronic); and
- aquatic plants (except for non-vascular plants, for which there are no listed species)

In the screening-level cotton risk assessment and soybean addendum as part of the earlier public comment process, the agency concluded that mitigation measures, including the use of rainfast mitigation to limit runoff exposure, limiting nozzles to those that restrict droplet spectra to extra-coarse and ultra-coarse, restricting applications under certain wind conditions (*i.e.* only apply when wind speeds are between 3 and 15 mph), and the use of a 110-foot buffer (for a 0.5 lb a.i./A application) in the direction of wind to account for spray drift and applying that buffer in every direction to account for potential volatilization (a discussion of the updates to this assessment is provided below), would limit any exposures beyond the treated field to levels below thresholds that would trigger any risk concerns for any taxa. These assessments concluded that by applying the rainfast mitigation and utilizing the spray drift and volatility buffer as setbacks from the edge of the field ("in-field buffers"), exposures that could potentially trigger risk concerns would be limited to the treated field. With these labeling restrictions, EPA determined that the vast majority of listed species would be off-field and therefore would not be part of the action area and consequently reached a No Effect decision for those species. Species that were potentially on the treated field or utilizing resources from the treated field and for

which the screening-level risk assessment indicated concerns for that taxa underwent further refinement to determine the potential for risk.

Subsequent to the screening level risk assessments and refined endangered species addenda, EPA issued several additional addenda including the evaluation of field volatility (flux) studies for DGA formulations, bridging data and volatility analysis for dicamba BAPMA salt and an additional refined endangered species addendum that covered listed species that were newly listed between the Section 3 registrations of dicamba DGA salt on dicamba-tolerant soybeans and cotton and the Section 3 registration of dicamba BAPMA salt. The evaluation of the flux studies for DGA and the volatility analysis for both DGA and BAPMA concluded that volatility buffer setbacks were not needed to limit exposures off the field to below the threshold level.

By limiting the action area to the treated field, the refined endangered species addenda concluded that all but 27 listed species were outside of the action area. Overall, of the remaining 27 species, one likely to adversely affect (LAA) determination was made, two not likely to adversely affect (NLAA) determinations were made, and no effect (NE) determinations were made for the remaining species. For one species, EPA consulted with U.S. Fish and Wildlife Service and they concurred with the NLAA Effects Determination, and no further action was needed for that species. For the remaining species, county prohibitions restricting use in areas where the species were known to be present addressed the other NLAA and LAA determinations. Therefore, these species were no longer inside the action area of the dicamba OTT uses on cotton and soybean.

However, since the 2016 registration of dicamba OTT uses on cotton and soybean, reports of alleged plant injury in 2017 and 2018 of dicamba off-target movement (either from physical drift, volatility, or a combination thereof) have led EPA to conduct an updated analysis of information regarding the potential impact of dicamba OTT uses on soybean and cotton on listed (threatened or endangered) species. An overview of these new reports of off-target movement, as well as updated information on potential endangered species concerns from the use of dicamba OTT registrations, appears in the following sections of this decision document.

### 1. Dicamba Use During 2017 and 2018

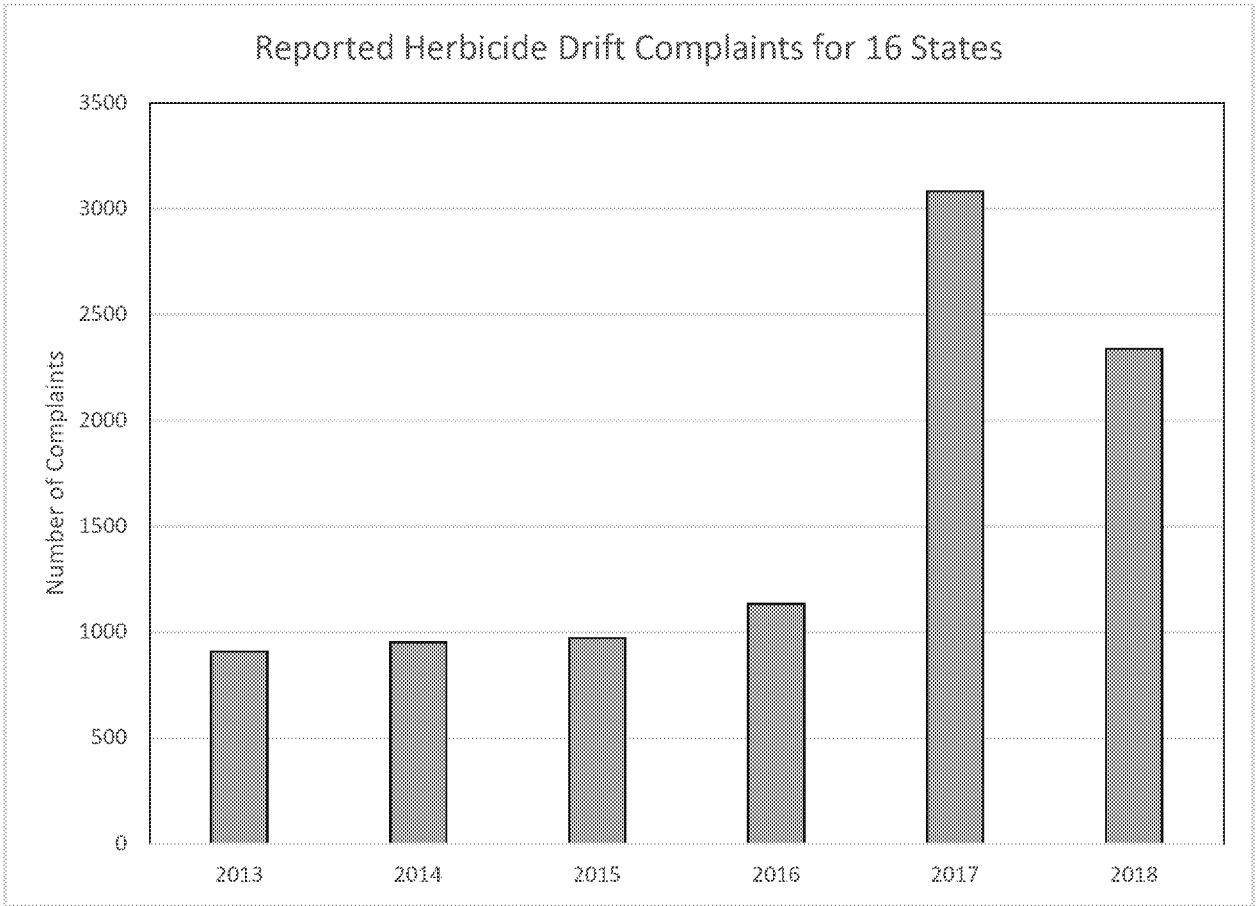
Following the registration of dicamba OTT uses, incident reports received in 2017 and 2018 suggest that damage from off-site movement attributed to dicamba has occurred. According to AAPCO, approximately 1,400 official complaints have been reported to state agencies claiming that crop injury was caused by off-site movement of dicamba in 2018. These incidents may be due to misuse (e.g., not following the label or use of an older more volatile formulation), drift to adjacent crops or sites, tank contamination (e.g., dicamba was not completely removed from the spray equipment and is sprayed on the next field at a lower concentration), or volatility (the dicamba was applied and then moved off the treated area after the application process was completed). Some pesticide products containing earlier formulations of dicamba have been known to be volatile (e.g., losing nearly half of the applied material due to volatility (Burnside et. al., 1966)). Newer formulations of dicamba, such as the products being addressed in this decision approved for OTT uses, show significantly lower volatility.

After the registration of OTT uses of dicamba, reported cases of agricultural pesticide off-target movement rose substantially after 2016 in many states where OTT dicamba was registered for

use (Figure 1). A large proportion of cases of off-site movement reported to state departments of agriculture were attributed to off-site movement of OTT applications of dicamba to dicamba-resistant crops. Alleged damage reported to state agencies included impacts to natural areas and numerous crops such as non-tolerant soybean, non-tolerant cotton, tobacco, alfalfa, vegetables, peaches, ornamentals and residential areas. In soybean alone, millions of acres were alleged to be damaged in both years since the registration of OTT dicamba products (Bradley 2017c, 2018). In addition, the Agency is aware of literature and investigations indicating that exposure to dicamba can have effects on soybean offspring from plants exposed to dicamba, such as reductions in vigor and health (Thompson and Egli, 1973; McCorn et al., 2016). These cross generational effects may impact breeding programs and occur in other crops, as well. According to the AAPCO, university researchers, and some growers, the number of cases reported to state agencies may be substantially lower than the actual incidents (WSSA Survey, 2018; AAPCO Pers. Comm. August 13, 2018) observed in the field for several reasons. These reasons include: fear of losing crop insurance; maintaining good relationships with neighbors; fear that the crop will be considered adulterated and cannot be sold; fear that the grower will lose their organic certification; and grower perception that no action will be taken. Others believe that there may be issues of overreporting. These reasons include: damage blamed on dicamba but actually caused by other chemistries; and damage reports given in terms of acreage that reflects the size of an entire crop field and not just the portion of the crop field that is actually damaged.[5]

Figure 1. Agricultural Herbicide Drift Complaints for Sixteen States

[5] Monsanto. 2018a. The Scientific Basis for Understanding the Off-Target Movement Potential of Xtendimax, MRID 50642701, received 3 Aug 2018.




Majority of states reported total agricultural herbicide drift complaints. States included in this figure are: AL, AR, AZ, IA, IL, IN, ND, MO, OK, GA, SC, MS, NC, NE, TN, and SD. Incidents occurred in other states for these years but data were incomplete for every year and were not included. Dicamba is registered for OTT use in 34 states. Data are current as of September 2018.
**Sources:** AAPCO 2018; Missouri Dept. of Agriculture, 2018

## 2. Summary of Effects Determination for Endangered Species

New information that is now available appear to show that dicamba emission (through spray drift, volatility, or a combination) from the use of these registrations on dicamba-tolerant cotton and dicamba-tolerant soybean fields has resulted in effects to non-target terrestrial plants offsite from the treated fields. This new information demonstrated the need to reevaluate the 2016 Endangered Species Act (ESA) effects determinations involving Federally listed threatened or endangered terrestrial plants for any new regulatory decision involving the use of these registrations on dicamba-tolerant cotton and dicamba-tolerant soybean fields.

EPA evaluated new data, including field volatility and vapor exposure toxicity studies submitted by the registrants and large field studies conducted by academic researchers. Additionally, much of the incident and some of the field study data described effects solely in terms of visual signs of damage, rather than effects to apical endpoints such as plant height and yield, EPA considered open literature data relating visual signs of damage to these apical endpoints.

EPA concluded that the new information supported the need for an additional in-field 57 foot omnidirectional buffer in areas where listed dicot plant species are present to support the previous No Effect calls. This buffer determination was based on a distributional approach combining the direct effects (based on the most sensitive endpoint of plant height) to distance data for all the available field studies. Accounting for the small number of studies and limited geographic distribution, EPA decided to evaluate the distribution of the direct measurement approach distances at the 95%-tile to calculate a reasonable and protective distance to the 5% apical effects threshold.

EPA established the geographic extent of the potential action area using the for expected terrestrial plant effects into Use Data Layers (UDL) for all of the 34 labeled states for dicamba uses on dicamba-tolerant cotton and dicamba-tolerant soybean. The UDL data layer was extended outwards 30 meters in all directions to incorporate the off-site distance of 57 foot or a minimum resolution distance for species action area overlap, whichever is greater. This area was then compared with the geographic area for the known listed terrestrial plant species ranges and all counties with a species with greater than 1% overlap with the action area in the county were established as within the action area and identified as "may affect."

Of the 69 listed species co-located with the action area described as treated cotton and soybean fields with an additional omnidirectional 30 meter boundary;

1. 69 species would be may-affect with no additional mitigation,
2. 1 species (the spring creek bladderpod) would be May Affect and 68 species would be No Effect with the imposition of a 57 foot omnidirectional in-field buffer and
3. all 69 species would be No Effects with the imposition of the 57 foot buffer and the continued labeled county prohibition for Wilson County, Tennessee (for the endemic spring creek bladderpod)

Of the 14 designated critical habitats co-located with the action area described as treated cotton and soybean fields with an additional omnidirectional 30 meter boundary;

1. 12 critical habitats would be "Modification" with no additional mitigation and 2 critical habitats would be "No Modification" by virtue of not having primary constituent elements related to non-monocot plant species
2. 14 critical habitats would be "No Modification" with the imposition of a 57 foot omnidirectional in-field buffer

These effects determinations, critical habitat modifications, and mitigation measures have considered the uncertainties in the analysis as noted throughout the document. These included, but are not limited to interpreting the incident data (largely due to the nature of incident observations being limited to visual signs of injury), field study limitations (*e.g.* varying environmental conditions in field studies, nature of subjectivity in estimates of visual symptoms of injury between different observers, etc.), and geospatial analysis (*e.g.* species are presumed to be distributed throughout their range at all times of the year).

## VI. Benefits and Impacts Assessments

### A. Benefits of the Registration of Dicamba OTT Uses Cotton and Soybeans

In accordance with FIFRA, EPA must consider both risks and benefits when considering the registration of a given pesticide. A summary of the benefits of dicamba OTT uses on cotton and soybeans appears in this section. To see EPA's current assessment of the benefits and impacts of OTT uses of dicamba, as updated since 2016, please refer to *Over-the-Top Dicamba Products for Genetically Modified Cotton and Soybeans: Benefits and Impacts (October 31, 2018)*.

As noted in the 2016 *Final Registration of Dicamba on Dicamba-Tolerant Cotton and Soybean* (available on regulations.gov, document ID: EPA-HQ-OPP-2016-0187-0959), cotton and soybeans are extremely important agricultural commodities. USDA estimates the gross value of soybean production at approximately 48 billion dollars in the United States, and the gross value of cotton production at over 6 billion dollars in the United States.[6] However, growers throughout the United States have experienced, and continue to face, crop yield and economic losses due to the prevalence of chemical-resistant weed biotypes (e.g., glyphosate resistance). There is a need in the agricultural community for additional tools to manage resistant weeds. Herbicide resistance has become a significant financial, production and pest management issue for many cotton and soybean growers, and agriculture as an industry.

Historically, most dicamba applications occurred in late winter or early spring for pre-plant or fallow removal of broadleaf vegetation prior to planting crops. Prior to the registration of OTT dicamba on soybeans and cotton, about 35 million acres of agricultural land were treated annually with 6 million pounds of dicamba (5-yr average; MRD 2012-2016). Field corn and winter and spring wheat were the agricultural use sites with the largest number of acres treated with dicamba with an average of 19.8 million total acres treated [TAT] per year (MRD, 2012-2016). Other use sites with substantial use from 2012-2016 include cotton, fallow land, pasture land, sorghum, and soybeans (pre-plant only).

The agency finds that the registration of OTT dicamba will provide growers of dicamba-tolerant soybean and cotton with an additional active ingredient to manage difficult to control broadleaf weeds during the crop growing season. In cases where there are herbicide-resistant weeds, the agency finds there are few herbicides available for users.

OTT dicamba product labels list preemergence and postemergence control of weeds such as Palmer amaranth. Palmer amaranth was selected as a case study because it has several characteristics that have led to Palmer amaranth being one of the most difficult weeds to control in the United States (Van Wychen, 2016a) and is a primary target weed by dicamba (MRD, 2012-2016). The agency recognizes that preemergence (residual soil activity) and postemergence (foliar activity) herbicides are an important component of a season-long weed management program. Preemergence herbicides (to the weed) prevent the emergence of Palmer amaranth, and if there are no emerged Palmer amaranth plants, there is no need for postemergence (to the weed) applications. However, there are circumstances where postemergence herbicides are important. For example, postemergence herbicides (to the crop and weed) may be needed if preemergence herbicides are not effective (e.g., insufficient moisture to activate, too much rainfall which moves

[6] These numbers represent data for 2016. These gross value of production values were first reported in EPA's 2016 assessment for dicamba, *Final Registration of Dicamba on Dicamba-Tolerant Cotton and Soybean*, and remain the most recent data currently available as of October 2018.

herbicide away from weed seeds, and resistant biotypes) or if there are Palmer amaranth plants that escaped earlier control measures and need to be controlled.

OTT uses of dicamba expand growers' options for broadleaf weed control in cotton and soybeans, including glyphosate-resistant weeds, but are not the only available tool. Pesticide usage data indicate 9 postemergence herbicides (to the crop and weed, including directed sprays or applications with hooded sprayers) were used in 2012-2016 in cotton and 14 herbicides in soybean targeting all broadleaf weeds. Of these postemergence herbicides, 4 and 13 active ingredients were applied over-the-top without injuring the cotton and soybean, respectively. Based on pesticide usage data from 2012 to 2016, glufosinate was an herbicide that was commonly applied, but there were other options (acifluorfen, cloransulam-methyl, imazamox, and fluthiacet-methyl) recommended in at least one of the extension weed control guides reviewed for control of Palmer amaranth (U of Ark, 2018, Steckel, 2018; Sprague, 2017). For both soybean and cotton, there is one other herbicide, 2,4-D, that provides similar control as dicamba when using a 2,4-D-resistant variety. Of the 13 OTT soybean herbicides, 3 are not recommended by extension publications; one was recommended as a tank mix partner only (U of Ark, 2018, Steckel, 2018; Sprague, 2017; Flessner et al., 2016; Jhala, 2014), effectively leaving 9 OTT herbicides for soybean weed control. Over-the-top alternatives are further reduced if a grower has herbicide-resistant biotypes such as Palmer amaranth.

***Resistance Management***

The agency recognizes the use of dicamba, when used as part of a season-long weed management program that includes preemergence (residual) and postemergence (foliar) herbicides, provides a long-term benefit as a tool to delay resistance of other herbicides. Fifty years of dicamba use, in rotation with other herbicides, has resulted in only two confirmed resistant weed species in the United States, kochia and prickly lettuce (Heap, 2018). However, with the development of dicamba-tolerant crops, the widespread use and multiple in-season applications will increase selection pressure on weeds to evolve resistance to dicamba.

However, dicamba used on dicamba-tolerant crops is not a stand-alone herbicide program even though the label states it has preemergence (soil residual) and postemergence (foliar) activity; other herbicides, especially preemergence herbicides, should be used as registrants and university researchers recommend (University of Arkansas, 2018; Steckel, 2018; Flessner et al., 2016; Sprague, 2017; Jhala, 2014, Mississippi State University, 2017; Marshall, 2017; McGinty, 2016; EPA Reg. Nos. 524-617 [Xtendimax]; 524-617 [Engenia]; and 352-913 [Fexapan]).

Because of the complexities involved with controlling multiple weeds (Xtendimax has over 250 weeds labeled for control), the agency considered one of the more difficult-to-control weeds in cotton and soybean, Palmer amaranth (Van Wychen, 2016a and 2016b). Palmer amaranth is native to the U.S. and occurs in 28 states (Hensleigh and Pokorny, 2017), and there are over 50 Palmer amaranth biotypes with resistance to at least one herbicide within 6 MOA groups in the U.S. (Heap, 2018). Additionally, more than 15 of the biotypes exhibit multiple herbicide resistance with up to three different herbicides within three different MOA (Heap, 2018). The agency assumes that Palmer amaranth serves as surrogate for other difficult to control broadleaf weeds.

For this benefits analysis, the baseline is the pre-2016 status of dicamba (i.e., when OTT uses were not registered for dicamba-tolerant soybean and dicamba-tolerant cotton). When comparing the baseline against an amended registration in which OTT uses are available for dicamba-tolerant cotton and soybean, the agency finds the following overall benefits for OTT dicamba:

- It provides growers with an additional postemergence active ingredient to manage difficult to control broadleaf weeds during the crop growing season, particularly for those situations where herbicide-resistant biotypes, such as Palmer amaranth, may occur (and few alternatives are available).
- It provides a long-term benefit as a tool to delay resistance of other herbicides when used as part of a season-long weed management program that includes preemergence (residual) and postemergence (foliar) herbicides (along with rotations between different MOA).

Additionally, as in the case of other genetically modified herbicide resistant varieties (i.e., glyphosate, glufosinate, and 2,4-D), the use of the OTT herbicide partner may reduce the management complexity associated with pre-selecting an effective postemergence herbicide with little to no risk of damage to the treated crop.

### B. Impacts Assessment

Impacts to non-dicamba tolerant soybean growers. Monsanto (now Bayer) predicted that 40 million acres of dicamba-tolerant soybeans would be planted in 2018 (Monsanto, 2018b). USDA (2018c) reported that 89.6 million acres of soybeans were expected to be planted in 2018. This implies that 49.6 million acres (55 percent) of the 2018 U.S. soybean crop is non-dicamba-tolerant and may potentially be damaged by very low levels of off-target dicamba. Exposure can result in damage levels that range from superficial visual symptomology to possible yield loss to plant death.

Impacts to growers of other dicamba sensitive crops. Many other plants are sensitive to low levels of dicamba and are listed on the dicamba labels. The OTT dicamba labels mention several hundred susceptible (e.g., sensitive) crops /crop groups, such as non-dicamba-tolerant soybeans and cotton, all fruiting vegetables, all fruit trees, all cucurbits, grapes, beans, flowers and ornamentals, peas, potatoes, sunflower, tobacco and other broadleaf plants. Labels also list about 250 weeds – annual and perennial broadleaf plants and trees – that are controlled, some of which are desirable in non-crop settings.

Impacts to the landscape. In 2017 and 2018, state agencies received reports from growers about incidents alleging damage to trees and other non-crop plants (Bradley, 2017c, 2018; AAPCO 2018a). Potential impacts could result in damage to shelterbelts and windbreaks, as well as desirable plants in public parks and spaces.

## VII. Registration Decision

In accordance with FIFRA section 3(c)(7)(B), the EPA conditionally amends a registration to add an additional use when it finds that it has satisfactory data pertaining to the proposed new use and the amendment will not significantly increase the risk of unreasonable adverse effects on man or the environment, taking into account the economic, social, and environmental costs and

benefits of the use of the pesticide. Under FIFRA, the EPA is charged with balancing the uncertainties and risks posed by a pesticide against the benefits associated with the use of the pesticide. The EPA must determine if the benefits, in light of its use, outweigh the risks in order for the Agency to register a pesticide.

While OTT use of dicamba on dicamba-resistant cotton and soybeans is currently a registered use, that use will expire before the end of 2018 unless these amendment requests are granted. Therefore, EPA believes it appropriate to consider the extension of these uses as a "new use" under section 3(c)(7)(B), and is taking this action under that section. But the risk-benefit related rationale for this decision would apply equally to an action under sections 3(c)(5) or 3(c)(7)(A). Based on all the information before it at this time, EPA has determined that extending the OTT use of dicamba for two years on dicamba-tolerant cotton and dicamba-tolerant soybeans in the manner authorized under this decision will not cause unreasonable adverse effects on the environment. The amendment would therefore meet the risk-benefit standard of section 3(c)(5). The risk-benefit standard for a conditional registration under 3(c)(7)(A) is that the registration not "significantly increase the risk of unreasonable adverse effects on the environment." EPA has always considered the standard under 3(c)(7)(A) and 3(c)(7)(B) to be less onerous than the risk-benefit standard in 3(c)(5); if the agency has determined that a pesticide does not cause unreasonable adverse effects on the environment, that pesticide cannot ***significantly increase*** the risks of unreasonable adverse effects on the environment.

In the case for the post-emergent uses of dicamba on dicamba-tolerant soybeans and dicamba-tolerant cotton, the EPA determined that its decision to extend the registration these uses meets the requirements of FIFRA. The database submitted to support the assessment of human health risk is sufficient for a full risk evaluation and is considered complete and adequate to evaluate risks to infants and children. The Agency has not identified any risks of concern in regard to human health, including all population subgroups, or for occupational handlers.

In 2016, EPA completed screening-level ecological risk assessments for the use of dicamba on dicamba-tolerant cotton and dicamba-tolerant soybeans. In summary, the screening-level risk assessments concluded that potential direct risk concerns could not be excluded for specific exposures to mammals, birds and terrestrial plants. In the screening-level risk assessments, EPA concluded that mitigation measures, including the use of mitigation to limit runoff exposure, limiting nozzles to those that restrict droplet spectra to extra-coarse and ultra-coarse, restricting applications under certain wind conditions, and the use of a 110-foot buffer in the direction of wind to account for spray drift and potential volatilization, would limit any exposures beyond the treated field to levels below thresholds that would trigger any risk concerns for any taxa. In a new Endangered Species Assessment, EPA has considered recent and relevant information and has concluded that the OTT use on dicamba-tolerant soybeans and dicamba-tolerant cotton is supported by a No Effects determination.

Over the period in which the OTT uses of dicamba have been available, a significant number of reports of alleged off-site movement have been received from state agencies and agricultural researchers. The number of separate incident complaints appears to have been greatest in 2017. During 2018, and in accordance with the agency's requirements, applicators received specialized training in the safe use of the OTT label. Growers also received a revised label in 2018, which considered and helped minimize the potential causes of off-site movement. The overall volume

of filed incident complaints for 2018 dropped even as more growers adopted this technology in 2018. In this new decision, EPA is further strengthening the OTT label. Notably, there are new restrictions on the seasonal amount of treatments that can be made. Moreover, within a given day, the permitted time window for using an OTT application has been narrowed. Overall, these changes will add greater clarity and structure for this use pattern and continue to further minimize potential off-site movement.

On the benefits side of the analysis, use of dicamba on dicamba-tolerant soybeans and dicamba-tolerant cotton is an important part of a resistance management strategy for these crops. Soybeans and cotton are extremely important agricultural commodities in the United States and the world. According to the USDA's National Agricultural Statistics Service, soybeans are grown on approximately 89.6 million acres and cotton is grown on approximately 13.5 million acres. USDA's Economic Research Service describes soybeans as the world's largest source of animal protein feed and the second largest source of vegetable oil, and describes cotton as one of the most important textile fibers in the world, accounting for around 25 percent of total world fiber use. The United States is the world's leading soybean producer and second leading exporter, and comprises about 90% of the United States' oilseed production. The United States is the world's third-largest cotton producer and the leading cotton exporter, accounting for one-third of global trade in raw cotton. The U.S. cotton industry accounts for more than $21 billion in products and services annually, generating more than 125,000 jobs in the industry sectors from farm to textile mill. Weed control experts warn that the problem of glyphosate resistance is increasing, and that significant economic consequences will continue to increase without effective alternatives for weed control. In addition, the use of dicamba, when used as part of a season-long weed management program that includes preemergence (residual) and postemergence (foliar) herbicides, provides a long-term benefit as a tool to delay resistance of other herbicides as well.

Use of dicamba on dicamba-tolerant soybeans and dicamba-tolerant cotton is beneficial as it provides an effective tool to treat especially noxious weeds, such as marestail, giant ragweed, common waterhemp, and Palmer amaranth, including glyphosate-resistant biotypes that threaten soybean and cotton production today. By adding an effective tool to combat glyphosate-resistant and other weeds, dicamba can help reduce this difficult weed pressure and aid significantly in production, reducing economic losses to dicamba-tolerant soybean and dicamba-tolerant cotton growers. In addition, effective treatment of glyphosate-resistant weeds can help control the spread of resistance. EPA finds these benefits significant and important for mitigating production and economic losses for these growers.

After weighing the risks of concern against the benefits of these uses, the EPA finds that when the requested mitigation measures for these uses are applied, the benefits of the use of the pesticide outweigh the risks. Therefore, renewing these registrations will not significantly increase unreasonable adverse effects on human health or the environment. The EPA believes that the overall considerations for benefits for weed management in these important crops support a FIFRA Section 3(c)(7)(B) registration finding for amending the registrations containing these uses.

Therefore, EPA will be extending the registrations for OTT applications of dicamba on dicamba-tolerant cotton and soybeans (EPA Registration Numbers 352-913, 524-617, and 7969-345), with

an automatic expiration date of December 20, 2020. As part of this registration extension, EPA is requiring additional label restrictions as described in Section VII C: Required Label Changes. Because the label changes will further restrict the use of OTT dicamba applications, EPA expects that this registration action will not significantly increase the risk of unreasonable adverse effects to either human health or the environment.

### A. Confirmatory Data

There is uncertainty associated with the existing database for the OTT uses and how they relate to reported incidents in terms of species effects, field conditions, and primary and secondary off-site movement. Non-guideline field studies examining primary and secondary drift off-target reporting direct measurements of height and yield from transects in all four cardinal directions and effects of dicamba-containing agricultural irrigation water on non-target plants are required to address this uncertainty. These studies would better represent expanded geographic areas where high numbers of complaints have been logged and ranges of environmental conditions (e.g., temperature and humidity).

There is an uncertainty in the current analysis as to how well the soybean-based field studies adequately represent reasonable responses of non-target plants to dicamba exposure. Dicamba incidents reported to the agency have indicated alleged plant damage to a broad diversity of plants in ornamental, agricultural and natural landscape settings, and include species of trees, shrubs and perennials. These types of plant growth and life histories are not represented by the data submitted as part of the registrant data for the various dicamba products. Non-guideline ecological effects data on non-target plants (present off the field), including sensitive non-soybean species, are required to address this uncertainty.

Uncertainties exist in the nature of the effect of pH on tank mixtures and the role of pH of the applied tank mix solution to resulting volatility and offsite damage. An analysis of all approved tank mix partners and how they impact the pH of the product would allow EPA to evaluate if this is occurring. Testing including a series of waters designed to mimic the variety of water pH throughout the country, particularly in areas with the largest number of incidents, are necessary in addressing this uncertainty. Therefore, non-guideline studies examining the effect of lower pH on secondary movement both in terms of the spray tank mixture are required to address this uncertainty.

### B. Required Label Changes

The Agency and the registrants have agreed to certain mitigation language to be included on all product labels for dicamba OTT uses on cotton and soybean. This includes both enforceable as well as advisory statements. This new label language supersedes any existing language already on product labels covering the same topics. Any product being used during the 2019 and 2020 growing seasons must contain a label that includes the new mitigation language that is being required in association with the approval of this action. Registrants must ensure that any preexisting language left on labels does not contradict or modify the new mitigation required by this Registration Decision. The specific labeling requirements for dicamba labels are outlined later in this section.

The additional new labeling requirements for dicamba OTT uses includes the following: a limitation on the maximum number of OTT applications of dicamba (two) permitted per field per

year for both cotton and soybeans; a prohibition on OTT spraying of dicamba 60 days or later after planting cotton and 45 days or later after planting soybeans; a time of day restriction limiting OTT dicamba applications to between one hour after sunrise and two hours before sunset; a provision that applications may be made only by certified applicators; equipment clean-out requirements; and an omnidirectional application buffer to protect endangered species from off-target movement of dicamba. These label changes are anticipated to result in a minimal reduction of the flexibility of growers to use dicamba as a tool for resistance management. The required labeling changes are expected to further minimize the potential for off-site movement. However, EPA recognizes the possibility that there may be additional factors which make it difficult to eliminate all off-target movement of dicamba.

*Certified Applicator Provision:*
The new label includes a provision that OTT applications of dicamba to cotton and soybeans may be made only by certified applicators. All dicamba OTT applications are already restricted use, but current labels allow for applications to be made either by a certified applicator themselves or "persons under their direct supervision." This decision removes the allowance for persons under the direct supervision of a certified applicator to make dicamba OTT applications. Because the agency believes that the complexity of the chemistry warrants ensuring that only the most highly trained individuals apply it, individuals who are not themselves a certified applicator may **not** make an OTT application of dicamba, even under the direct supervision of a certified applicator. Given the extensive reports of alleged damage from the off-target movement of dicamba due to failure to follow the label or use the approved OTT dicamba formulation, the Agency has decided that if dicamba OTT applications are to be preserved as a tool for growers, only those individuals with the highest level of pesticide application training may make such applications[7]. Restricting dicamba OTT applications to only certified applicators will increase compliance with label requirements and, in turn, further minimize the potential for off-target movement.

*Limit on Number of OTT Applications:*
Limiting the maximum number of applications permitted of a pesticide will help reduce the number of opportunities for off-target movement from a field to occur. This change does not impact the previously registered preplant uses. In addition, in the case of soybeans, limiting applicators to two OTT dicamba applications represents no change from currently allowed practices. In the case of cotton, however, a maximum of two OTT dicamba applications reduces by 50% the previously allowed maximum of four applications. Because the maximum in-crop, single application amount of dicamba that can be applied OTT to cotton will remain 0.5 lb. a.e. dicamba per acre, the new limit of two OTT dicamba applications for cotton represents a reduction of the maximum allowed total of all post-emergent in-crop applications from 2.0 to 1.0 lb. a.e. dicamba per acre. EPA does not have information on the number of cotton growers that have been making more than two OTT dicamba applications per season. However, with less dicamba allowed to be applied OTT in cotton fields, off-target movement of dicamba from cotton field should be further minimized.

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[7] The Indiana State Chemist reported that 94 percent of the 2018 cases of alleged dicamba damage to non-target areas in Indiana involved OTT applications with documented examples of label violations.

*Days after Planting Spray Prohibition:*
Dicamba OTT applications to large weeds provide incomplete control and speed the development of dicamba-resistant weeds by creating an in-field seedbank born from weeds that have bounced back from a dicamba application. Repeated sub-lethal doses to herbicides are known to promote the development of resistance. For this reason, EPA recommends that dicamba OTT uses be used for early season applications rather than late season rescue treatments. Alternative herbicide tools other than dicamba are available to assist with late season weed control. This decision document adds a prohibition on OTT spraying of dicamba 60 days or later after planting cotton and 45 days or later after planting soybeans. Because the majority of dicamba OTT spraying already occurs within these timeframes, the additional burden on growers is expected to be minimal. For those applications that would have occurred outside these timeframes, when plant coverage is significant and the ability of dicamba to reach the soil is reduced, EPA expects to further minimize the potential for off-site movement.

*Sunrise/Sunset Timing Restriction:*
A revised time-of-day restriction now requires applicators to limit OTT applications of dicamba to at least one hour after sunrise and two hours before sunset. This revision is intended to reduce the possibility of applications being made at times of day when temperature inversions often occur. Inversions can contribute to off-target damage from pesticides by suspending pesticide particles in the air and enabling them to migrate long distances before returning to the ground. All labels with OTT dicamba uses already include advisory language on avoiding inversions and language prohibiting applications between sunset and sunrise. The revised restriction reduces the daily allowed application window by three hours, and is expected to lower the potential for off-target movement of dicamba from physical spray drift but not from volatility. This is because physical spray drift occurs during or shortly after an application is made, while volatility is a secondary transport mechanism that can occur, in the case of dicamba, for days after an application. The new timing restriction will mitigate the scenario of any immediately volatilized dicamba particles entering an inversion during an application but will not lower the possibility of volatilized dicamba particles entering any future inversions occurring over a field after an OTT dicamba application concludes.

*Equipment Clean-out Requirements:*
Poor hygiene practices for maintaining pesticide application equipment used to spray dicamba has the potential to result in cross-contamination. Because even trace amounts of dicamba can cause crop injury, residues that are accidentally left in application equipment can carry over to subsequent applications to non-dicamba tolerant crops. Equipment clean-out instructions are already on dicamba OTT labels. By adding new advisory language on the subject of application equipment hygiene, however, the Agency intends to raise awareness of this issue among applicators by reiterating the risks of even trace amounts left in the equipment and by offering additional techniques to ensure all parts of application equipment are cleaned, thereby reducing the potential for any dicamba incidents caused by improper cleaning of application equipment.

*Endangered Species Buffer:*
As mentioned, the list of new label statements in this dicamba decision includes an Endangered Species Protection Requirement of an omnidirectional infield buffer of 110 feet downwind and 57 feet in the other directions. The previously approved label contains a 110-foot downwind buffer for 0.5 pound active ingredient per acre (220 feet for 1 pound active ingredient per acre

rate) that will remain on the new label. The addition of a 57 foot buffer in the three other directions creates an omni-directional buffer. The purpose of the additional buffer requirements is to protect endangered species that may be near an application site, and, therefore, susceptible to off-site movement of dicamba. To determine if a particular area is subject to the 57-foot omnidirectional buffer restriction, applicators must check Bulletins Live! Two (BLT) prior to making an application. Instructions on how to access Bulletins Live! Two will be included on the label.

*Advisory Language/Best Management Practices:*
In addition to enforceable label language, additional guidance in the form of advisory label language on factors that can influence the potential for off-target movement of dicamba is expected to be beneficial to applicators. Therefore, EPA is requiring new advisory statements as well. The categories of advisory language required for dicamba uses on dicamba-tolerant cotton and soybean include pH, applicator training, and the identification of sensitive areas. A pH statement is being required because dicamba is more prone to volatilization in acidic environments. Factors such as the pH of the soil where dicamba is being applied, the pH water used as a tank mix, as well as the pH of other herbicides or additives used with OTT applications of dicamba can increase the likelihood that dicamba will volatilize and possibly cause off-target damage. The additional label revision is intended to clarify existing dicamba training requirements. Well-trained applicators are less likely to make application errors. By strengthening training requirements for dicamba, the Agency hopes to minimize human error as a cause of potential dicamba off-target movement. Finally, advisory language on the subject of identifying sensitive areas will assist applicators in complying with sensitive area-based buffer restrictions.

***Labeling Requirements for All Dicamba Products Registered for Uses on Dicamba-Tolerant Cotton and Dicamba-Tolerant Soybeans***

New Labeling Requirements for Dicamba OTT Uses:

(1) A maximum number of **two** over-the-top applications of dicamba is permitted per field per year.
(2) In cotton: reduce the maximum allowed total amount of dicamba for all post-emergent in-crop applications from 2.0 to 1.0 lb. a.e. dicamba per acre.
(3) In cotton: OTT applications of dicamba may not be applied 60 days or later after planting.
(4) In soybeans: OTT applications of dicamba may not be applied 45 days or later after planting.
(5) Applications are limited to at least one hour after sunrise and two hours before sunset.
(6) Applications may be made only by certified applicators.
(7) Additional equipment clean-out instructions.
(8) Add an omnidirectional buffer of 57 feet in addition to the downwind buffer in counties where endangered species are present.
(9) Additional advisory to stress the importance of pH in product volatility.
(10) Additional clarifications on training requirements.
(11) General label edits for clarity.

## C. Terms and Conditions of Registration

As part of its decision to extend registrations for OTT uses of dicamba on dicamba-tolerant cotton and soybeans, the Agency will require that registrants meet certain terms as a condition of the registration. These terms will include collecting various data (monitoring, conducting new scientific studies, *etc.*).

EPA has evaluated currently available data from the 2017 and 2018 growing seasons regarding the use of OTT dicamba registrations, but needs to gather additional information as the basis for making an informed regulatory decision regarding any future use of dicamba for the OTT uses on cotton and soybean beyond the 2019 growing season. In addition to new data regarding the environmental fate and effects of dicamba, the Agency is also specifying various monitoring requirements that will aid EPA in assessing both the market for dicamba products registered for OTT uses and the impacts of the new mitigation measures included in this decision. The Agency's new data and monitoring requirements for dicamba are listed below:

*Confirmatory Data:*

1. Field studies examining off-site movement of dicamba.
2. Studies to investigate temperature effects on volatility of dicamba.
3. Ecological effects data on non-target plants, related to survival, growth and reproduction for select sensitive tree/shrub/woody perennial species.
4. Studies examining the effect of lower pH on secondary movement both in terms of the spray tank mixture.

*Monitoring Needs for the 2019 and 2020 Growing Seasons:*

1. Enhanced incident reporting that aggregates reports of potential damage to non-target vegetation.
2. Information concerning dicamba-resistant weeds and cases of weed control failure.
3. Information by state and acres regarding the sales of dicamba tolerant cotton and soybean seed.
4. Information by state and acres regarding sales of product used for OTT dicamba applications.

As noted in Section VII of this decision, extending the registration of dicamba OTT uses for until December 20, 2020 will enable EPA to provide cotton and soybean growers with continued access for at least a limited time for a tool that is important to control glyphosate resistant weeds, while simultaneously collecting additional data on the impacts of this tool and positioning the Agency to be responsive to any new findings. Studying the impact of off-target movement from dicamba OTT applications on high-value specialty crops, as well as privately-owned gardens, landscaping, and orchards is of particular interest to the Agency, because unlike cotton and soybean growers, managers of those types of vegetation do not have the option to purchase protective dicamba-tolerant seed. Finally, by August 2019, USDA information regarding soybean yields from 2018 should also be available, though yield loss due to a particular application's off-target movement will be difficult to determine.

## D. Registration Expiration

Although EPA has determined that the benefits of the continued use outweigh the potential risks, the Agency is requiring expiration dates on EPA Registration Numbers 352-913, 524-617, and 7969-345 that will ensure that the EPA retains the ability to easily modify the registration or allow the registration to terminate if necessary.

Specifically, this registration automatically expires on December 20, 2020, unless the EPA takes further action to amend the registration. It is noted that the original registration also involved a term of registration that acknowledged an expiration of the registration after a five-year period if weed resistance to dicamba developed at a level that the Agency considered unacceptable. Therefore, if this automatic expiration date is amended (in whatever way the EPA determines is appropriate at the time), it shall not be amended to a date later than November 9, 2021, by which date this registration will automatically expire unless the EPA determines before that date that herbicide resistance to dicamba is not occurring at unacceptable frequencies or levels, and also that off-site incidents are not occurring at unacceptable frequencies or levels.

## E. Geographic Limitation of the Registration

The list of states in which dicamba may be used as an OTT application on dicamba-resistant cotton and soybean remains unchanged since the Agency's original registration of this use. Products registered for use as an OTT application of dicamba on dicamba-tolerant cotton and/or soybeans may only to be sold and used in Alabama, Arizona, Arkansas, Colorado, Delaware, Florida, Georgia, Illinois, Iowa, Indiana, Kansas, Kentucky, Louisiana, Maryland, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Virginia, West Virginia, and Wisconsin.