Managing 2,4-D and Dicamba in Enlist™ and Xtend® Soybean

TakeACTION Herbicide-Resistance Management

USE THESE FACTS AND BEST MANAGEMENT PRACTICES FOR SYNTHETIC AUXIN HERBICIDES

Enlist™ and Xtend® traits are engineered to provide resistance to the group 4 synthetic auxin herbicides 2,4-D and dicamba, respectively. These traits allow, for the first time, POST applications for control of broadleaf weeds in soybean and cotton. However, many broadleaf plants are inherently sensitive to 2,4-D and dicamba, and the use of the Enlist and Xtend technologies requires proactive stewardship of the herbicides.

Figure 1. Soybeans that have been damaged by 1/20,000 of a standard use rate of dicamba. Notice the newest trifoliates are distinctly cupped upwards.

Figure 2. Soybeans that have been injured by off-target movement of 2,4-D. Notice the twisted stems and petioles.

Figure 3. Tomato plants damaged by off-target movement of dicamba from a nearby soybean field. ▶

NEED TO KNOW

1. 2,4-D and dicamba are not interchangeable. Enlist soybean and cotton tolerate 2,4-D but are sensitive to dicamba while Xtend soybean and cotton tolerate dicamba but are sensitive to 2,4-D.
2. Enlist Duo® is the only 2,4-D formulation that does not have preplant application restrictions and can be used POST on Enlist soybean and cotton. XtendiMax®, Engenia™, and FeXapan™ are the only dicamba products that do not have preplant application restrictions and that can be used for POST applications to Xtend crops.
3. Most broadleaf plants, including non-2,4-D and non-dicamba tolerant soybean and cotton, tomato, watermelon, and others, are extremely sensitive to low doses of 2,4-D and dicamba (Figures 1-3).
4. The person applying the herbicide is responsible for ensuring that the application is made in accordance to the approved labeling and under allowable weather conditions.
5. To delay the onset of 2,4-D or dicamba resistance in weeds, an integrated weed management program is necessary. 2,4-D and dicamba should not be used as POST-only approaches but as part of an integrated residual and POST-emergence herbicide program. The Enlist Duo, XtendiMax, Engenia, and FeXapan herbicide labels mandate scouting for herbicide non-performance following an application.

BMPs for APPLICATIONS

1. **USE ONLY APPROVED 2,4-D OR DICAMBA HERBICIDE FORMULATIONS** when applying to Enlist or Xtend crops. These formulations are less volatile than older formulations.

2. **READ THE HERBICIDE LABEL.** The Enlist Duo, Engenia, XtendiMax, and FeXapan labels are very specific on application parameters. Each herbicide has supplemental label(s) and updates to the labels will be posted on the product website (Table 1, see back cover).

3. **CHECK THE WEATHER.**

   - **Wind:** The new dicamba formulations will not minimize the risk of physical drift of herbicide droplets due to wind. Enlist Duo, Engenia, XtendiMax, and FeXapan can only be applied when wind speeds do not exceed 15 mph (Table 1).
   - **Rain:** Do not apply XtendiMax or Enlist Duo when rain is forecast within the next 24 hours following application. The rainfast period is 4 hours for Engenia and FeXapan.
   - **Temperature and Humidity:** High temperatures and low humidity favor herbicide volatilization, which can lead to vapor drift. Use only the approved low-volatile dicamba and 2,4-D formulations, and set equipment to produce larger droplets when making applications.
   - **Temperature Inversions:** Avoid making applications during weather patterns that result in stable air masses in which small herbicide particles can become suspended. Applications should not be made when wind speeds are < 3 mph to avoid spraying in an inversion. Inversions typically form near dusk on clear evenings and break up as the sun begins to rise the next morning (Figure 4). Low-lying fog and dew are often present during an inversion.

4. **OBSERVE BUFFERS.** Maintain the proper distance when spraying near sensitive plants that are downwind (Figure 5). Some state regulations on buffer distances are stricter than the EPA's. Applicators must follow the most stringent regulations. When any of the following are immediately adjacent to a treated field, they may be considered part of the buffer:

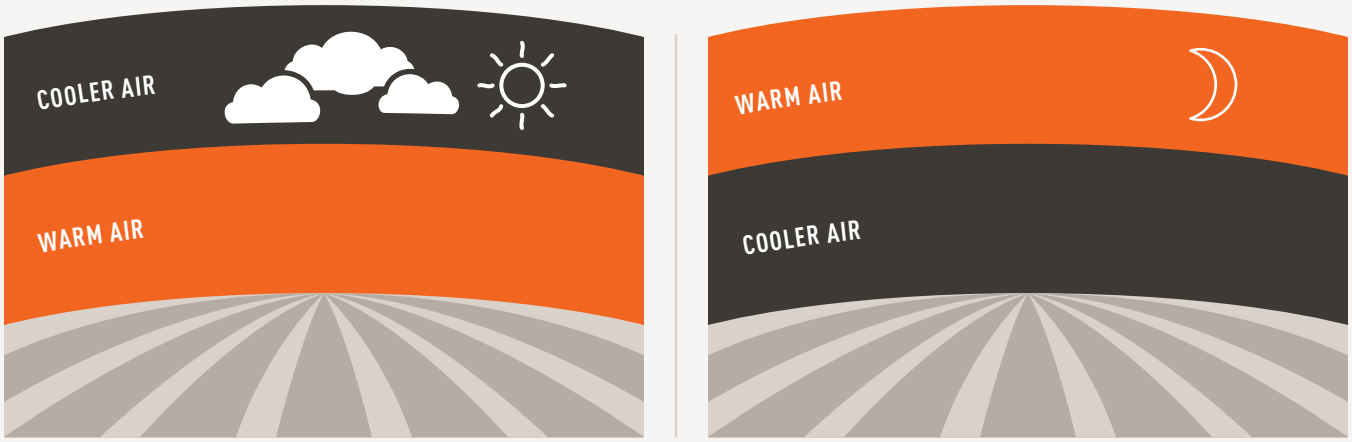
   a. Roads (paved or gravel surfaces)

   b. Fields of corn, sorghum, proso millet, small grains, sugarcane

   c. Fields that are prepared for planting but not yet planted

   d. Areas covered by the footprint of a building or other man-made structure with walls and/or a roof and similarly traited crops

Figure 4. Temperature inversions



NORMAL SITUATION

Indicators:

Wind – produced as warm air rises and mixes with cooler air

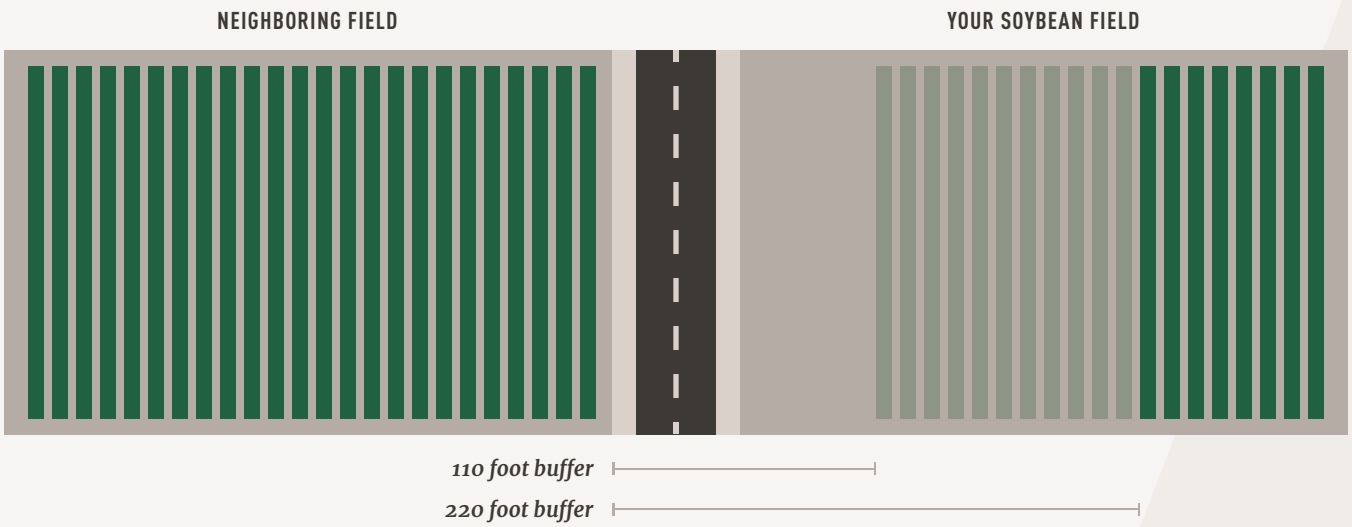
Cumulus clouds – sit atop wind columns

TEMPERATURE INVERSION

Indicators:

Clear night with no clouds, calm air with little to no wind, dew or low-lying fog forms in the morning

Figure 5. For XtendiMax and FeXapan, the buffer between the last treated soybean row and the downwind sensitive area must be maintained as follows: 22 oz/A = 110 foot buffer and 44 oz/A = 220 foot buffer. For Engenia applications, the buffer distance is 110 feet. For Enlist Duo applications, the buffer distance is 30 feet.



5. **BE AWARE OF YOUR SURROUNDINGS.** Many ornamental, vegetable, and tree species are extremely sensitive to dicamba and 2,4-D. It is best to consult with a sensitive crop registry such as driftwatch.org before application. Additionally, Flag the Technology is a quick and inexpensive method to prevent misapplication of dicamba and 2,4-D between neighbors (Figure 6).

6. **ONLY USE APPROVED NOZZLES.** Go online (Table 1) to find approved nozzles that may be used with Enlist Duo, XtendiMax, or FeXapan. Nozzles approved for use with one herbicide may not be approved for use with another.

7. **KNOW TANK MIX RESTRICTIONS.** Go online (Table 1) to find approved adjuvants, drift reduction agents and other herbicides to mix with Enlist Duo, Engenia, XtendiMax, or FeXapan.

8. **MAKE TIMELY APPLICATIONS.** Avoid resistance. Don't spray weeds that are too large.

9. **USE FULL RATES** to delay the onset of resistance. See Table 1.

10. **CLEAN ENTIRE SPRAYER PROPERLY.** With so many herbicide-tolerant traits available, properly cleaning out the spray tank and other sprayer components is necessary to avoid contamination when switching between herbicides and crops. Each label has specific steps for cleaning the sprayer.

Figure 6. Flag the Technology

RED - Signifies conventional varieties with no herbicide technology traits. *Extreme caution.*

WHITE - Represents the Roundup Ready® technology that is tolerant to glyphosate herbicide.

BRIGHT GREEN - Indicates the Liberty Link® technology. This technology is tolerant to glufosinate (Liberty®) herbicide.

BRIGHT YELLOW - Is the color chosen for Clearfield® rice technology and STS® soybean.

TEAL - Indicates tolerance to both 2,4-D and FOP (ACCase) herbicides or the Enlist technology. The white stripes indicate tolerance to glyphosate. For Enlist cotton and soybean fields, a green flag should be added to denote tolerance to glufosinate (Liberty).

BLACK - Indicates tolerance to dicamba herbicide or Xtend technology. The black and white checks indicate tolerance to both dicamba and glyphosate (Roundup). A green flag should be added for cotton to denote glufosinate (Liberty) tolerance.

Table 1

FACTOR	ENLIST DUO	XTENDIMAX /FEXAPAN	ENGENIA
Herbicide formulations	Glyphosate + 2,4-D (Colex D)	Dicamba (DGA salt+VaporGrip®)	Dicamba (BAPMA salt)
GPA	10 to 15 GPA	≥ 10 GPA	≥ 10 GPA
Nozzle types	23 on label	www.xtendimaxapplicationrequirements.com www.fexapanapplicationrequirements.dupont.com	www.engeniatankmix.com
Droplet category[a]	Coarse to extremely coarse	Extremely coarse to ultra-coarse	Extremely coarse to ultra-coarse
Tank mixtures	www.enlisttankmix.com	www.xtendimaxapplicationrequirements.com www.fexapanapplicationrequirements.dupont.com	www.engeniatankmix.com
Wind speed	< 15 MPH	3 to 10 mph (optimal) 10 to 15 mph if all other application requirements are met	0-15 MPH, ensure inversion conditions not present
Sprayer speed	Not applicable	< 15 MPH	< 15 MPH
Boom height above canopy	Nozzle manufacturer recommendation	Not to exceed 24"	< 24"
Environment	30 ft downwind buffer; DO NOT APPLY when wind is blowing toward adjacent commercial-grown fruiting vegetables	110 to 220 ft downwind buffer depending on application rate; DO NOT APPLY when wind is blowing toward adjacent commercial-grown, dicamba-sensitive crop	110 ft downwind buffer; DO NOT APPLY when wind is blowing in the direction of a neighboring specialty crop
Weed size	3 - 6"	< 4"	< 4"
Tank rinsing	Triple rinse	Triple rinse	Triple rinse
Tank cleaner	May be used	Yes	Yes

[a]Specific droplet size has been estimated by author if not specified by company.

DICAMBA

- Minimum rate of XtendiMax, FeXapan, and Engenia applications are 22 oz/A, 22 oz/A, and 12.8 oz/A, respectively.
- Maximum rate per application following soybean or cotton emergence is 22 oz/A of XtendiMax or FeXapan and 12.8 oz/A of Engenia. Total of all in-crop applications on soybean cannot exceed 44 oz/A of XtendiMax or FeXapan and 25.6 oz/A of Engenia. The total in cotton is 88 oz/A of XtendiMax or FeXapan and 51.2 oz/A for Engenia.
- Maximum application for entire year is 88 oz/A for XtendiMax and FeXapan and 51.2 oz/A for Engenia.

2,4-D

- Enlist Duo can be applied at rates from 3.5 to 4.75 pts/A depending on the weeds present and environmental conditions.
- Application cannot exceed 14.25 pt/A per season.

Technical editing for this piece was completed by Mandy Bish, Ph.D., and Kevin Bradley, Ph.D., University of Missouri; and Bill Johnson, Ph.D., Purdue University.

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