

# Using 2,4-D Choline Herbicide Products on 2,4-D-Tolerant Crops<sup>1</sup>

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This publication is an important resource for UF/IFAS Extension agents. It provides specific information on herbicide options and application requirements on newer 2,4-D formulations to the appropriate stakeholders. The publication also provides information to the growers and pesticide applicators for safer use of newer low-volatility formulations of 2,4-D herbicide products on Enlist crops.

Enlist crops are a relatively new herbicide-resistant crop technology that allows the application of 2,4-D choline to Enlist Cotton, Enlist Corn, or Enlist E3 Soybean. Currently, Enlist One and Enlist Duo herbicide products are the only products with 2,4-D choline formulation that are labeled on Enlist Crops because this formulation has very low volatility compared to the traditional 2,4-D formulations, such as amine and esters. Still, the concern with off-target injury to sensitive crops remains. Therefore, the herbicide label should be followed carefully. Proper precautions need to be in place to mitigate injury to sensitive crops. Numerous crops grown in Florida (soybean, cotton, snap bean, peanut, watermelon, cantaloupe, tomato, pepper, blueberry, pecans, etc.) are sensitive to 2,4-D. Care should be taken during planning and herbicide application. Moreover, when using 2,4-D products, it is important to be aware of Endangered Species Act (ESA) and how it may apply. Due to endangered species concerns and current label restrictions, Enlist One and Enlist Duo cannot be applied in numerous Florida counties (Brevard, Broward, Charlotte, Collier, DeSoto, Glades, Hardee, Hendry, Highlands, Hillsborough, Indian River, Lee, Manatee, Martin, Miami-Dade, Okeechobee, Orange, Osceola, Palm Beach, Polk, Sarasota, and St. Lucie Counties).

Auxin herbicides have historically been associated with off-target injury potential. Therefore, the Enlist One and Enlist Duo labels provide details and important information for applying these products safely. This includes information on product selection, application rates, application timing, approved tank-mix partners, approved nozzles and pressure combinations, wind speed and spray application parameters, and sprayer cleanout procedures. Likewise, the Florida Department of Agriculture and Consumer Services (FDACS) Organo-Auxin Rule (“Organo-Auxin Herbicides: Restrictions and

Prohibitions,” <https://www.flrules.org/gateway/ruleno.asp?id=5E-2.033>) outlines the guidelines for using auxin-type herbicide products. This rule must be followed while applying these herbicides. In addition, FDACS has made available the “Suggested Pesticide Recordkeeping Form for Organo-Auxin Herbicides” (<https://forms.fdacs.gov/13328.pdf>) for the pesticide applicators’ use.

## Endangered Species Act, Bulletins Live! Two and Pesticide Use Limitation Areas

The Endangered Species Act (ESA) protects threatened and endangered species as well as their habitat, which can impact the use of certain herbicides, like Enlist One and Enlist Duo. Applicators must consult product labels and access Bulletins Live! Two (<https://www.epa.gov/endangered-species/bulletins-live-two-view-bulletins>) to determine if mitigation measures are required in their specific locations to comply with ESA and any state-level Pesticide Use Limitation Areas (PULAs). The Bulletins Live! Two should be verified within 6 months of application window, and PULAs can vary due to seasonal occurrence and migratory species. Applicators must have bulletin records for 2 years to demonstrate that applications were performed in compliance with label recommendations and Federal regulations.

When using 2,4-D in areas with threatened or endangered species, applicators may need to implement mitigation measures based on a system of points assigned by the U.S. Fish and Wildlife Service to quantify risk. Applicators should check Bulletins Live! Two for details on the mitigation points associated with product use in their local area. Depending on the mitigation points required, steps may include adjusting application rates/timing, establishing buffer zones, using drift-reducing techniques, and conducting pre-treatment surveys.

Implementing the necessary mitigation measures allows applicators to comply with the ESA while still using Enlist

One and Enlist Duo products appropriately. Staying current on the latest mitigation point information through Bulletins Live! Two is crucial, and applicators should confirm specific requirements with wildlife agencies prior to application.

## Herbicide Product Selection and Application

Currently, there are two products containing 2,4-D choline that can be applied on 2,4-D-tolerant crops (Enlist Crops). Enlist One only contains 2,4-D choline, while Enlist Duo contains a premix of 2,4-D choline plus glyphosate. The product selection can be made according to the individual field situation and weed problems. For example, Enlist One does not provide any level of grass weed control, while Enlist Duo does provide grass weed control because it contains glyphosate. Other products containing 2,4-D (2,4-D amine, LV4, 2,4-D ester, etc.) cannot be applied on 2,4-D-tolerant crops (Enlist Crops).

## Tank-Mix Products

There are only certain herbicide or pesticide products that are compatible with Enlist One or Enlist Duo herbicides. Only products recommended in the Enlist One or Enlist Duo label can be safely tank-mixed. If incompatible products are tank-mixed, then it can result in a significant increase of 2,4-D volatility and off-target crop/plant injury. The list of recommended tank-mix products for Enlist One and Enlist Duo herbicides can be found below.

- Enlist One:  
<https://www.enlist.com/en/herbicides/approved-tank-mix/enlist-one-tank-mix-products.html>
- Enlist Duo:  
<https://www.enlist.com/en/herbicides/approved-tank-mix/enlist-duo-tank-mix-products.html>

## Using Ammonium Sulfate

Ammonium sulfate (AMS) is a recommended product for Enlist One or Enlist Duo application. Appropriate AMS products can be used as water conditioning agents. Unlike 2,4-D choline products, **AMS should never be used with XtendiMax, which is a newer dicamba formulation.**

## Buffer Requirement

A minimum of 30-feet downwind buffer to sensitive area/crops is required for Enlist One and Enlist Duo applications. Application swath cannot be initiated within 30 feet of any downwind sensitive areas. Even with the appropriate buffer distance in place, the safe practice to prevent off-target injury is not to spray when wind is blowing towards a sensitive crop.

## Nozzle Selection

Only qualified nozzles should be used with the corresponding pressure ranges for Enlist One or Enlist Duo herbicide applications. The use of unqualified nozzles can result in a higher percentage of driftable particles and cause significant off-target injury. Detailed information on Enlist One and Enlist Duo herbicide allowed nozzles and pressure combinations can be found below. **Note that use of any nozzle not specifically approved and listed on these websites would be considered a misuse.**

- Enlist One:  
<https://www.enlist.com/en/herbicides/qualified-nozzles/enlist-one-tank-mix-products/enlist-one-allowable-nozzles.html>
- Enlist Duo:  
<https://www.enlist.com/en/herbicides/qualified-nozzles/enlist-duo-tank-mix-products/enlist-duo-allowable-nozzles.html>

## Boom Height

In the presence of wind, increased boom height increases the travel distance for a spray droplet. Higher boom height can increase the potential for drift. With appropriate boom height, the droplet is less likely to travel longer distances, thus reducing drift potential. A maximum boom height of 24 inches above the target weed/crop canopy is recommended for applying Enlist One or Enlist Duo herbicides.

## Wind Speed and Direction

Even though the Enlist One and Enlist Duo herbicide labels include a maximum wind speed of 15 mph, it is essential to pay close attention to wind speed and direction requirements for the Florida Organo-Auxin Rule. The Florida Organo-Auxin Rule prohibits application of synthetic organo-auxin herbicides (such as 2,4-D, dicamba, etc.) if wind is blowing towards sensitive crops at the speed/gusts above 10 mph (FDACS 2021). At higher wind speed, spray droplets can move longer distances and increase drift potential.

## Temperature Inversion Condition

Enlist One and Enlist Duo herbicides should never be sprayed if low-lying temperature inversion conditions exist. Spraying during temperature inversion conditions poses significant risk for off-target herbicide movement and crop injury. Cool conditions near the ground, a low-lying layer of fog, or presence of dew represent temperature inversion conditions. The temperature inversion condition is usually common during early morning or the later part of the day but can also occur during the afternoon.

## Sprayer Cleanout

After applying Enlist One or Enlist Duo herbicide, the sprayer should be thoroughly cleaned following the triple-rinse procedure outlined in the label or the Enlist Product Use Guide. The entire sprayer, including tank, boom, hoses, connections, nozzles/screens, etc., should be cleaned properly to avoid spray contamination. If another tank-mixed product has a more stringent sprayer cleanout requirement, then follow that procedure. Do not let herbicide solution sit in the sprayer overnight or for extended hours.

## Management of Runoff

Enlist One and Enlist Duo require applicators to assess soil, slope, and weather to adjust application practices and minimize runoff. Applicators must plan applications so there is at least a 48-hour period before rain or irrigation, and implement measures earning at least 4 or 6 credit points, depending on whether the land falls in Hydrologic Soil Groups (HSG) A/B or C/D, to reduce off-field impacts.

## Recordkeeping

According to the FDACS Organo-Auxin Rule, recordkeeping is mandatory for two years for synthetic organo-auxin herbicides if applied to more than five acres in a 24-hour window (this is a common scenario for crop field applications). The recordkeeping should contain the information outlined in the rule, which can be found below.

- FDACS Organo-Auxin Rule:  
<https://www.flrules.org/gateway/ruleno.asp?id=5E-2.033>
- FDACS Suggested Pesticide Recordkeeping Form for Organo-Auxin Herbicides:  
<https://forms.fdacs.gov/13328.pdf>

## References

- Corteva AgriScience. 2021. "Enlist™ Weed Control System—2021 Product Use Guide." Accessed June 23, 2022.  
<https://www.enlist.com/content/dam/dpagco/enlist/na/us/en/files/fact-sheets/DOC-Enlist-PUG-NA-US.pdf>
- FDACS. 2021. "5E-2.033 Organo-Auxin Herbicides: Restrictions and Prohibitions." *Florida Department of State Florida Administrative Code & Florida Administrative Register*. Accessed June 23, 2022.  
<https://www.flrules.org/gateway/ruleno.asp?id=5E-2.033>

Table 1. Information on Enlist One and Enlist Duo herbicide rate and application timing on Enlist crops.

Herbicide Active Ingredient (Trade/Product names)	Mode of Action Group (MoA)	Application Rate per Acre (Total per Acre/season or year)	Reentry Interval (REI)	Specific Comments/Remarks
<b>Enlist Corn</b>				
2,4-D choline (Enlist One)	4	1.5–2 pt/A (6 pt/A)	48 hours	<p>Single application can be made any time before or after planting (but prior to corn emergence) as preplant (burndown).</p> <p>Up to two POST applications can be made with at least 12 days between applications.</p> <p>Do not apply on top of corn that is larger than V8 growth stage or greater than 30 inches tall, whichever occurs first. When corn plants are 30–48 inches tall and free standing, use only ground equipment with drop nozzles positioned to avoid spraying directly into the whorl of the plants.</p> <p>Do not apply within 30 days of forage harvest.</p>
2,4-D choline + glyphosate (Enlist Duo)	4 + 9	3.5–4.75 pt/A (14.25 pt/A)	48 hours	<p>Single application can be made any time before or up to 5 days after planting (but prior to corn emergence) as preplant (burndown).</p> <p>Up to two POST applications can be made with at least 12 days between applications.</p> <p>Do not apply on top of corn that is larger than V8 growth stage or greater than 30 inches tall, whichever occurs first. When corn plants are 30–48 inches tall and free standing, use only ground equipment with drop nozzles positioned to avoid spraying directly into the whorl of the plants.</p> <p>Do not apply within 50 days of forage harvest.</p>
<b>Enlist Cotton</b>				
2,4-D choline (Enlist One)	4	1.5–2 pt/A (6 pt/A)	48 hours	<p>Single application can be made any time before or after planting (but prior to cotton emergence) as preplant (burndown).</p> <p>Up to two POST applications can be made with at least 12 days between applications.</p> <p>Apply any time after cotton emergence but no later than first white bloom.</p> <p>Do not apply within 30 days of harvest.</p>
2,4-D choline + glyphosate (Enlist Duo)	4 + 9	3.5–4.75 pt/A (14.25 pt/A)	48 hours	<p>Single application can be made any time before or after planting (but prior to cotton emergence) as preplant (burndown).</p> <p>Apply any time after cotton emergence but no later than first white bloom.</p> <p>Up to two POST applications can be made with at least 12 days between applications.</p>
<b>Enlist Soybean</b>				

Herbicide Active Ingredient (Trade/Product names)	Mode of Action Group (MoA)	Application Rate per Acre (Total per Acre/season or year)	Reentry Interval (REI)	Specific Comments/Remarks
2,4-D choline (Enlist One)	4	1.5–2 pt/A (6 pt/A)	48 hours	Single application can be made any time before or after planting (but prior to soybean emergence) as preplant (burndown).  Up to two POST applications can be made with at least 12 days between applications.  Apply any time after soybean emergence but no later than R1 growth stage.  Do not apply within 50 days of harvest.
2,4-D choline + glyphosate (Enlist Duo)	4 + 9	3.5–4.75 pt/A (14.25 pt/A)	48 hours	Single application can be made any time before or after planting (but prior to soybean emergence) as preplant (burndown).  Up to two POST applications can be made with at least 12 days between applications.  Apply any time after soybean emergence but no later than R1 growth stage.  Do not apply within 50 days of harvest.

Mitigation Measures			Credits
Reduce number of applications—Reduced number of applications of Enlist products per year. Applications may be made at any time during crop development but must maintain a minimum 12-day retreatment interval.	3 applications	0	
	2 applications	2	
	1 application	4	
Residue Tillage Management: no-till, strip-till, ridge-till, and mulch-till			4
Vegetative Filter Strips	30 ft off-field vegetative buffer on down slope	HSG A or B*	2
		HSG C or D	0
	100 ft off-field vegetative buffer on down slope	HSG A or B	4
		HSG C or D	1
Field border: border with dense vegetative stands with a minimum width of 30 ft.			2
Cover Crop			2
Vegetative Barrier: Permanent strips of dense vegetation along the contours of the field with a minimum width of 3 ft			2
Contour Buffer Strips or Terrace			2
Grassed Waterway			2
Water and Sediment Basin			1
Contour Farming or Contour Strip Cropping			1
*Hydrologic Soil Group (HSG) definitions: A = Sand, loamy sand, or sandy loam; B = Sandy clay loam; C = Silt loam or loam; D = Clay loam, silty clay loam, sandy clay, silty clay or clay.			
Source: Adapted from Enlist One and Enlist Duo labels.			

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