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## Spray equipment operation for emerging herbicide technology

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Weed resistance to herbicide is prompting applicators to consider using a broader spectrum of herbicides. Reassessing use of existing herbicides and shifting away from predominant use of a single herbicide such as glyphosate is a sort of “back-to-the-future” approach as long-time applicators and those involved with crop production reacquaint themselves with application requirements of other products. Opportunities for confusion exist as label requirements have changed for variations of once familiar products.

Use of pre-emerge herbicides with residual control is encouraged to provide early weed management rather than relying on timely ability to spray smaller weeds postemergence. An alternative approach with GMO herbicide-resistant seeds is use of glufosinate (e.g. LibertyLink products). Glufosinate’s contact mode-of-action suggests use of smaller ‘medium’ spray quality droplets, rather than coarse or larger size droplets commonly used to balance drift with efficacious weed control with a wide range of systemic herbicide products.

Additional GMO herbicide-resistant crop technology is on the horizon using dicamba and 2,4-D (i.e., Engenia, Xtend, Enlist) pending EPA regulatory approvals for dicamba products and Chinese import approval of GMO Enlist crop. Use of a growth-regulator, systemic type herbicide suggests cautious application using larger droplets, but as with all products selection of droplet size (spray quality) needs to be balanced with efficacious weed control.

Rapidly changing weed management strategies in response to herbicide resistance has the potential for rapid adoption of new products, but comes with new application requirements that differ from older familiar formulations (e.g., dicamba and 2,4-D).

An Enlist Duo (glyphosate and 2,4-D) label is currently available, but labels for new Engenia and Xtend dicamba products have not been published as of this writing. As applicators know, “the label is the law”. At this time application requirements can only be anticipated with guidance from a *suggested* label for new dicamba technology used for discussion and the Enlist Duo label that is currently available. The final dicamba labels may have different requirements.

### Read the label

*Applicators are cautioned to refer to the final published applicable label for instructions on specific products following regulatory approval.* Points discussed below are based on a suggested label used for discussion with Xtend, discussion of potential label guidelines for Engenia, and the current Enlist Duo label. Actual application requirements for new dicamba-resistant technology awaits EPA label release.

Specific sections to review on any label are frequently headed with terms such as application equipment, application methods, and drift management. Expect to see more specific requirements on spray quality and approved nozzle types (including sizes and range of operating pressures), along with boom height, sprayer sanitation (cleanout), and acceptable tank additives (herbicide products, adjuvants, AMS, etc.). Other application aspects such as weather conditions, application rate, buffer requirements, and travel speed may also have more specific restrictions than were on labels of earlier products.

## Nozzles

Applying a range of herbicide products will almost certainly require more than a single type and size of nozzle to comply with label requirements. Keys to nozzle selection are determining desired nozzle flow rate (gal/min) from application rate (gal/acre, from label) and travel speed (equation 1), and then matching desired flow rate with spray quality (e.g., medium, coarse, extra coarse, etc.).

$$\text{gal/min} = \frac{(\text{gal/acre}) \times (\text{speed, mi/h}) \times (\text{nozzle spacing, in.})}{5940} \quad (1)$$

The second step of matching desired spray quality with correct output of the nozzle at a given pressure is important. As an example, many different nozzles (by type and size) can deliver 0.40 gal/min, but only a portion of them deliver coarse spray quality at this flow rate and pressure.

Because sprayer travel speed will likely vary in the field due to soil or weather conditions, take time to check speed effects to determine maximum and minimum operating pressure and the resulting spray quality from the nozzle at these pressures. Coarse spray quality acceptable according to the label at a lower travel speed can become unacceptable medium or fine spray quality as the controller increases boom pressure for faster travel speed when covering more acres per hour are desired.

Use of new dicamba GMO resistance technology is expected to require TTI (Turbo Teejet Induction) nozzles with ultra or extremely coarse spray quality, at least until other nozzles can be tested for approval. Spray quality with these nozzles is extremely or ultra coarse, but the large droplets provide weed control with the herbicide product while reducing the fraction of small, drift-prone droplets to a minimum.

Conversely, labels of products including glufosinate frequently suggest using much smaller “medium” spray quality droplets. This spray quality is commonly found with regular or some chamber- or preorifice-style flat fan nozzle tips, but spray quality at specific tip size and operating pressure should be checked. Specific nozzle tip styles and sizes from several manufacturers are listed as acceptable choices on the Enlist Duo label, but with specific maximum allowable operating pressures for each nozzle choice.

## Boom height, travel speed, buffers, weather conditions

Maximum boom height above the target crop canopy may be specified. Keeping boom height roughly the distance of nozzle spacing along the boom or no greater than 24 in. above the target area helps eliminate drift potential while maintaining nozzle overlap.

Maximum travel speed (e.g. 15 mi/h) may be specified to ensure spray coverage and deposition. Buffer zone distances and locations may be specified. These may be related to specific sensitive areas, and specify general avoidance with no application if wind is blowing toward adjacent commercially grown sensitive crops such as tomatoes, grapes, cucurbits (squash, pumpkins), or an orchard.

Beside maximum wind speed, specific guidance on a minimum speed may be given as well as avoiding temperature inversions. Increased droplet size may be recommended on the label during periods of low relative humidity and warm air temperature (to compensate for evaporation effects).

## Sprayer sanitation, tank additives

Equipment sanitation and cleanout is another key strategy to avoid damage to non-herbicide tolerant crops. Label directions may include steps similar to the following.

Drain the sprayer and don't leave product in the sprayer overnight. Use a preliminary flush with clean water and inspect filters (strainers, screens, etc.). Follow with use of a commercial detergent, sprayer cleaner, or ammonia solution to triple rinse the system. Allow 15 minutes with agitation for each tank rinse, and at least one minute for lines and other plumbing during each rinse. Remove and clean nozzles and filters separately after triple rinsing. Drain the entire system (tank sump, filters, lines) before a final rinse with clean water. Small dicamba concentrations have potential to produce visual plant symptoms, so consider rinsing off external parts of the sprayer chassis that may touch plants.

Tank additives such as other herbicide products and adjuvants (including drift-control adjuvants) should not be used unless specified on the label. Adjuvants do not have a uniform droplet size effect on all pesticide solutions and are being individually tested with newer GMO herbicide-resistant technology. It is anticipated that ammonium sulfate (AMS) will not be allowed to be mixed with new dicamba technology (due to potential effect on product vapor pressure).

### **What to do?**

Allocate time during the winter off-season to assess potential herbicides that may be used next spring and *consult the label for application requirements*. Pay particular attention to GMO-linked herbicide use for new product technology or any products that you may be unfamiliar with.

Determine what type and size of nozzles will be required and check your existing nozzle inventory before purchasing. Don't forget to check the effect of slower or faster travel speed on operating pressure and resulting spray quality of the nozzle selected for each application.

Don't assume that application requirements will mimic those of glyphosate or other herbicide products with which you've had long-time experience. Recognize that newer versions of dicamba and 2,4-D product formulations have more specific application requirements than older versions of similar products. Also, substituting older versions of similar products will not only be off-label in many cases, but also potentially creates other problems in terms of crop injury, offsite drift potential, and pesticide residue affecting preharvest or preplant intervals and worker protection. Long-term availability of products will depend on stewardship by all in the application industry (crop advisors, farm managers, technical representatives, extension, along with applicator operators).