Drift Reduction Adjuvant Response to Shear

Shear and Drift Reduction Adjuvant Performance

Drift Reduction Adjuvants (DRAs) are designed to reduce the number driftable spray droplets in an application. When applying new dicamba herbicides, some tank-mix partners require the addition of a DRA to minimize the risk of off-target movement. These DRAs were tested under a protocol that did not subject the spray solution to shear. Research has shown that repeated exposure to a high-shear environment will likely induce the degradation of polymeric drift reduction adjuvants and reduce drift reduction performance.[1]

WinField® United DRA Shear Testing

To determine the effects of shear-stress on polymeric adjuvants, WinField® United applied a shearing condition to three different adjuvants, two polyacrylamide based products and one polysaccharide based product. Solutions of dicamba plus glyphosate alone, and with each one of the three adjuvant samples were subjected to the same testing protocol. Each of the four solutions were circulated through a gear pump, and samples were removed after 0, 10, 25 and 50 times through the pump. All samples were then tested in the WinField® United Spray Analysis System to determine the volume fraction of driftable droplets from each treatment. A dicamba sample was also tested but only after 0 iterations through the gear pump to provide a baseline.

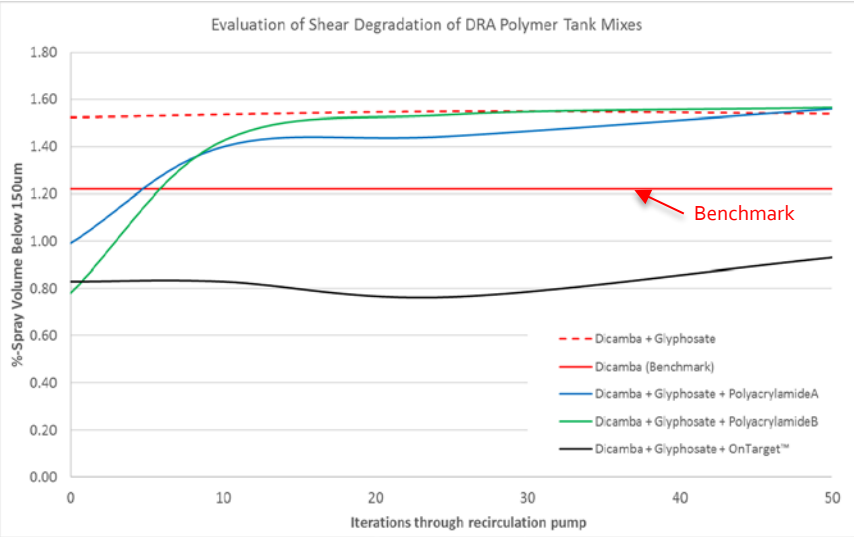


Figure 1.

Not all DRAs were resistant to effects from shear forces.

In Figure 1, the results show that after 10 iterations through the gear pump, both polyacrylamide adjuvants no longer reduced driftable droplets to a level at or below when applying dicamba alone. After 25 iterations through the pump neither polyacrylamide adjuvants provided a reduction of driftable droplets compared to the dicamba plus glyphosate alone treatment. In comparison, the polysaccharide DRA, OnTarget™, provided fine droplet reduction compared to dicamba alone after 50 iterations through the pump.

Not all products shear equally

Using an adjuvant that is more susceptible to shear increases the risk of off-target movement of the spray solution. This study demonstrates that the polysaccharide tested, OnTarget™, was more resistant to shear than the other two polyacrylamides tested. Before using a DRA with new dicamba herbicide applications, it is important to understand that products are susceptible to degradation from shear forces. A product that is more susceptible to degradation may not be delivering any driftable droplet reduction after exposure to the recirculation pump. It is important to use a DRA that is more resistant to high shear forces to reduce the risk by reducing driftable fines and the potential for off target movement.

Shear Forces Occur in Ground Sprayers

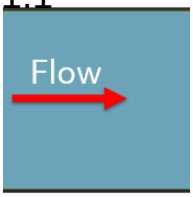
Strong shear forces can occur in ground sprayers. Anytime the spray solution is moves around, past, or through a stationary part or piece of the sprayer plumbing, there are shear forces within the fluid. Specifically, this can occur in the sprayer hoses, the metering ball valves and even the nozzles. Some of the strongest shear forces occur in the sprayer pumps.

Shear Force

Shear is a planar force that causes an internal strain in a substance. This occurs when layers of the substance move in relation to each other. In other words, it is caused by non-uniform motion of a substance. For example: picture a fluid flowing through a pipe, the fluid in the middle is moving the faster than the fluid very close to the side of the pipe. The difference in these velocities creates a region that may deform or even break structures in the fluid due to the shear environment.

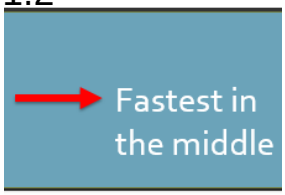
Shear Example

1.1



A DRA moving through a pipe

1.2

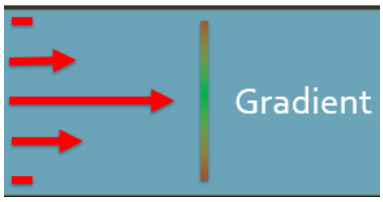


The DRA is moving fastest in the middle of the pipe

1.3

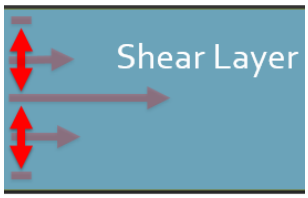
As you move closer to the walls of the pipe the DRA slows down. Very close to the wall the DRA is not moving at all.

1.4



This creates a gradient – the fluid in the middle is moving fast and the fluid at the walls is not moving at all.

1.5



This gradient creates a shear environment where the DRA structure could deform or even break.