AUXIN HERBICIDES AND SPRAYER CLEANOUT

Auxin herbicides applied to auxin-resistant crops offer new control options for producers who are battling glyphosate-resistant (GR) weeds. However, when using one spray apparatus to apply auxin herbicides to auxin-tolerant crops and non-auxin herbicides to auxin-susceptible crops, it is imperative that the spray rig is thoroughly cleaned after applying auxin herbicides.

Drs. Gary Cundiff, Dan Reynolds, and Thomas Mueller published a paper in the Mar.-Apr. 2017 issue of *Weed Science* Journal entitled "Evaluation of Dicamba Persistence among Various Agricultural Hose Types and Cleanout Procedures Using Soybean as a Bio-Indicator" that provides results from research that was conducted to address this issue. Major points in the conduct of this research and pertinent findings are presented below.

Synthetic rubbers, synthetic plastic polymers [polyvinyl chlorides (PVC)], polyurethane blends, and polyethylene blends are the component materials of today's agricultural spray hoses.

The objective of the research reported in the above article was to evaluate the sequestration potential of dicamba by five agricultural hose types when cleaned with different procedures. Rinsate resulting from the cleanout processes was applied to auxin-susceptible soybean as a bio-indicator of the effectiveness of the cleanout.

Field studies were conducted in 2012-2015 using the auxin herbicide dicamba (Engenia).

Five different hose types were used: 1) John Deere PMK 4131-08 [yellow/PVC]; 2) John Deere PMA 4086-08 [blue/polyethylene blend]; 3) John Deere PMA 1687-08 [green/PVC/polyurethane]; John Deere PMA 1628-08 [gray/PVC/polyurethane blend]; and 5) Goodyear hose [black/Versigard synthetic rubber].

Three cleanout procedures were used–water, ammonia, and no-cleanout.

For the soybean analysis, spray lines were filled with dicamba spray solution and left to equilibrate for 48 hours. The spray solution was then flushed from the lines and the hoses were cleaned with one of the above three cleanout processes to simulate an actual in-field cleanout. The cleaning solution was then left to equilibrate in the hoses for 24 hours. After 24 hours, the cleaning solution was flushed from the lines and they were left empty for 48 hours. The spray lines were then filled with glyphosate and left to equilibrate for 48 hours. After the 48-hour equilibration period, the glyphosate spray solution was sprayed on GR soybean that was at the R2 stage of development. Hoses were used for the same treatment from one year to the next for the entire study period.

Visual estimates of soybean injury were recorded at 7, 14, 21, and 28 days following the application [DAT] of the glyphosate spray solution. Visual determinations of chlorosis, necrosis, stunting, leaf cupping, epinasty, and plant height reduction were used to estimate injury to soybean compared to an untreated check. Soybean yield from all treatments was measured and yield reductions in the treatments were calculated. Scanning electron microscopy was used to analyze each hose type that was used throughout the experiments, and comparisons were made to hoses of the same type that had not been used.

A summary of the results follow.

Cleanout of hose systems with both water and ammonia significantly reduced visual injury to soybean compared to the no-cleanout. Cleanout with both water and ammonia resulted in statistically equal reduction of visual injury [cleanout with both resulted in near-zero visual injury to soybean].

Rinsate from the blue hose type caused the least visual injury [≤2%] on all rating DAT. Rinsate from the black and green hose types caused the greatest visual injury to soybean at all rating DAT. Thus, the blue hose type showed the greatest potential to decrease sequestration of dicamba following its use.

Rinsate from the blue hose type resulted in the least [≤5%] height reduction at 21 and 28 DAT. Rinsate from the black and green hose types resulted in the most plant height reduction on those DAT.

Rinsate from the blue hose type caused a 7% reduction in yield averaged over all cleanout procedures [note that this average includes the rinsate from the no-cleanout procedure]. It is assumed that since the water and ammonia cleanout procedures significantly reduced injury to soybean compared to no-cleanout that the soybean yield reduction resulting from blue hose rinsate application would have been below this 7% average.

The blue hose type sequestered the least dicamba [<1 ppmv] of all the hose types following cleanout. The other hose types sequestered from ~5 to >10 ppmv dicamba following cleanout with water or ammonia.

The SEM analysis revealed that the blue hose type [with a polyethylene core] had the smoothest internal surface of all the hose types, and this likely resulted in its having the least retention potential of dicamba after rinsing.

Conclusions from this research follow. 1) A no-cleanout procedure will result in visual injury to and height reduction of soybean regardless of hose type. 2) Using either water or ammonia for cleanout of dicamba from the hose system will reduce injury to soybean when the sprayer is used to apply non-auxin herbicides to auxin-susceptible soybean. 3) The blue hose type with its smooth internal surface showed the least retention of dicamba following cleanout. 4) Rinsate from the blue hose type showed the least visual injury to and height and yield reduction of soybean and the lowest analyte retention after cleanout. 5) These results suggest that a polyethylene hose type may facilitate a more thorough cleanout following dicamba use prior to using the same sprayer system to apply other herbicides to auxin herbicide-sensitive crops.

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