Integrated Pest Management
University of Missouri

June 2017

Integrated Pest & Crop Management

Mizzou Pest Management Field Day
on July 7th to Include Many Weed Management Topics

by Mandy Bish

The annual Mizzou Pest Management Field Day will be Friday July 7th at the Bradford Research and Extension Center, approximately 8 miles east of Columbia, Missouri.

Registration will begin at 8:00 a.m. with opening comments by Dr. Kevin Bradley at 8:30. The morning will include guided wagon tours with stops that feature presentations of research results by university-trained scientists.

Weed management research topics that will be discussed this year include weed seed contamination in commercial mixes; stewardship of dicamba; and the integration of cover crops in soybean production. The guided tour will also include a variety of research results and topics pertaining to the management of herbicide-resistant weeds such as studies on harvest weed seed destruction techniques, comparisons of new herbicide-resistant soybean systems, and many other topics.
Malynda O'Day sorts weed seed out of commercial seed mixes

Undergraduate Malynda O'Day sorts weed seed out of commercial seed mixes; seed mix contamination is one topic that will be discussed at the 2017 Mizzou IPM Field Day.
tomatoes with dicamba injury

Fresh market tomatoes with dicamba injury; the ongoing discussion of stewardship of dicamba will continue at the 2017 Mizzou IPM Field Day.

Lunch will be served at noon after which attendees will have the opportunity to view plots that showcase a variety of herbicide treatments and weed management programs for use in corn, soybean, or grain sorghum. These plots will be clearly labeled and mapped out so that they can be viewed easily.

Registration for the field day will be $10.00 to cover cost associated with lunch and refreshments.

To register call 573-884-7945 or send an e-mail to chismt@missouri.edu by Thursday, June 29th.

For certified crop advisors, CEU credits are pending.

The Bradford Research and Extension Center is located at 4968 Rangeline Road, Columbia, MO 65201. To learn more about the largest plant sciences' research farm in the state of Missouri visit the Web site: Bradford.cafnr.org.

To learn more about Mizzou Weed Science, visit the Web site at www.weedscience.missouri.eduor find us on Facebook and Twitter at Mizzou Weed Science.

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In This Issue

Cleanout and upkeep of the sprayer: don't get complacent

by Peter C. Scharf

The availability of dicamba-tolerant soybean this season increases the need for emphasis on proper maintenance and thorough cleanout of the sprayer system between applications; especially POST applications. The likely introduction of additional herbicide-tolerant traits in the future indicates that sprayer maintenance and cleanout will continue to be an essential focal point to avoid tank contamination and injury to subsequently sprayed crops.

One specific concern about dicamba and 2,4-D in the spray tank is that although they are water soluble, similar to glyphosate, they act as weak acids and require more effort and care in effectively being removed from the spray tank. Additionally, glyphosate is very effective in dissolving remnant dicamba residue left in the sprayer.

So the scenario in which: dicamba is in the spray tank and applied, followed by improper cleanout of the sprayer, followed by glyphosate being added to the tank and then applied to non-dicamba soybean; is likely going to result in injury to the non-dicamba tolerant soybean.

It is not just about the tank

Overall sprayer maintenance and cleanout is important. Researchers at Mississippi State University recently published results where they studied combinations of spray line types and cleanout practices to determine which were most likely to perform best and leave the least amount of dicamba residue to contaminate subsequent spray mixes. They compared 5 types of hose (Table 1). Dicamba and glyphosate were added to each hose. The hoses were drained and cleaned with either water or an ammonia solution or not cleaned at all for comparison. The researchers found that the type of hose mattered more than whether ammonia or water was used for cleaning. The black, Goodyear hose retained the most dicamba regardless of the cleanout procedure used. Amounts of dicamba in the Goodyear hoses were similar between the ammonia rinse and no cleanout and only slightly less with water. The John Deere blue, low-density polyethylene hose held the least amount of dicamba at less than 1 ppm when washed with either water or ammonia. Detectable dicamba in the other three hoses fell in between the Goodyear and John Deere polyethylene blend, and detected levels did not change regardless of whether ammonia or water was used for cleaning the tank. The scientists cut open the tubes following the experiments to look at wear and tear on the inside of the lines using a specialized microscope. As might be expected, the black Goodyear hose had the most wear and tear over the three years of the experiments and the polyethylene hose had the least.

Table 1: Node reduction (%) on non-dicamba tolerant soybean plants treated with glyphosate from a tank that had previously been filled with dicambaa

Tank Cleanout Procedure Used Following a Tank Mix of Dicamba + Glyphosate and before Glyphosate Alone was Added and Applied

% node reduction compared to non-treated plants on non-dicamba soybean following application of glyphosate from the same tank that initially had a dicamba + glyphosate tank mix

Hose type	Hose description	Water Only	1%V/V Ammonia	No cleaning
John Deere PMK 4131-08	Yellow/PVC/high tensile strength yarn/1 ply	6%	5%	33%
John Deere PMA 4086-08	Blue/linear low-density polyethylene blend	7%	11%	14%
John Deere PMA 1687-08	Green/PVC/polyurethane/high tensile strength yarn/2 ply	27%	14%	43%
John Deere PMA 1628-08	Gray/PVC/polyurethane blend/high tensile strength yarn/2 ply	2%	17%	35%
Goodyear	Black/Versigard synthetic rubber	33%	32%	45%

[a]Table adapted from Cundiff et al. 2017 Weed Science 65:305-316

But what does all this mean?

The wear and tear in the hoses provides opportunity for dicamba to settle and escape cleaning. We know from some of our earlier research that it only takes a very small amount of dicamba to injure non-tolerant soybean so any time there is dicamba left in any of the sprayer parts prior to spraying non-dicamba tolerant crops, it is concerning. The Mississippi State researchers who conducted the spray line study added glyphosate to the spray lines following cleanout and then sprayed non-tolerant soybean to represent a subsequent, sensitive crop. They found that soybean node reduction (Table 1) seemed to be affected by the amount of dicamba detected in the lines following cleanout. The more dicamba detected in the lines, the less nodes on the subsequently, sprayed non-tolerant soybean and consequently less yield.

This study emphasizes proper maintenance and cleanout of the spray lines, especially following application of dicamba and 2,4-D, is just as important as maintenance of the entire tank. Last year we surveyed over 2,300 pesticide applicators in Missouri. Of applicators willing to share information on spray tank inspection and cleanout, over 69% responded that they inspected spray parts a minimum of once per week although only about 60% of those who regularly check said they inspect spray lines. Approximately 48% of respondents indicate they clean the spray tank three times following application of one herbicide and prior to mixing another herbicide. These procedures may have worked fine in recent years when applying glyphosate over large acreages; however, from now on we need to improve our alertness and effort in caring for the sprayer in order to minimize off-target herbicide injury to soybean. In addition to the spray tank and lines, it is equally important to check the inductor, endcaps, nozzles, and filters for particulates.

Consider your Neighbor this Spray Season

by Kevin Bradley and Brian Dintelmann

As we move into that part of the season where post-emergence herbicide applications are commonly made in soybean, it's important to remember the effects that off-target movement of herbicides can have on others around you. And this year, for the first time ever, we will be able to legally apply dicamba (in the form of Xtendimax, Engenia, or Fexapan) to Xtend-traited soybean.

Unfortunately last season we learned a lot of lessons about off-target movement of dicamba the hard way. We can't afford to have this happen again. I'm only aware of a few incidents of off-target movement of dicamba that have been reported in Missouri so far, but numerous reports of off-target movement of dicamba have been coming in from states south of us. And often whatever issue happens in those states tends to find its way north a few weeks later.

So just before this major post-emergence herbicide "push" occurs, all I intend to do here is briefly remind our Missouri applicators of a few highlights about this technology that we taught throughout the winter months:

- **This technology is unlike anything we've ever done before.** It's not like Roundup Ready. It's not like Liberty Link. There are very specific application requirements that must be followed, and these are unlike anything we've ever had with any other technology. Each of the approved dicamba herbicides (Xtendimax, Engenia, and Fexapan) have specific websites that are an extension of the label and provide detailed information on the legal rates allowed, tank mix partners, tank clean out procedures, environmental conditions at application (wind, temperature, etc.), nozzles, ground speed, and buffer distances. Study these labels and websites before making any applications. Also, another reason this technology is unlike anything we've ever done before is because dicamba can injure other plant species at extremely low rates. Treat it accordingly. Treat it with kid gloves at least until you know you can do it correctly. I have had a lot of people question and disagree with me on those statements. The response is often, "We've been spraying dicamba in corn for decades." That's true. But we haven't been spray-

A garden in close proximity to a soybean field treated with dicamba. These tomatoes are showing characteristic signs of dicamba injury.

An ornamental tree bordering a field that was sprayed with dicamba approximately 3 weeks before this photo was taken.

Soybean without the Xtend trait can be injured by fractions of the normal use rate of dicamba if off-target movement occurs.

ing dicamba in June and July on soybean. And we haven't been spraying as much of it as we have the potential to spray right out of the gate on Xtend soybean in its first year of release.

- **The dicamba products are not going to kill large weeds** (like Palmer or waterhemp) in soybean, and the Xtend system shouldn't be viewed as the next answer to all our weed management problems. In fact, the most common report I've heard or seen about dicamba so far this season is a failure to control weeds like horseweed, Palmer amaranth or waterhemp. This herbicide is very sensitive to weed size. You must be spraying your pigweeds when they are less than 4 inches in height. These dicamba products will not be a viable solution for "escaped" waterhemp sticking above the soybean canopy in July. This technology is another tool in the toolbox; it can't be viewed or promoted as the next silver bullet.

- In case you didn't get the subtle hint from number 1 above, you must remember **that many other plant species are extremely sensitive to "driftable fractions" of dicamba**. Non-dicamba tolerant soybean and cotton in neighboring fields can become severely injured and substantial yield losses can occur. Fruit trees, ornamental trees and shrubs, vegetables, annual and perennial commercial flowering plants, and grapes are all species that can be injured by fractions of the normal use rate of dicamba. Like 1/10, 1/100, or in some cases 1/1000 of the normal use rate of dicamba. Applicators will have to consider this fact and their surroundings when applying these herbicides in 2017.

Weather Data for the Week Ending June 27, 2017

Station	County	Weekly Temperature (ºF)						Monthly Precipitation (in.)		Growing Degree Days‡	
		Avg. Max.	Avg. Min.	Extreme High	Extreme Low	Mean	Departure from long term avg.	June 1 - 27	Departure from long term avg.	Accumulated Since Apr 1	Departure from long term avg.
Corning	Atchison	82	59	94	50	71	-5	1.49	-2.49	1356	+173
St. Joseph	Buchanan	80	61	90	53	71	-4	1.60	-2.76	1328	+178
Brunswick	Carroll	81	61	91	51	72	-4	3.02	-1.40	1453	+269
Albany	Gentry	79	56	89	48	69	-6	2.86	-1.63	1153	+57
Auxvasse	Audrain	81	59	91	50	71	-5	2.50	-1.53	1341	+119
Vandalia	Audrain	80	60	91	52	71	-5	2.50	-1.43	1326	+177
Columbia-Bradford Research and Extension Center	Boone	80	59	89	49	70	-6	2.38	-1.31	1272	+41
Columbia-Capen Park	Boone	85	57	93	48	70	-6	3.17	-0.56	1311	+71
Columbia-Jefferson Farm and Gardens	Boone	81	59	90	50	71	-5	2.43	-1.32	1332	+89
Columbia-Sanborn Field	Boone	82	63	92	54	73	-4	3.04	-0.98	1459	+152
Columbia-South Farms	Boone	81	60	90	50	71	-5	2.58	-1.22	1342	+106
Williamsburg	Callaway	81	58	89	49	70	-6	3.31	-0.63	1255	+88
Novelty	Knox	78	57	89	50	69	-6	3.71	-0.42	1196	+84
Mosow Mills	Lincoln	82	60	91	49	72	-4	4.08	+0.08	1341	+159
Linneus	Linn	79	58	89	50	70	-5	1.84	-2.74	1248	+138
Monroe City	Monroe	79	59	89	51	70	-6	6.33	+2.86	1296	+100
Versailles	Morgan	83	60	91	52	72	-5	3.22	-0.73	1403	+101
Green Ridge	Pettis	80	60	89	52	71	-5	4.05	-0.47	1323	+97
Unionville	Putnam	78	57	88	50	69	-5	2.14	-3.06	1157	+191
Lamar	Barton	82	63	90	59	73	-4	3.68	-1.40	1380	+40
Butler	Bates	81	60	89	55	71	-7	3.18	-1.93	1320	+113
Cook Station	Crawford	83	55	91	49	70	-6	1.34	-2.23	1292	+16
Round Spring	Shannon	85	58	92	50	70	-5	2.63	-0.58	1283	+52
Mountain Grove	Wright	79	59	86	52	69	-6	2.63	-0.76	1223	+25
Delta	Cape Girardeau	83	63	90	57	73	-5	2.89	-0.40	1516	+34
Cardwell	Dunklin	86	67	91	62	75	-5	5.00	+2.12	1688	+11
Clarkton	Dunklin	85	66	89	59	75	-5	2.31	-0.66	1644	+27
Glennonville	Dunklin	85	65	90	59	74	-6	4.72	+2.07	1641	+30
Charleston	Mississippi	84	66	88	59	75	-4	4.17	+0.56	1638	+101
Hayward	Pemiscot	84	67	89	62	75	-5	4.25	+0.98	1656	+9
Portageville	Pemiscot	86	68	90	62	76	-4	4.06	+0.70	1749	+82
Steele	Pemiscot	86	67	91	62	75	-5	4.40	+0.85	1676	-15

‡Growing degree days are calculated by subtracting a 50 degree (Fahrenheit) base temperature from the average daily temperature. Thus, if the average temperature for the day is 75 degrees, then 25 growing degree days will have been accumulated.

Weather Data provided by Pat Guinan | GuinanP@missouri.edu | (573) 882-5908

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