An Update of Dicamba Drift Injury Thresholds for Dry Beans and Field Peas

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Dicamba injury to soybeans was a hot topic in 2017. Prior to this year, research was conducted in 2015 and 2016 to evaluate the injury to several specialty crops including dry beans and field peas. Soybeans are the most dicamba-sensitive crop grown in North Dakota. However, the above crops are sensitive to dicamba and yield loss can occur with fewer symptoms than soybeans. Because of this, the following studies were conducted to determine how well visual injury after a drift event corresponds to yield loss and whether a tissue test can be used predict yield damage.

Simulated drift was studied with the application of 2.5-25% of Clarity (0.6-6% of the new dicamba formulations) and 0.45-4.5% of RoundUp Powermax (or equivalent) alone and together. This would be the same product ratio that is used for Extend soybeans. The applications were made just prior to flowering for each crop. Injury was rated 10 and 20 days after the drift event and tissue samples were taken at the same time. Plots were harvested and grain was sent for residue analysis and tested for germination.

Field Peas. Field peas received as much as 26% injury 10 days after treatment (DAT), but finished with 17% (Table 1). This only occurred with the highest rate of the combination of the two products. Dicamba caused more injury than glyphosate at the rates used. Glyphosate applied alone did not cause significant injury in the trials.

Table 1. Field pea injury, leaf residue levels, and yield following dicamba and glyphosate applications

		Phytotoxicity		Residue Level 10 DAT		Residue Level 20 DAT			
Treatment	Rate	10 DAT	20 DAT	Dicamba	Glyphosate	Dicamba	Glyphosate	Yield	Protein
	fl oz/ac	%	%	ppb	ppb	ppb	ppb	%	%
Check		0	0	0	0	0	0	0.90	29.74
Dicamba	0.05	1	0.3	3.1	0	2.4	5.9	0.89	29.62
Dicamba	0.25	5.5	3.4	8.7	0	8.9	0	0.88	29.81
Dicamba	0.5	12	6.9	11.4	0	17.9	0	0.86	29.84
Glyphosate	0.1	0.6	0.6	0.4	0	0	0	0.89	29.89
Glyphosate	0.5	0.8	1.3	0.3	3.3	0	0	0.91	30.13
Glyphosate	1	3.4	2.8	0.8	0	0	5.2	0.88	29.92
Glyphosate + dicamba	0.1 + 0.05	1.4	0.9	2.7	4.7	3.1	0	0.92	29.85
Glyphosate + dicamba	0.5 + 0.25	13	8.1	10.5	0	11.7	0	0.82	29.81
Glyphosate + dicamba	1 + 0.5	26.6	17.1	18.4	14.7	17.0	4.5	0.73	29.90
LSD (0.05)		5.2	3.0	5.2	NS	6.3	NS	0.06	NS

Leaf tissue analysis revealed that glyphosate was detected in some treatments but that none of the treatments differed statistically from the check. Dicamba was detected at more meaningful levels both 10 and 20 days after treatment. When combined across site-years, the 10 and 20 DAT data do not differ much. Dicamba was present in tissue at the intermediate and high rates that were used.

Yield was affected by the combination of glyphosate and dicamba at the two highest rates. Yield reductions of 8 and 17% were observed with the intermediate and high rates of the combined products. No yield reduction was realized with either product alone. Protein was not affected by any treatment. In grain samples, seed germination was not affected by any treatment combination, nor was any significant herbicide residue detected.

Dry Beans. Dry beans were affected heavily by the rates used in this study. Dry bean injury ranged from 5-40% when combined across site-years (Table 2). Both glyphosate and dicamba were damaging to dry beans. Only the lowest rates used did not significantly injure plants.

Table 2. Dry bean injury, leaf residue levels, and yield following dicamba and glyphosate applications

		Phytotoxicity		Residue Level 10 DAT		Residue Level 20 DAT		
Treatment	Rate	10 DAT	20 DAT	Dicamba	Glyphosate	Dicamba	Glyphosate	Yield
	fl oz/ac	%	%	ppb	ppb	ppb	ppb	%
Check		0	0	0	0	0	0	0.91
Dicamba	0.05	4.6	5.5	7	0	62	0	0.83
Dicamba	0.25	19.5	21	22	6	1204	1	0.72
Dicamba	0.5	22.8	26.4	259	253	625	30	0.33
Glyphosate	0.1	6.2	5.4	15	11	305	5	0.74
Glyphosate	0.5	20.6	16.1	65	1037	414	143	0.54
Glyphosate	1	24.6	25.3	121	510	145	75	0.40
Glyphosate + dicamba	0.1 + 0.05	11.4	11.4	8	258	49	108	0.78
Glyphosate + dicamba	0.5 + 0.25	29.3	23.8	85	541	628	38	0.48
Glyphosate + dicamba	1 + 0.5	33.4	39.3	262	676	509	185	0.14
LSD (0.05)		9.1	11.6	192	930	586	100	0.26

Dicamba and glyphosate leaf residue data was very difficult to interpret due to the variability. Glyphosate concentrations received from the lab were sometimes several times higher than would be anticipated. At times, the check plots would read residue levels at several thousand ppm even though no visible injury occurred. Dicamba was less erratic but suffered a similar result. With either product, there was no consistent meaningful correlation between visual injury and residue levels.

Visual injury was more related to final yield data. Yield reductions of up to 80% occurred with the highest rates of both products. Even each product individually caused unacceptably high levels of injury at the highest rates. Only the lowest rates of each product alone and together produced yields similar to the check.

Germination was reduced in the highest rate of dicamba alone and dicamba plus glyphosate. Unfortunately, dicamba was also detected in the grain of the highest rate of dicamba plus glyphosate. However, the yield of that treatment was reduced to the point that it is unlikely a farmer would harvest the crop (86% yield loss).

Summary. The levels of herbicide concentration with this study should be sufficient to measure causality, however, the highest detected concentrations many times did not correspond to the highest application rates. Once again, the relationships between residue levels and yield are only moderate at best across herbicide dose and species. Overall, dicamba was more predictive of response than glyphosate, but only when averaged across sites. Sometimes there was little or no correlation between dicamba leaf concentration and yield at an individual site. When averaged across sites and species, glyphosate did not accumulate to a consistent concentration in leaf tissues. However, dicamba concentration in the leaves tended to be higher when applied with glyphosate than alone. Overall,

without the visual injury and yield information, the herbicide residue data would not mean much in this study, representing a challenging situation to producers who may have been affected by drift. Instead of relying on tissue testing, it will be necessary to use that data as supporting evidence only in determining if a drift situation has occurred.

With the information generated from this study, we were able to identify visual injury and leaf concentration values that indicate when yield loss begins as a result of dicamba drift. Due to the variability in dry bean data, there is a wide range of possible responses (Table 3). Both dry beans and field pea could begin to see yield losses at similar leaf concentrations of dicamba. However, with dry beans, a significant yield response did not occur until 25% yield loss, whereas the same concentration caused a 6% yield loss in field peas. This indicates that dry beans are more sensitive to dicamba drift than field peas. More Information about residue sampling procedures will be found on page 111 of the 2018 North Dakota Weed Control Guide.

Table 3. Dicamba leaf concentration and visual injury that caused a yield loss in field peas and dry beans

	Ppb	ppm	Visual injury	Yield Reduction	Crop
Dicamba	30-130	0.03-0.13	21-33%	≥25%	Dry Bean
Dicamba	20-30	0.02-0.03	10-22%	≥6%	Field Peas

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