Implications of off-target herbicides near specialty crops

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Upper Midwest specialty crops

- Diverse
- Valuable
- Dispersed

Synthetic auxin resistance in corn and soy

- Synthetic auxin herbicide resistance in corn and soy may increase weed control spectrum, particularly if glyphosate resistant weeds are present

- Occasional observations of alleged off-target synthetic auxin herbicides in specialty crops, but data to determine potential effect on crop yield and quality is often lacking

Materials and Methods

- ‘Russet Burbank’ potato:
  - Dicamba rates: 1.4, 4.2 and 7.0 g ae/ha
  - Two application timings: 25 cm potato plants, at tuber initiation
- ‘Hercules’ snap bean:
  - Dicamba or 2,4-D rates: 1.4, 4.2 and 7.0 g ae/ha
  - Glyphosate rates: 7.0 g ae/ha
  - One application timing: 1 to 2 trifoliate snap beans

Materials and Methods

- Conventional production practices, including PRE herbicides
- Conventional 2,4-D amine and dicamba formulations
- Four-row plots 6.1 m in length, with surrounding crop buffer
- Four replications, two years

Snap beans: year 1

Treatment	Rate	Injury			Yield
	g ae/ha	%, 7 DAT	%, 18 DAT	%, 28 DAT	mt/ha
Non-treated	--	0 f	3 c	0 d	6.0 a
dicamba	1.4	19 c	43 b	11 b	1.1 d
dicamba	4.2	26 b	40 b	14 b	0.9 d
dicamba	7.0	45 a	53 a	24 a	0.5 d
2,4-D	1.4	4 ef	3 c	1 cd	5.8 a
2,4-D	4.2	6 e	9 c	1 cd	4.1 b
2,4-D	7.0	11 d	10 c	1 cd	2.8 c
glyphosate	7.0	5 e	3 c	4 c	5.5 a

Snap beans: year 2

Treatment	Rate	Injury			Yield
	g ae/ha	%, 7 DAT	%, 14 DAT	%, 22 DAT	mt/ha
Non-treated	--	0 d	0 d	0 d	4.3 a
dicamba	1.4	6 c	38 b	28 b	0.7 b
dicamba	4.2	10 ab	48 a	40 a	0.1 b
dicamba	7.0	11 a	43 ab	29 b	0.1 b
2,4-D	1.4	8 bc	6 cd	5 cd	4.7 a
2,4-D	4.2	8 bc	6 cd	5 cd	4.2 a
2,4-D	7.0	8 bc	11 c	10 c	4.1 a
glyphosate	7.0	5 c	9 cd	6 cd	4.6 a

dicamba, 7.0 g ae/ha

2,4-D, 1.4 g ae/ha

glyphosate, 7.0 g ae/ha

Potatoes: year 1

Treatment	Rate	Timing	% Injury		B's	Culls	Total yield
	g ae/ha		30/16 DAT	38/22 DAT		mt/ha	
Non-treated	--	--	0 c	0 c	6.6b	1.5ab	43.5
dicamba	1.4	early	1 c	0 c	8.7b	1.2ab	41.8
dicamba	4.2	early	10 b	6 bc	14.4a	0.9ab	50.0
dicamba	7.0	early	19 a	14 ab	10.1ab	1.2ab	43.2
dicamba	1.4	late	5 bc	14 ab	6.4b	0.8ab	43.8
dicamba	4.2	late	8 b	15 ab	10.4ab	0.6b	47.0
dicamba	7.0	late	10 b	23 a	7.7b	1.9a	41.0

Potatoes: year 2

Treatment	Rate	Timing	% Injury		B's	Culls	Total yield
	g ae/ha		31/15 DAT	38/22 DAT		mt/ha	
Non-treated	--	--	1 d	1 b	8.6	6.8 b	83.9 a
dicamba	1.4	early	4 cd	1 b	9.0	5.2 b	77.7 b
dicamba	4.2	early	6 c	2 b	8.1	6.6 b	71.6 c
dicamba	7.0	early	15 b	8 a	6.8	13.2 a	79.9 ab
dicamba	1.4	late	6 c	5 ab	9.1	6.1 b	74.8 bc
dicamba	4.2	late	13 b	7 a	11.0	5.1 b	78.4 ab
dicamba	7.0	late	20 a	9 a	9.5	6.7 b	84.3 a

dicamba, early, 1.4 g ae/ha

dicamba, early, 7.0 g ae/ha

dicamba, late, 7.0 g ae/ha

Does injury relate to yield?

	Pearson correlation coefficients		
	First estimation timing	Second estimation timing	Third estimation timing
Year 1			
Snap bean total yield	−0.84	−0.90	−0.81
Potato total yield	0.23	−0.01	−0.05
Year 2			
Snap bean total yield	−0.43	−0.88	−0.82
Potato total yield	−0.22	0.19	0.04

Summary:

- Observations of visible injury aren't a good indicator of yield or quality risk
- Regardless of visible injury, harvested crop is subject to pesticide residue limits
- Stewardship programs must also consider weed resistance, not just off-target risks

Seed potatoes: glyphosate and other herbicides

- Evaluating herbicides used near potatoes
  - Several anecdotal observations of potential issues, but hard to confirm
  - Somewhat sporadic reports in the literature with differing results
  - Newer active ingredients that have not been evaluated

Tank-mix “cocktails” complicate matters…

Materials and Methods

- 'Russet Burbank' potatoes grown in Hancock, WI in 2013
  - Tank-contamination herbicide application at tuber initiation
  - Injury and yield evaluated
  - Seed stored in winter 2013
- Seed sent to winter grow-out test in HI
- Seed planted in Hancock in 2014
  - Injury and yield evaluated

Materials and Methods

Evaluated at 1% of typical use rate, with appropriate adjuvants:

- 2,4-D
- Dicamba
- Aminopyralid
- Glyphosate
  - Also at 2 and 4%

- Fluthiacet-ethyl
- Flumiclorac
- Cloransulam
- Thifensulfuron
- Tribenuron
- Metsulfuron
- Mesotrione
- Tembotrione
- Topramezone

Mesotrione, 5 DAT, 10%

2013 Hancock | 2013 Hawaii | 2014 Hancock

Dicamba, 28 DAT, 16%

2013 Hancock | 2013 Hawaii | 2014 Hancock

Aminopyralid, 28 DAT, 18%

2013 Hancock | 2013 Hawaii | 2014 Hancock

2013 Potato Yield:

- No differences in tuber yield
- No differences in tuber quality

2013 Hancock | 2013 Hawaii | 2014 Hancock

2013 Hancock | 2013 Hawaii | 2014 Hancock

2014 Injury:

- Transient
- Subtle
- Affecting individual plants
- Statistically similar, but generally greatest with herbicides that also caused in injury in 2013
  - Addition: thifensulfuron

Aminopyralid, year after exposure

2013 Hancock | 2013 Hawaii | 2014 Hancock

2014 Yield:

- Total yield, B's and culls did not differ among treatments
- 10-13 ounce tubers were reduced by dicamba, cloransulam and tribenuron

Summary:

- Injury in the year of exposure may not affect yield or quality in that year, but may affect growth (aminopyralid) and yield grade distribution in the following year (dicamba)
- Some herbicides may not cause much injury in exposure year, but may affect growth (thifensulfuron) or yield distribution (tribenuron) in the following year
- The winter grow-out procedures may mask these affects