Evaluation of sunflower, lentil, and dry pea tolerance to fall-applied herbicides.

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Background

- Winter annual weeds can be challenging to control in sunflower, dry pea, and lentil.
- Weeds such as horseweed, prickly lettuce, narrowleaf hawksbeard, and mustard species can be difficult to control in-crop.
- Glyphosate alone may not be sufficient to control all weeds.
- Some weeds like horseweed have developed resistance to glyphosate, others, such as narrowleaf hawksbeard, have innate tolerance to glyphosate.

Background (cont.)

- Need for an effective and inexpensive herbicide that won't antagonize glyphosate and won't carry over to injure the spring-planted crop.
- 2,4-D and dicamba can provide effective weed control in the fall.
- The 2,4-D label states that crops can be planted 30 days after application.
- Dicamba labels are not clear on when specific crops can be planted.

- **According to current labels, planting crops following a fall application of dicamba and 2,4-D may be off-label depending on when the herbicide is applied.**

- **However, we do not know which specific crops were actually tested, at what rates they were tested, and at what time of the fall they were applied.**

- **If we can show that we can safely plant these crops following a fall application, growers will have another tool to control tough winter annual weeds and manage resistant weeds.**

Clarity label

- **Crop Rotational Restrictions:**
  The interval between application and planting rotational crop is given below. Always exclude counting days when the ground is frozen. Planting at intervals less than specified below may result in crop injury. Moisture is essential for the degradation of this herbicide in soil. If dry weather prevails, use cultivation to allow herbicide contact with moist soil.

  Planting/replanting restrictions for Clarity applications of 24 fluid ounces per acre or less: No rotational cropping restrictions apply at 120 days or more following application. Additionally, for annual crop uses in this label including corn, cotton, sorghum, and soybean, follow the preplant use directions in section **VI. Crop-Specific Information**. For barley, oat, wheat, and other grass seedings, the interval between application and planting is 15 days per 8 fluid ounces per acre applied east of the Mississippi River and 22 days per 8 fluid ounces per acre west of the Mississippi River.

  Planting/replanting restrictions for applications of more than 24 fluid ounces and up to 64 fluid ounces of Clarity per acre: Corn, sorghum, cotton (east of the Rocky Mountains) and all other crops grown in areas with 30" or more of annual rainfall may be planted 120 days or more after application. Barley, oat, wheat, and other grass seedings, may be planted if the interval from application to planting is 30 days per 16 fluid ounces per acre east of the Mississippi River and 45 days per 16 fluid ounces per acre west of the Mississippi River. For all other crops in areas with less than 30" of annual rainfall, the interval between application and planting is 180 days or more.

Herbicide carryover trials

- Trials conducted at two locations (Minot and Hettinger)
- **At Minot**, Herbicides applied on Oct 18, 2018 and May 7, 2019
  - 2,4-D applied at 1 and 2 pt/acre in fall and 4 and 8 oz/acre in spring
  - Dicamba applied at 4 and 8 oz/acre in fall and 1 and 2 oz/acre in spring
  - Field pea (May 20), lentil (May 20), and sunflower (May 29) planted following each treatment

Percent crop injury following an October herbicide application (Minot)

			Lentil			Peas			Sunflower		
			Jun 27	Jul 8	Jul 19	Jun 27	Jul 8	Jul 19	Jun 27	Jul 8	Jul 19
			----------Crop injury (%)----------								
2,4-D	1 pt	Oct 18	6	7	5	0	0	2	0	11	13
2,4-D	2 pt	Oct 18	7	7	4	0	2	2	0	11	9
Dicamba	4 oz	Oct 18	26	25	13	0	0	0	0	6	6
Dicamba	8 oz	Oct 18	19	17	9	0	0	0	0	5	3

Percent crop injury following a May herbicide application (Minot)

			Lentil			Peas			Sunflower		
			Jun 27	Jul 8	Jul 19	Jun 27	Jul 8	Jul 19	Jun 27	Jul 8	Jul 19
			----------Crop injury (%)----------								
2,4-D	4 oz	May 7	43	44	31	0	0	0	0	0	0
2,4-D	8 oz	May 7	84	81	73	7	17	12	0	11	11
Dicamba	1 oz	May 7	46	45	23	0	9	5	0	6	6
Dicamba	2 oz	May 7	76	77	65	0	16	16	10	15	15

Crop height following a fall and spring 2,4-D application (Minot)

			Lentil	Peas	Sunflower
			Height (cm) July 23		
Untreated			34	54	100
2,4-D	1 pt	Oct 18	33	61	104
2,4-D	2 pt	Oct 18	34	63	111
2,4-D	4 oz	May 7	30	57	104
2,4-D	8 oz	May 7	26	58	111

Crop height following a fall and spring dicamba application (Minot)

			Lentil	Peas	Sunflower
			Height (cm) July 23		
Untreated			34	54	100
Dicamba	4 oz	Oct 18	34	65	118
Dicamba	8 oz	Oct 18	34	65	120
Dicamba	1 oz	May 7	33	61	121
Dicamba	2 oz	May 7	26	56	109

Herbicide carryover trials

- Trials conducted at two locations (Minot and Hettinger)
- **At Hettinger**, herbicides applied on Sept 28, Oct 11, and Oct 26, 2018
  - 2,4-D applied at 1 and 2 pt/acre (based on 4 lbs/gallon)
  - Dicamba applied at 4 and 8 oz/acre (based on 4 lbs/gallon)
  - Field pea (May 4), Lentil (May 10), Chickpea (May 28), and Sunflower (June 7) were planted following each treatment

Percent crop injury following a Fall 2,4-D application (Hettinger)

			Lentil			Peas			Sunflower		
			Jun 7	Jun 21	Jul 19	May 31	Jun 11	Jun 28	Jun 28	Jul 12	Jul 30
			----------Crop injury (%)----------								
2,4-D	1 pt	Sep 28	0	0	0	0	0	0	0	0	0
2,4-D	1 pt	Oct 11	1	0	0	0	0	0	0	0	0
2,4-D	1 pt	Oct 26	3	0	0	0	0	0	0	0	0
2,4-D	2 pt	Sep 28	0	0	0	0	0	0	0	0	0
2,4-D	2 pt	Oct 11	5	1	0	0	0	0	0	0	0
2,4-D	2 pt	Oct 26	0	0	0	0	0	0	0	0	0

Percent crop injury following a Fall Dicamba application (Hettinger)

			Lentil			Peas			Sunflower		
			Jun 7	Jun 21	Jul 19	May 31	Jun 11	Jun 28	Jun 28	Jul 12	Jul 30
			----------Crop injury (%)----------								
Dicamba	4 oz	Sep 28	5	1	0	0	0	0	0	0	0
Dicamba	4 oz	Oct 11	8	3	0	0	0	0	0	0	0
Dicamba	4 oz	Oct 26	5	4	0	0	0	0	0	0	0
Dicamba	8 oz	Sep 28	12	5	0	0	0	0	0	0	0
Dicamba	8 oz	Oct 11	4	5	0	0	0	0	0	0	0
Dicamba	8 oz	Oct 26	1	6	0	2	2	0	0	0	0

Crop Stand following a fall 2,4-D application (Hettinger)

			Lentil	Peas	Chickpea	Sunflower
			Jul 19	Jul 19	Jul 19	Jul 30
			Stand (plants per square meter)			
Untreated			104	62	36	15
2,4-D	1 pt	Sep 28	128	63	39	14
2,4-D	1 pt	Oct 11	130	64	32	16
2,4-D	1 pt	Oct 26	106	63	43	16
2,4-D	2 pt	Sep 28	127	66	32	16
2,4-D	2 pt	Oct 11	100	61	37	15
2,4-D	2 pt	Oct 26	118	74	37	15

Crop height following a fall dicamba application (Hettinger)

			Lentil	Peas	Chickpea	Sunflower
			Jun 11	Jun 11	Jun 18	Jul 12
			Stand (plants per square meter)			
Untreated			104	62	36	15
Dicamba	4 oz	Sep 28	130	68	35	14
Dicamba	4 oz	Oct 11	143	68	36	16
Dicamba	4 oz	Oct 26	115	74	38	13
Dicamba	8 oz	Sep 28	127	67	40	14
Dicamba	8 oz	Oct 11	115	62	31	15
Dicamba	8 oz	Oct 26	158	73	36	17

Crop height following a fall 2,4-D application (Hettinger)

			Lentil	Peas	Chickpea	Sunflower
			Jul 19	Jul 19	Jul 19	Jul 30
			Height (cm)			
Untreated			36	87	47	69
2,4-D	1 pt	Sep 28	35	90	47	59
2,4-D	1 pt	Oct 11	36	89	47	69
2,4-D	1 pt	Oct 26	35	86	48	68
2,4-D	2 pt	Sep 28	38	89	46	68
2,4-D	2 pt	Oct 11	37	89	47	68
2,4-D	2 pt	Oct 26	37	92	48	69

Crop height following a fall dicamba application (Hettinger)

			Lentil	Peas	Chickpea	Sunflower
			Jul 19	Jul 19	Jul 19	Jul 30
			Height (cm)			
Untreated			36	87	47	69
Dicamba	4 oz	Sep 28	36	88	47	74
Dicamba	4 oz	Oct 11	36	88	46	71
Dicamba	4 oz	Oct 26	36	88	47	62
Dicamba	8 oz	Sep 28	37	88	48	67
Dicamba	8 oz	Oct 11	36	85	45	71
Dicamba	8 oz	Oct 26	36	85	47	71

Summary

- Little to no injury to sunflower from fall-applied 2,4-D or dicamba at either Minot or Hettinger
  - No reduction in crop height or stand
- Of the crops evaluated, lentil was most sensitive to carryover from fall application, especially to dicamba
- Spring applications at Minot resulted in more injury than fall application, especially in lentil
- May application of dicamba at 2 oz/A and 2,4-D at 2pt/A reduced lentil height, but not sunflower or field pea
- Results indicate that fall applications of 2,4-D and dicamba should be safe prior to planting sunflower and field pea, but there may be some risk for lentil

Continuing Research

- Single application of dicamba (4 and 8 oz/A) and 2,4-D (1 and 2 pt/A) applied on November 9, 2019
- Will plant sunflower, field pea, chickpea, and lentil in spring
- Larger plot size to allow for harvest and collection of yield data
  - 10 by 40 foot plots

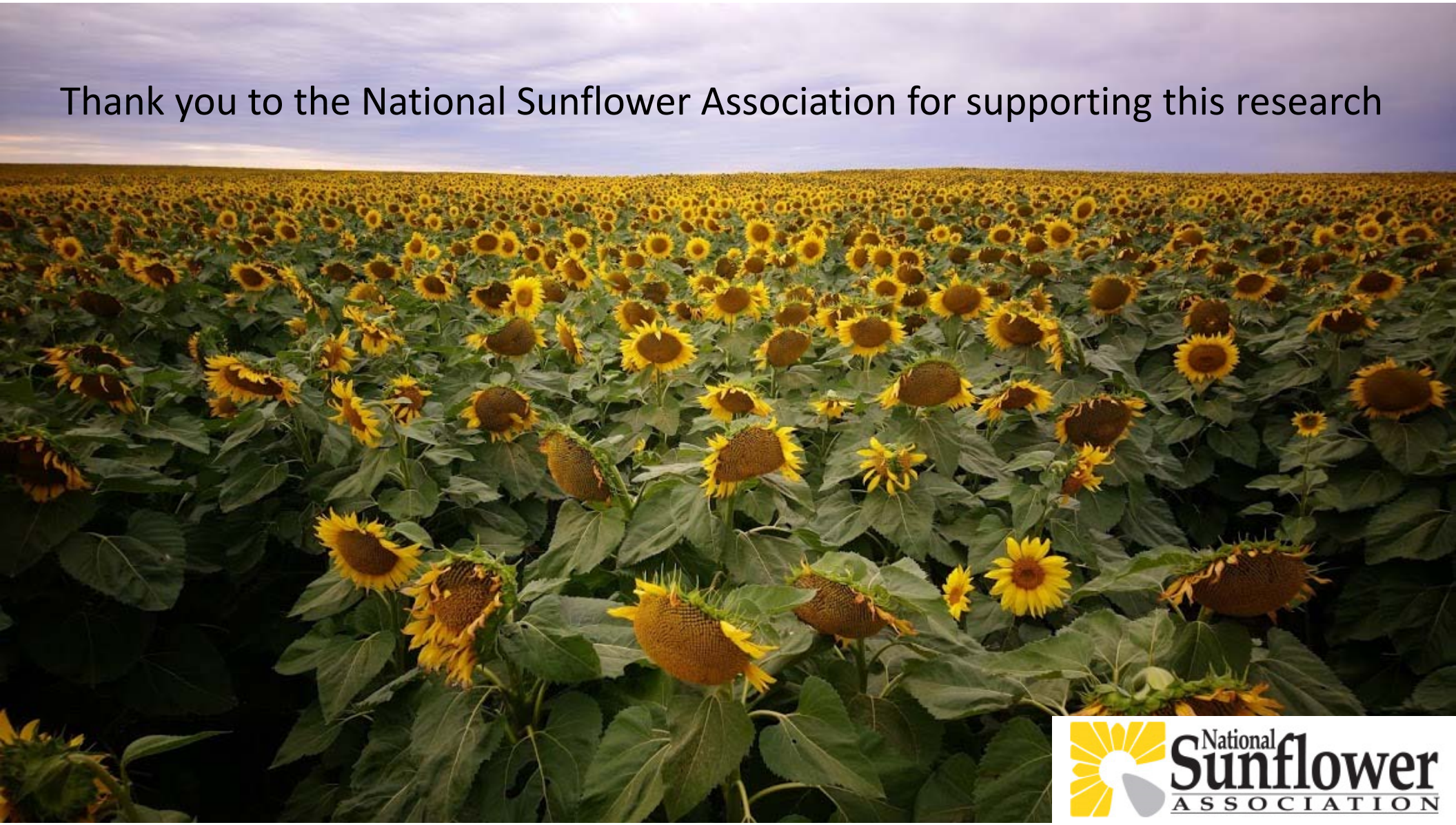
Sunflower injury from POST dicamba

- With adoption of dicamba tolerant soybean, there is increased risk of injury to sunflower from sprayer contamination and/or drift from application to soybean
- Need to make sure sprayer is properly cleaned after application of dicamba
- Make sure to follow guidelines regarding wind speed and direction and temperature inversions

Dicamba Injury to Sunflower

- Dicamba was applied (Engenia at 12.8 oz/A) with glyphosate (Roundup PowerMAX at 22 oz/A).
- Tank was cleaned following application, but pump was not turned on and hoses remained contaminated with dicamba and glyphosate
- On July 12, Clearfield Sunflower about 1 foot in height was sprayed with Beyond contaminated with dicamba and glyphosate at an estimated 1.3% of previous application
  - 0.0067 lbs/acre of dicamba (0.17 oz/A of Engenia)
  - 0.013 lbs/acre of glyphosate (0.37 oz/A of Roundup PowerMAX)
- Resulted in 80 to 95% yield loss

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