Blackbird Damage is an Important Agronomic Factor Influencing Sunflower Production

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ABSTRACT: From 2001 to 2013 (except 2004), the National Sunflower Association sponsored a comprehensive production survey of physiologically mature sunflower (*Helianthus annuus*) fields in the Canadian province of Manitoba and eight states in the United States. Trained teams of surveyors randomly stopped at one sunflower field for every 4,047 – 6,070 ha (10,000-15,000 acres). Each team evaluated plant stand, yield potential, disease, insect, weed, and bird damage for each field. We pooled data gathered during the most recent 5-years (2009 to 2013) of the survey and found that sunflower damage caused by blackbirds and plant lodging ranked fifth (behind plant spacing, disease, drought and weeds) as the most limiting factors on production. We found that overall annual economic losses from blackbird damage averaged $US13.5 million and $US4.9 million for oilseed hybrids and confectionery hybrids, respectively. We suggest elements of a multi-faceted bird management plan that might help reduce damage.

Key Words: blackbirds, crop damage, Icteridae, Integrated Pest Management, nonlethal management, Prairie Pothole Region, sunflower

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INTRODUCTION

Blackbird (Icteridae) damage is the most common reason that sunflower (*Helianthus annuus*) producers in North Dakota stop planting sunflower (Linz and Homan 1998, Linz et al. 2011, Hulke and Kleingartner 2014). Blackbirds form large flocks in late summer that feed on ripening crops, including sunflower, corn (*Zea mays*), and small grains (Peer et al. 2003). Klosterman et al. (2013) estimated that annual blackbird damage to oilseed sunflower and corn in the Prairie Pothole Region (PPR) of North Dakota averaged $US3.5 and $US1.3 million, respectively. These are direct costs of damage and do not include costs of damage management.

From 2001 to 2013 (except 2004), National Sunflower Association sponsored national surveys of blackbird damage in physiologically mature sunflower fields throughout the main

sunflower growing states of the United States and the Canadian province of Manitoba. Annual reports are available on factors that limit national sunflower production (Berglund 2005, 2006, 2007, 2008, 2009; Kandel 2010, 2011, 2012, 2013; Lamey et al. 2002, 2003). In this paper, we analyze and summarize the magnitude of blackbird damage in 8 states in the U.S. and Manitoba over the most recent five years (2009-2013) of the survey.

METHODS

From mid-September to early October 2009-2013, 32 to 60 trained teams, including agronomists, entomologists, pathologists, crop consultants and producers, randomly selected one physiologically mature sunflower production field, for every 4,047 to 6,070 ha (10,000 – 15,000 acres). Planted hectares were determined by the USDA-Farm Service Agency and other state estimates. The exception is Vermont where most of the fields in an extension bio-diesel project were surveyed. Each team evaluated plant stand, yield potential, disease, insect, and weed issues for each field. They also assessed bird damage and agronomic practices used in the field. A sunflower seed sample was taken from each field to detect insect damage in the laboratory.

Yield was estimated in two random locations within the field. Surveyors entered the field in a random location and walked ≥ 25 m from the field edge, stopping in a representative area of the field. The second representative location was selected at ≥ 100 m further into the field. Yield was based on plant stand, head size, seed size, percent filled seeds, center seed set, and percent loss due to bird feeding. Plant stand was estimated based on counting all consecutive yield-contributing plants in 7.6 m within the row. Head diameter was measured for 5 consecutive heads in the row. Five wedges, one from each head, were cut out of the head and seeds were hand shelled. Average seed size was determined comparing seed sample with a chart (Anonymous 2008). One hundred seeds were evaluated for seed fill and percent filled seed determined. The center area of the head without seeds was measured and subtracted from the production estimate. Loss due to bird damage was estimated based on sample charts with examples of various levels of bird damage (Anonymous 2008).

We used arithmetic means and standard errors to describe central tendency and accuracy of the damage estimates. We used analysis of variance to assess statistical differences in damage between confectionery and oilseed hybrids and among study years.

RESULTS

From 2009 to 2013, sunflower damage caused by blackbirds and plant lodging (i.e., plants that fall on the ground and are unharvestable) ranked fifth (behind plant spacing, disease, drought and weeds) as the most limiting factors on production (Table 1). Among biological issues, blackbird damage to sunflower ranked 3rd behind disease and weeds.

Percentage of sunflower damaged did not differ across the five study years ($F_{4, 65} = 0.95$, $P = 0.440$). Thus, we combined study years for further analyses. Percentages of oilseed and confectionery sunflower hybrids damage also did not differ ($F_{1, 68} = 0.64$, $P = 0.427$). However, confectionery and oilseed hybrids produce achenes which are fundamentally different in oil content, size and hull thickness. Confectionery achenes are also sold at a ~35% premium over oilseeds (NASS 2015). Thus, we present damage data for both variety types.

We pooled the data over years and found mean percent blackbird damage was 2.5% in oilseed fields and 1.9% in confectionery fields (Tables 2, 3). Average annual blackbird damage was valued at $US13.4 million and $US4.9 million for oilseed and confectionery sunflower, respectively. Of the 8 states and Manitoba,

North Dakota growers suffered the highest economic damage, with average annual losses of $US8.7 million for oilseed and $US2.0 million for confectionery hybrids (Table 4). South Dakota ranked 2nd and 3rd in total annual damage to oilseed sunflower ($US3.4 million) and confectionary fields ($US905), respectively. Nebraska ranked 2nd ($US1.2 million) in damage to confectionery hybrids.

Of the 951 oilseed and confectionery sunflower fields surveyed, 72% had ≤ 1% damage, 16% were >1 and ≤5%, 8 % >5 and ≤ 15% and 4% >15%. Across all years, 122 fields (12%) had damage >5%. This level is often considered significant economic damage and thus might warrant damage management actions (Linz et al. 2011).

Table 1. In late summer 2009 to 2013, trained teams assessed 951 physiologically mature oilseed and confectionery hybrid sunflower fields for yield and production limiting factors, in 8 states and the Canadian province of Manitoba. Percentage of fields with production limited by each listed agronomic factor were calculated for data pooled across years (n=5).

	First Limiting Factor		Second Limiting Factor	
	Mean	SE	Mean	SE
Plant spacing	20	1.6	13	1.5
Disease	18	3.6	9	1.0
Weeds	8	1.0	9	1.0
Lodging	7	1.9	6	1.6
Birds	7	0.5	4	0.6
Drought	11	4.9	4	1.0
Other	7	0.9	8	1.6
Insects	4	0.8	6	1.1
Uneven plant growth	3	0.3	3	1.2
Drown out	1	0.7	1	0.6
Hail	1	0.4	1	0.5
No problem	13	0.7	36	2.0

Table 2. During late summer 2009 to 2013, trained teams assessed physiologically mature oilseed hybrid sunflower fields for agronomic characteristics, including blackbird damage, in 8 states and Manitoba. Mean value of damage (@$US0.49/kg) and SE were calculated for data pooled across years (n=5).

	Harvested (10^3 ha) [1]		Sampled Fields	Yield (kg ha) [1]		Percent Bird Damage		Damage Value ($US/ha)	
	Mean	SE	N	Mean	SE	Mean	SE	Mean	SE
North Dakota	251	29	378	1774	81	4.2	0.9	36.4	7.8
South Dakota	195	14	164	1820	112	1.7	0.8	17.0	9.0
Kansas	40	8	26	1514	145	1.0	1.0	9.9	9.9
Colorado	29	4	31	1156	156	0.3	0.3	2.5	2.5
Minnesota	15	2	37	1744	120	0.8	0.3	7.4	3.0
Texas	16	3	23	1241	86	0.3	0.2	1.5	0.9
Manitoba	10	2	6	1784	86	2.0	1.0	18.9	22.7
Nebraska	11	<1	15	1342	169	5.2	2.3	36.2	19.4
Vermont	2	<1	41	1694	198	7.2	0.6	58.9	5.3

[1]Estimated production prior to bird damage based on NASS (2015) reported production.

Table 3. During late summer 2009 to 2013, trained teams assessed mature confectionary hybrid sunflower fields for agronomic characteristics, including blackbird damage in 8 states and Manitoba. Mean value of damage (@$US0.66/kg) and SE were calculated for data pooled across years (n=5).

	Harvested (10^3 ha) [1]		Sampled Fields	Yield (kg ha)[1]		Percent Bird Damage		Damage Value ($US/ha)	
	Mean	SE	N	Mean	SE	Mean	SE	Mean	SE
North Dakota	41	8	79	1764	98	4.5	1.2	53.6	15.3
South Dakota	32	6	31	1905	86	1.7	1.6	23.6	21.6
Texas	17	2	21	1333	261	0.0		-	
Nebraska	8	2	11	1734	368	5.8	4.6	93.8	79.9
Manitoba	27	9	43	1837	239	1.9	0.3	24.0	6.3
Minnesota	7	2	25	1762	241	0.8	0.6	8.8	5.8
Colorado	8	2	14	1585	147	0.5	0.5	5.3	4.7
Kansas	8	1	6	1716	38	0.0		-	
Vermont	0		-	-		-		-	

[1]Estimated production prior to bird damage based on NASS (2015) reported production.

Table 4. During late summer 2009 to 2013, oilseed and confectionery sunflower fields were assessed for blackbird damage in 8 states. Oilseed was valued @$US0.49/kg and confectionery was valued @$US0.66/kg[1]. Data were pooled across years.

	Oilseed		Confectionery	
	Mean Damage $US 10^3	SE	Mean Damage $US 10^3	SE
North Dakota	8708	1498	2019	510
South Dakota	3395	1874	905	834
Texas	26	17	0	0
Nebraska	360	186	1234	1113
Manitoba	218	145	637	267
Minnesota	134	62	71	48
Colorado	70	70	72	68
Kansas	559	559	0	0
Vermont	11	1	-	-

[1]NASS (2015)

DISCUSSION

Our data show that sunflower damage caused by blackbirds and plant lodging ranked fifth (behind plant spacing, disease, drought and weeds) as the most limiting factors on production. The amount of precipitation falling on fields is an uncontrollable environmental factor. Plant spacing can be addressed with changes in planting depth and seed density, and plant lodging might be reduced with selection of an appropriate hybrid.

Blackbird damage ranked 3rd behind disease and weeds among biological issues that limited production. Improved pesticides are now available for controlling disease, weeds (and insects). On the other hand, sunflower growers have limited cost-effective options for addressing blackbird damage (Linz et al. 2011).

From 2009 to 2013, bird damage in North Dakota averaged 4.2% in oilseed sunflower compared to an average loss of 2.7% in 2009 and 2010 reported by Klosterman et al. (2013). We inspected the data and found that percentage of bird damage was similar in both studies during 2009 and 2010. The higher percentage damage in our study might be related to 30% fewer hectares harvested from 2010 to 2013 compared to 2009 and 2010 (NASS 2013).

Bird damage was highly variable within and among the sampled states and Manitoba. This is not surprising as blackbirds tend to be clustered around certain landscape features, such as wetlands and trees that are favored roosting sites and the availability of food, particularly sunflower. The availability of preferred roosting sites and food also can vary among years as a result of extreme environmental events (e.g., drought, flooding).

Our data showed that the birds ate 35% more oilseed achenes ($\bar{x}$ = 2.5%) than confectionery achenes ($\bar{x}$ = 1.9%). These percentages are not statistically different due to high variance; nevertheless, the arithmetic difference might be biologically important.

Oilseed hybrids produce achenes that have a higher oil content, smaller size and thinner hull than do confectionery hybrids. These factors can affect the birds' food selection when given a choice between oilseed and confectionery hybrids (Mason et al. 1991). That is, as the confectionery achenes mature, it becomes more difficult for the birds to obtain the kernel, forcing the birds to search for more easily acquired food (Linz et al. 1984). The second author (GML) has observed that when confectionery and oilseed fields are planted in juxtaposition, invariably the oilseed field will suffer a greater percentage of damage. We hasten to add, however, when a confectionery field is the only source of food, the birds will cause significant economic losses.

There is no doubt that the potential for significant economic losses due to blackbird feeding is real. Additionally, feeding flocks are highly visible in ripening fields, further adding to the perception of huge losses. Despite the overall economic losses from other sources (e.g., disease and weeds), producer surveys show blackbirds are a major cause of declining sunflower hectares in the PPR (Kleingartner 2003, Klosterman et al. 2013, Hulke and Kleingartner 2014). The lack of management techniques that are consistently effective for reducing damage and the availability of alternative profitable crops that suffer less bird damage likely contribute to a decline in planted hectares (Linz and Hanzel 2015).

MANAGEMENT IMPLICATIONS

Bird damage to sunflower is an especially difficult problem for producers because damage occurs from early seed-set until harvest; however, most of the damage occurs before the achenes reach physiological maturity (Cummings et al. 1989). Thus, resources dedicated to management efforts should be focused when birds are first noticed in the fields. Linz et al. (2011) and Linz and Hanzel (2015) suggested that producers develop a bird management plan that might include modifying roost habitat; using a plant desiccant to accelerate fall harvest; using propane cannons; planting decoy crops; synchronizing planting time of sunflower with neighbors; leaving stubble, especially sunflower, unplowed to provide alternative feeding sites; and planting short-stature sunflower to facilitate bird-hazing strategies.

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