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Demonstration of Avian Control® bird repellent (a.i., methyl anthranilate) for managing blackbird damage to ripening sunflower.

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1. Introduction

After the reproductive period, blackbirds in the northern Great Plains aggregate in large flocks that feed on ripening crops, especially sunflower. At today's prices, blackbirds eat about $8–12 million of sunflower annually in northern Great Plains, with most of this damage occurring in North Dakota and South Dakota (Peer et al. 2003). Additional expenditures are incurred by producers trying to protect their crop, including the costs in time, travel, and materials for hazing blackbirds. A chemical feeding repellent would be ideal for protecting sunflower from blackbirds because it would not only cut the amount of losses from foraging but also reduce hazing costs.

Methyl anthranilate (MA) was identified in the early 1960s as a candidate feeding repellent for deterring foraging birds (Avery 2002). Since then, numerous efficacy studies have been conducted on corn, sunflower, and fruit crops (Cummings et al. 1991; Avery 1992; Cummings et al. 1995a, 1995b; Avery et al. 1996; Avery and Cummings 2003). Various formulations and adjuvants were tried, including the following MA concentrations (kg/ha [a.i.]): 0.31, 3.4, 15.7, and 59.0 (Cummings et al. 1995a, 1995b; Mason and Clark 1995; Werner et al. 2005). Methods of application have included hand sprayer, all-terrain vehicle, and fixed-wing aircraft. Results have ranged from no effect, to partially effective, to highly effective (Cummings et al. 1991; Cummings et al. 1995a, 1995b; Mason and Clark 1995; Werner et al. 2005). Reasons used to explain studies showing no effect include inadequate rate of application, population turnover in bird flocks, and biodegradation of the MA.

A commercial formulation, Bird Shield® (Bird Shield Repellent Corporation, Spokane, Washington), is registered for use on ripening sunflower (Linz et al. 2011). However, researchers and growers have both reported either equivocal or inconsistent results. For example, Bird Shield applied by fixed-wing aircraft at the recommended label rate (0.31 kg/ha [a.i.]) and volume (46.7 l/ha) did not reduce blackbird damage to ripening rice in Missouri or sunflower in North Dakota (Werner et al. 2005). Low application rate and low spray volume were given as 2 possible reasons that Bird Shield was ineffective (Werner et al. 2005).

During 2012 in North Dakota, we conducted a research-demonstration project using another commercially available MA product, Avian Control™ (AC, [Avian Enterprises, Jupiter, Florida]). This product is registered by the U.S. Environmental Protection Agency for use on ripening sunflower. AC (20% MA [a.i.], 0.2 kg/l) also contains a proprietary inert ingredient that the maker claims may enhance its longevity and effectiveness. We aerially applied AC during the early-ripening period, when sunflower is most vulnerable, and the largest amount of damage occurs (Cummings et al. 1989). Our goals were to expand the testing of AC as a bird repellent on ripening sunflower. If effective, this product would represent a major advance in blackbird

damage management.

2. Study Area

Our study area lies within the Prairie Pothole Region in McLean County, North Dakota (47.51 N, -100.92 W). Numerous shallow wetland basins occupy the landscape. These wetlands often have dense stands of cattail (*Typha* spp.), which may be used by blackbirds for either daytime loafing sites or night roosts (Linz et al. 2011). The landscape's vegetation type was mixed-grass prairie. Most of the native grasslands have been converted for agriculture; 63% of the county's land area is in harvestable crops. In 2010, McLean County ranked 6th in production of oilseed sunflower among the 53 North Dakota counties, with production of 25.3 million kg (NASS 2012). In 2010, oilseed sunflower ranked as the 3rd most planted crop (14,170 ha) in McLean County, behind small grains (149,798 ha) and canola (28,744 ha).

3. Methods

Field selection and AC application

From mid-August to mid-September 2012, we petitioned interested sunflower producers to contact either us or a North Dakota Wildlife Services Field Specialist if birds were observed in ripening sunflower fields. We selected 10 sunflower fields, with the criterion that ≥500 blackbirds were feeding in the fields. Each study field was divided into 2 strata, each having an equal number of rows. If the field was larger than 100 acres, each stratum was limited to 50 acres. We applied AC when >50% of the sunflower heads were at the R-6 or later growth stage (i.e., anthesis complete, ray flowers wilting/falling; ~6–10 weeks prior to harvest). An agricultural

spray plane was used to apply AC at a rate of 4.7 l/ha (0.92 kg/ha [a.i.]) mixed in 47 l/ha of water. Each treated stratum received a single application of AC.

The AC was donated by Steve Stone (Executive Vice President, Avian Enterprises, LLC). The USDA-WS National Wildlife Research Center paid each grower's selected applicator for applying the AC. Growers were informed that use of AC for a demonstration did not imply endorsement by the USDA.

Damage Estimates

We estimated pretreatment bird damage within the treated and untreated strata a few days before or on the same day of AC application. Posttreatment estimates were made 10–14 days after treatment. Damage estimates were made by randomly selecting 2 rows per stratum. The location of the first sample plot of 5 consecutive sunflower heads was a randomly selected distance in paces (~1 m) between 0–100 m. After establishing the first plot, we systematically sampled plots of 5 consecutive sunflower heads equidistance along the rows so that 6 plots were sampled. For sunflower heads with bird damage, we measured both the diameter (±1 cm) of the head and undeveloped center (light-colored, immature achenes) by averaging 2 perpendicular tape measurements. We estimated the amount of missing achenes by placing a template with 5-cm^2 grids over the damaged area of the head (Dolbeer, 1975). Undamaged heads were left unmeasured and 0 cm^2 was recorded. We used an ANOVA to compare the difference in mean loss (cm^2) between the pre- and posttreatment damage surveys in the treated- and untreated strata.

4. Results

Of the 10 fields sprayed with AC, 1 field (at grower discretion) was sprayed with 0.46 kg/ha (a.i.), which is 50% below manufacturer recommendation. Two fields were sprayed before our

pretreatment assessments could be completed. Thus, the final data set had 7 fields. The average difference in damage between the pretreatment and posttreatment assessments in the 7 fields increased 9.9 cm^2 (SE = 7.25, range = 0–52 cm^2) in the treated strata and 13.8 cm^2 (SE=9.64, range = 0–60 cm^2) in the untreated strata. Although the difference in damage in the untreated strata was nearly 40% greater than the difference in the treated strata, it was not statistically significant (P = 0.75).

5. Discussion

Under the conditions of this demonstration study, the increases in bird damage in our 7 fields were not significantly different between treated and untreated strata. Methyl anthranilate is an effective bird repellent when used in circumstances where high concentrations can be maintained. The birds must have contact with MA with their nostrils, eyes, or mouth; technically, it is a taste repellent not an aversive repellent (Clark 1996).The AC application rates used in this study may have been insufficient to elicit a negative response from the birds because the threshold level that induces repellency was not reached. Additionally, high variability in damage among fields within treatments combined with small sample sizes may have contributed toward lack of enough evidence to find a significant difference between treatments despite greater damage in the untreated strata.

Sunflower is a preferred food for migrating blackbirds and is vulnerable to damage for 8 weeks or longer. Thus, a repellent that does not have persistence in repellency effect will require repeated applications over the damage period. To meet these limitations, the manufacturer of AC suggests that airplanes be equipped with fine mist spray nozzles and that 3 applications be made as follows (Steve Stone, Pers. Comm. 2012)**:** first application - 2.6 l/ha, a second application after several days with 1.8 l/ha, and a third application after 10 days with 2.6 l/ha. Betty Bottger

(Pers. Comm. 2012, Alicel Feed and Seed, Cove, Oregon) reported that this application strategy was effective for keeping blackbirds out of a 185-ha sunflower field.

Obviously, this application strategy would need to be tested experimentally with a large number of fields before a reasonable judgment could be made on efficacy of AC for protecting ripening sunflower. Even this task would be challenging because of logistics, cost, and high variability in damage across the sunflower region from year to year.

7. Acknowledgments

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