Potential Use of Perennial Sunflower to Reduce Blackbird Damage to Sunflower

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ABSTRACT: Wildlife Conservation Sunflower Plots (WCSP) have shown potential to reduce blackbird (Icteridae) damage in commercial sunflower. Also known as lure, decoy, or trap crops, WCSP are strategically placed food plots that provide an easily available and proximate food source that entices blackbirds away from valuable commercial crops. By providing an alternative food source, WCSP reduce direct damage to commercial fields, while also lowering indirect costs that producers incur attempting to prevent blackbird damage. However, cost inefficiencies have deterred widespread use of WCSP. Cost-benefit ratios of using WCSP would be greatly improved if a perennial sunflower were used instead of the annual types currently available. Perennial sunflower would reduce seed cost and planting cost, and perhaps lower opportunity costs, if able to thrive on poorer quality soils. In the near-term, scientists are focused on producing a perennial sunflower sufficiently productive to replace annual WCSP plantings. In 2013, scientists from the University of Minnesota, USDA-Agricultural Research Service, and USDA Wildlife Services National Wildlife Research Center evaluated a test plot of an open-pollinated variety of perennial sunflower resulting from genetic crossing of a domesticated annual species (*Helianthus annuus*) and a perennial wild species (*H. tuberosus*). Here, we report on results from the 2013 field test and discuss the outlook for development of perennial sunflower, which would help lessen damage to commercial sunflower when used in WCSP; provide a pesticide-free food source for beneficial insects, such as honey bees; help stabilize highly erodible lands near wetlands; and provide year-round habitat for wildlife. Lastly, we provide an initial strategy for using perennial sunflower to reduce blackbird damage in commercial sunflower.

KEY WORDS: blackbirds, crop damage, decoy crops, perennial sunflower, WCSP, wildlife conservation sunflower plots

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INTRODUCTION

Blackbird (Icteridae) damage is the key reason that agricultural producers in the U.S. have stopped planting sunflower (*Helianthus annuus*) along major blackbird flyways (Hulke and Kleingartner 2014). Damage is quite variable and usually clumped around roosting habitat, which limits economically important damage to relatively few growers (Klosterman et al. 2013). Although the damage is clumped and localized, it seems to have had a pervasive effect on regional production by discouraging unaffected producers from planting sunflower. Localized damage may be 100% in extreme circumstances but is generally 1-3% regionally (Linz and Hanzel 1997, Linz et al. 2011, Klosterman et al. 2013, Linz and Hanzel 2015).

In the northern Great Plains of the U.S., post-reproductive flocks of blackbirds often feed on ripening crops, especially sunflower, but also corn and small grains (Linz et al. 2011). Sunflower damage is particularly evident in the Prairie Pothole Region (PPR) of North Dakota, Minnesota, and South Dakota because of high densities of breeding blackbirds (Peer et al. 2003). Over a 2-year study in North Dakota, Klosterman et al. (2013) found that blackbird damage annually averaged \$1.3 million for corn and \$3.5 million for sunflower. None of the surveyed cornfields surpassed 5% damage; whereas 15% of ripening sunflower fields received >5% damage, which is often regarded as an economic threshold. Damage in other sunflower producing states in the upper Midwest is likely similar. Besides the direct losses from blackbird depredation, sunflower producers also incur expenses trying to protect their crop (Linz et al. 2011).

In the 1980s, Cummings et al. (1987) tested the notion that blackbirds could be lured away from commercial sunflower fields by planting small fields of sunflower and corn on public lands adjacent to large commercial fields. Although results from this study were promising, the concept was abandoned for logistical and economic reasons. In 2004 and 2005, Hagy et al. (2005, 2007, 2008, 2010) revisited the potential use of decoy fields using Wildlife Conservation Sunflower Plots (WCSP, also known as decoy, lure, or trap crops). The 8-ha WCSP were cost-shared by USDA Wildlife Services and sunflower producers. Blackbird damage was lower in commercial oilseed sunflower fields close (≤2.4 km) to WCSP compared to fields >10 km from WCSP (Hagy et al. 2008, Hagy et al. 2010). However, the high cost of hybrid sunflower seed together with costs associated with yearly cultivation, planting, and plot maintenance resulted in a negative cost-benefit ratio over 3:1. The cost-benefit ratio would be greatly improved if one or more operational costs associated with WSCP were reduced.

Perennial sunflower would reduce planting costs for WCSP and serve as potential tool to alleviate blackbird damage in commercial (i.e., annual) sunflower (Kantar et al. 2012, Linz et al. 2011, Kantar et al. 2014). Additionally, perennial sunflower would provide a pesticide-free food source for beneficial insects such as honey bees (*Apis mellifera*), help stabilize highly erodible lands near wetlands, and offer year-round habitat for wildlife. The native perennial sunflower, *H. tuberosus*, is found in wetland areas near lakes and river systems in the PPR and is highly tolerant of the harsh winters typical of the northern plains. In 2003, interspecific hybrids were created from crosses between *H. tuberosus* and inbred *H. annuus* lines contributed by the USDA Agricultural Research Service (ARS) Sunflower Unit in Fargo, North Dakota. Nearly all of the hybrids exhibited perennial habit, moderate fertility, and heterosis for above ground biomass production. In order to improve agronomic quality, seed oil quality, genome stability, and quality of the hybrids, the population was inter-mated and progeny assessed. Tubers from the best plants (i.e., largest flower diameter and highest yield) were grown in a small plot for seed increase. This seed was termed Synthetic 1.

In 2013, collaborating scientists from the University of Minnesota, USDA ARS, and USDA APHIS Wildlife Services National Wildlife Research Center planted a 0.2-ha field for an initial field plot evaluation of Synthetic 1, an open-pollinated perennial sunflower. Our objectives were to 1) assess potential of Synthetic 1 for use in WCSP, 2) assess yield of Synthetic 1 planted at two depths, 3) determine its longevity, and 4) increase seed stock for future plantings.

STUDY AREA AND METHODS

In June 2013, we successfully planted a seed-increase plot consisting of promising IM_2F_1 perennial plants. We planted 24 rows on a 0.2-ha plot near Washburn, ND. The soil was classified as a silt loam (USDA SCS 1979). We used preemergence herbicide and glyphosate applications prior to planting. From June through September, the area received about 27.9 cm of precipitation, 5 cm above normal (NDAWN 2014). The average air temperature during this period equaled the 30-yr average of 19°C.

We planted sunflower achenes at a depth of 1.5 cm in the first 12 rows and 1.0 cm in the remaining 12 rows. Inter-row width was 0.76 m, with seeds about 15.2 cm apart within rows. We assumed the plot would subsequently regrow from rhizomes and tubers for at least 3 years; however, a level of uncertainty existed about regrowth of this variety because it was its first field test. We counted the number of plants in each row and harvested sunflower heads in October. The heads were dried and delivered to Brent Hulke at USDA ARS in Fargo, ND. Heads were threshed and yield was estimated. Seed was saved for future seed-increase plots.

RESULTS

The number of plants in rows 1-12 and 13-24 averaged 22 plants (range 7-48) and 35 (range 21-48), respectively. Although not definitive, it appeared that more plants emerged at the shallower-seeded (1.0 cm) depth. Shallow seeding was likely made more effective because of the abundance of soil moisture at planting. Total yield for this first-year plot was 3,000 seeds.

DISCUSSION

Numerous species of wildlife use agricultural fields for food and shelter in North Dakota (Hagy et al. 2005, Hagy et al. 2007, Hagy et al. 2008, Galle et al. 2009, Hagy et al. 2010). However, sunflower fields appear to be particularly important as stopover habitat for migrating birds. Using a combination of mist-nets and field observations, researchers found that 78 bird species used sunflower fields during fall and 29 bird species used tilled sunflower fields during spring (Hagy et al. 2007, Galle et al. 2009, Hagy et al. 2010). Thus, perennial varieties of sunflower in WCSP would not only efficiently help reduce damage to commercial sunflower but also provide many species of both resident and migratory birds with protective cover and nutrition.

We have already received requests from natural resource agencies and private land owners for perennial sunflower achenes, showing that a need exists for use of perennial sunflower in wildlife food plots. We project that ~40,000 ha of perennial sunflower could be planted in the U.S. as a decoy crop to mitigate blackbird predation to commercial crops and as food plots on Conservation Reserve Program lands, Fish and Wildlife Refuges, and State Wildlife Management Lands. Use of these types of lands would negate the need to use valuable agricultural land to plant WCSP.

Research Plans 2014-2016

The goal of the perennial sunflower breeding program is to develop alternative varieties for commercial production while providing habitat enhancements to landscapes often made barren by intensive agricultural practices (Hulke and Wyse 2008, Cox et al. 2010, Glover et al. 2010, Kantar et al. 2014). Geneticists are currently examining tetraploid interspecific hybrids between the perennial *H. tuberosus* and annual sunflower (*H. annuus*) for possible use as a perennial (Hulke and Wyse 2008, Cox et al. 2010, Kantar et al. 2012, Kantar et al. 2014). Characterization of our initial interspecific population showed large variability in phenotypic characteristics but a simple segregation pattern (3:1) for tuber production, which is the habit of perennial sunflower (Kantar et al. 2014). The crossing strategy has been to progressively develop open-pollinated populations with improved plant architecture, seed yield, and flowering characteristics created from the best individual crosses. Comparisons from these trials and future trials will form the basis for selection of individuals to form the next generation of synthetic open-pollinated populations.

In 2014, we will plant seed-increase plots consisting of segregating IM_1F_1, IM_2F_1, and IM_3F_1 lines to create sufficient seed to examine oil profiles and further assess yield. We might also provide domestic honey bee hives to increase pollination in the plots. Our goal is to begin an evaluation of our genetic populations in the context within which they will be used (wildlife food plots and oil seed production), while steadily improving the populations' characteristics in relation to those of commercial annual sunflower. The small-scale seed increases in 2014 will allow for larger-scale plots in 2015 with the goal of large-scale trials by 2016.

MANAGEMENT IMPLICATIONS

A perennial sunflower variety would enhance WCSP economic contributions by substantially reducing planting costs. We also view perennial sunflower as a quality food source for insects, especially honeybees. Honeybees need alternate food sources in late summer, and perennial sunflower might provide an excellent source of nutrients to help combat colony collapse disorder (ARS 2012). This is especially important because plantings of commercial sunflower have declined and loss of native prairie habitat, with its plant diversity, has increased.

If perennial WCSP were used in an integrated pest-management strategy for sunflowers, it would provide synergy with other management tools being developed, especially chemical feeding repellents. When an alternative food source is available, repellents might be more effective because if starvation is the only alternative, birds will withstand greater levels of discomfort from repellents (Avery 2002, Avery and Cummings 2003).

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