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### Groups Affected By This Problem:

- Consumers and producers of sunflower, rice, corn, dairy, meat and other products
- Feedlot Owners Association
- National and State Fruit Grower Associations
- National Sunflower Association
- North Dakota Department of Agriculture
- North Dakota Game and Fish Department
- Processors, manufacturers, suppliers, and sellers of sunflower, rice, fruit, corn, dairy and meat
- South Dakota Department of Agriculture
- South Dakota Game, Fish, and Parks
- South Dakota Oilseed Council
- Utility companies

### Major Cooperators:

- Gowan Company
- Kansas Feedlot Association
- Louisiana Blackbird Committee
- Louisiana Rice Producers Association
- Louisiana Rice Research Board
- Louisiana State University, Louisiana Rice Research Station
- Michigan State University
- Missouri Rice Research and Merchandising Council
- National Sunflower Association
- North Dakota State University
- North Dakota Department of Agriculture
- Ohio Dairy Association
- Ohio State University
- Syngenta Crop Protection
- USA Rice Federation

### National Wildlife Research Center Scientists Address the Concerns of Farmers, and Feedlot, Dairy and Urban Area Managers

Wildlife Services' (WS) National Wildlife Research Center (NWRC) is the only Federal research organization devoted exclusively to resolving conflicts between people and wildlife through the development of effective, selective, and socially responsible methods, tools, and techniques. NWRC's field station in North Dakota evaluates and develops methods for managing blackbird damage to sunflower, rice, and corn in the Great Plains. The field station also leads research on national problems involving bird damage to fruit crops; Canada goose damage to sprouting crops; European starling damage and diseases in urban areas, feedlots and dairies; and woodpecker damage to utility structures and buildings.

Blackbirds and European starlings damage grain crops and eat livestock feed, resulting in significant economic losses to agricultural producers. Red-winged blackbirds, common grackles, yellow-headed blackbirds, and brown-headed cowbirds cause an estimated \$20 million worth of damage to newly planted and ripening rice in Arkansas, California, Louisiana, Missouri, and Texas; \$15 million worth of sunflower in North Dakota and South Dakota; and \$35 million worth of ripening and newly planted corn nationally. Some individual rice and sunflower growers report 100 percent losses due to bird depredation. Birds, especially European starlings, cedar waxwings and robins, cause \$41 million in damage to high value fruits like blueberries, cherries, grapes and apples in the leading fruit growing states of California, Michigan, New Jersey, New York, North Carolina, Pennsylvania, and Washington. NWRC scientists are studying ways to refine current damage abatement methods and develop new methods for reducing damage. Additionally, researchers are looking for nonlethal methods to expand capabilities to target specific problem-causing birds.

To improve profitability for farmers and ranchers, NWRC scientists routinely work with producers, commodity groups, research boards, universities, and local, State and Federal agencies to develop safer and more effective methods to reduce bird depredation on seeded and ripening sunflower, corn, rice, and fruit crops, as well as livestock feed. As part of their efforts to develop new methods and tools, NWRC scientists conduct multifaceted behavioral studies involving the use of both captive and free-ranging birds; estimate the economic impacts of bird damage; evaluate and develop nonlethal repellants for deterring birds; and improve the effectiveness and safety of avicides for reducing depredating populations.

### Applying Science and Expertise to Wildlife Challenges

**40 Years of Blackbird-Sunflower Research.** — Sunflower is a globally important oilseed crop grown on approximately 59 million acres worldwide. Because of its high-energy content, numerous bird species—from doves and parakeets to crows and cockatoos—feed on the crop. In the United States, blackbirds cause most of the bird damage to sunflowers, which are grown primarily in North Dakota and South Dakota.

For nearly 40 years, NWRC researchers and their collaborators have worked to reduce blackbird damage to sunflower by studying the life history and ecology of blackbirds and testing a variety of chemical and physical frightening agents, aversive repellents, bird-resistant sunflowers, decoy crops, habitat management, population management, and cultural modifications in cropping.

Managing bird damage to crops like sunflower, fall into three main categories: frightening, evading, and population control. From decades of research and experience, NWRC experts believe methods that focus on evasion have the best chance of long-term success. Evasion methods, such as decoy crops, habitat management, and alternative harvesting regimes, focus on manipulating the environment rather than the birds. NWRC scientists published a formal review in *BioScience* on 1) the efficacy and economic viability of current bird damage management strategies for sunflower, 2) methods previously tested in the field and later abandoned for lack of efficacy or safety, and 3) future directions of bird-damage research. In summary, researchers believe habitat management of roosting sites, plant desiccants to accelerate

harvest time, and decoy crops are the most effective, economically viable and practical strategies for reducing blackbird damage to sunflower. However, further protection can be gained through methods that target birds directly. In the next decade, researchers anticipate an effective bird repellent will be registered for use on ripening sunflowers (and other grain crops) and that a perennial sunflower variety will be developed that could be used as part of a decoy crop regime and alternative food source for birds. Alternative sources of foods, possibly in combination with repellents, should help make significant advances in the management of blackbird damage to sunflower crops

**Ultraviolet Cues Improve Effectiveness of Bird Repellent.** — Red-winged blackbirds, common grackles, yellow-headed blackbirds and brown-headed cowbirds cause millions of dollars of damage to agricultural crops each year. Application of chemical repellents, such as anthraquinone, can be effective in reducing damage and loss to crops, but maintaining repellent concentrations over long periods of time can be expensive. NWRC researchers previously found that birds can associate inert visual cues with the effects of repellents. Current experiments yielded two significant findings. First, combining anthraquinone with a spectrally matched ultraviolet (UV) pigment creates a synergistic effects (i.e., it took less repellent to yield a specified avoidance). Second, once experienced with the repellent-UV pairing, birds avoided seeds treated with the UV pigment alone, and the response was more robust than for non-spectrally matched pigments. Researchers hope to use these findings to improve the development of cost-effective, repellent-based strategies for reducing bird damage to crops.

**Application Strategies for an Anthraquinone-Based Repellent.** — Although anthraquinone is a naturally occurring substance effective at reducing bird damage to many crops, no anthraquinone-based repellents are currently registered for agricultural applications in the United States. If registered, anthraquinone-based repellents could be included in chemical applications that producers commonly use to reduce pest damage. These single applications often include a combination of insecticides, fungicides, and repellents. NWRC researchers tested the effectiveness of anthraquinone in preventing blackbird damage to sunflowers when applied in conjunction with either an insecticide or fungicide. In studies, more than 80 percent of captive red-winged blackbirds were repelled from sunflowers treated with either anthraquinone and an insecticide (Asana XL) or fungicide (Headline)-a result similar to that found for sunflowers treated only with anthraquinone. Given that anthraquinone formulations are not affected by the addition of either the insecticide or the fungicide, it is likely that anthraquinone-based repellents can be effectively added to tank mixtures that include these commonly used, late-season pesticides. However, additional tests are needed to determine whether anthraquinone-based repellents retard the efficacy of insecticides and fungicides.

**E. coli in Dairies and Starling Roosts.** — *E. coli* O157:H7 is a foodborne bacterial pathogen that causes major public health problems throughout North America. Cattle are the major reservoir of *E. coli* O157:H7 in North America, but this pathogen has also been found in deer, rodents, rabbits, and wild birds, including European starlings. To better understand the role starlings play in disseminating *E. coli* among livestock, and possibly identify control points to disrupt pathogen transmission, NWRC researchers examined the prevalence of *E. coli* O157:H7 in large starling night roosts and whether these roosts contributed to *E. coli* infection among nearby dairy cows. Over several years, researchers collected and analyzed fecal samples from cows and starlings in 150 northeastern Ohio dairy farms. Genetic analysis showed that *E. coli* samples from farms were closely related to subtypes from nearby starling roosts. Because birds from roosts travel to multiple farms, starlings are likely a significant risk factor in disseminating *E. coli* O157:H7 among dairy farms. Roost control may be an efficient means to decrease transmission of *E. coli* O157:H7 among farms.

**Image Recognition Hazing System for Canada Geese.** — The Goose Guardian is an image-recognition, real-time hazing system that uses audio/visual tools to scare away birds. As part of a cooperative agreement with TKO Enterprises, Inc., which produces the system, NWRC researchers evaluated how effectively it disperses Canada geese. In studies with captive Canada geese, the image-recognition component of the Goose Guardian successfully detected geese 3 to 9 meters away from the image sensor and accurately detected 93 to 96 percent of the geese throughout the study. In areas where the Goose Guardian was activated, goose occupancy decreased from 86 to 42 percent. Researchers recommend additional testing of the device in agricultural and other field settings.

#### **Selected Publications:**

Linz, G.M., H.J. Homan, S.J. Werner, H.M. Hagy, and W.J. Bleier. 2011. Assessment of bird-management strategies to protect sunflowers. *BioScience* 61:960-970.

Homan H.J., Stahl R.S., Linz G.M. 2013. Comparison of two models for estimating mortality from baitings with Compound DRC-1339 Concentrate avicide. *Crop Protection* 45:71-75.

Swirski, A.L., D.L. Pearl, M.L. Williams, H.J. Homan, G.M. Linz, N. Cernicchiaro, and J.T. LeJeune. Spatial epidemiology of *Escherichia coli* O157:H7 in dairy cattle in relation to night roosts of *Sturnus vulgaris* (European Starling) in Ohio, USA (2007-2009). *Zoonoses and Public Health* 61:427-435. doi: 10.1111/zph.12092.

Werner, S.J., S.T. DeLiberto, S.E. Pettit, and A.M. Mangan. 2014. Synergistic effect of an ultraviolet feeding cue for an avian repellent and protection of agricultural crops. *Applied Animal Behaviour Science* 159:107-113. doi: 10.1016/j.applanim.2014.06.012.

Werner, S.J., S.K.Tupper, S.E. Pettit, J.W. Ellis, J.C. Carlson, D.A. Goldade, N.M. Hofmann, H.J. Homan, and G.M. Linz. 2014. Application strategies for an anthraquinone-based repellent to protect oilseed sunflower crops from pest blackbirds. *Crop Protection* 59:63-70. doi:10.1016/j.cropro.2014.01.016.

#### **Major Research Accomplishments:**

- WS research indicates that roosting site habitat management, plant desiccants that accelerate harvest time, and decoy crops are the most effective, economically viable, and practical strategies for reducing blackbird damage to sunflower.
- WS research shows that the repellent anthraquinone combined with ultra-violet cues can be effective in reducing bird damage and loss to crops.
- Anthraquinone remains effective at repelling blackbirds from crops when combined with commonly-used insecticides or fungicides.
- WS research shows European starlings are a potential risk factor in the dissemination of *E. coli* O157:H7 among dairy cattle and dairy farms.
- WS studies showed the Goose Guardian- an image-recognition, real-time hazing system- was effective at identifying and scaring captive Canada geese.