# PROJECT REPORT

Project Title: Concentration-response Relationship of an Anthraquinone-based Repellent for Wild Turkeys.

Research Agency: United States Department of Agriculture, Animal and Plant Health Inspection Service

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Background:

Although the reintroduction of wild turkeys (Meleagris gallopavo) in 49 of 50 states (Miller et al. 2000) has been successful in most states since the 1970s–1980s (Craven 1989), wild turkeys have been recently identified as a potential cause of human-wildlife conflicts in the United States (Paisley & Kubisiak 1994; Miller et al. 2000, Clark et al. 2006). Wild turkeys can reportedly damage mature corn, alfalfa, oats, soybean, strawberries, and baled hay (Craven 1989; Gabrey et al. 1993; MacGowan et al. 2006; OFAH 2009). Although agricultural foods comprised 69% of the spring diet of wild turkeys collected from agricultural fields in southwestern Wisconsin (Paisley & Kubisiak 1994), crop contents primarily consisted of waste grains in spring and insects (mostly grasshoppers) in summer (Wright et al. 1989; Paisley & Kubisiak 1994). Wild turkeys can also negatively impact ginseng production during seed production (Scott et al. 1995) and late-winter scratching by flocks within partially-melted ginseng gardens (i.e., crown scarification; Joe Heil-President, Ginseng Board of Wisconsin, Inc., pers. comm.). Tefft et al. (2005) used mail surveys to report that the following crops (ranked) were associated with wild turkey depredation in the United States from 1996–1999: silage corn, spring corn, wheat, fall corn, grapes, oats, soybeans, tobacco, apples, gardens, ginseng, rye, strawberries, tomatoes, ornamentals, peanuts, alfalfa, and barley. Complaints regarding wild turkeys in urban areas have also increased in recent years (MacGowan et al. 2006).

Although most surveyed agricultural producers in Wisconsin (51% of 294 survey respondents) regarded wild turkey damages as “minor;” only 3% of respondents claimed turkey-caused losses >$500 (Craven 1989). In Iowa, 82% of survey respondents (N=377 landowners/operators)

indicated that they had wild turkeys on their land; although 52% of respondents reported damages caused by wild turkeys, only 5% of respondents estimated that turkeys caused >$500 damage (Gabrey et al. 1993). Indeed, “the association between turkey presence and assumed turkey responsibility for all damage observed must be kept in mind when discussing perceived losses, and in educational efforts” (Gabrey et al. 1993). Although wildlife damage to harvestable field corn in

1993 was estimated at $11.6 million in Indiana (Wywialowski 1996), ≤ $10,000 of agricultural damage in Indiana has been attributed to wild turkeys each year (Tefft et al. 2005) and <3 percent of producers in north central Indiana viewed turkeys as a nuisance (MacGowan et al. 2006).

The most difficult human-wild turkey conflicts may occur with high-value specialty crops (e.g., ginseng) on small acreages interspersed in woodland turkey habitat (Miller et al. 2000). Our study was part of a Specialty Crops Block Grant funded by the California Department of Food and Agriculture in 2010–2013. Whereas wild turkeys can damage ginseng while scratching straw and waste grains within melted areas of ginseng gardens in late winter, we evaluated an oat seed treatment as an avian repellent for wild turkeys. The active ingredient of the repellent seed treatment is 9,10-anthraquinone (Arkion Life Sciences, New Castle, DE). We recently developed concentration-response relationships of an anthraquinone-based repellent for Canada geese, red- winged blackbirds, ring-necked pheasants (Werner et al. 2009), and common grackles (Werner et al. 2011). The study reported herein was designed to develop a concentration-response relationship of an anthraquinone-based repellent for wild turkeys.

Results:

Gobbler concentration-response experiment:

Gobblers exposed to oats treated with 0.5–4% anthraquinone exhibited 78–99% repellency during repellent exposure (Figure 1). Actual anthraquinone concentrations for our 0.5–4% anthraquinone-treated oats used for both the gobbler and hen experiments were: 4120 ppm, 8820 ppm, 19100 ppm, and 34400 ppm anthraquinone, respectively. Gobbler repellency (y) was a function of anthraquinone concentration (x): $y = 9.921 \ln(x) - 2.260$ ($r^2 = 0.93$, $P = 0.034$). We therefore predicted a threshold concentration of 4,000 ppm anthraquinone for gobblers offered treated oats.

Hen concentration-response experiment:

Hens in the control group (<0.5 ppm anthraquinone; HPLC method limit of detection) consumed 216.1 ± 21.0 g of untreated oats during the test; their average, pre-test consumption of untreated oats was 193.3 ± 22.5 g. In contrast, hens exposed to oats treated with 0.5–4% anthraquinone exhibited 75–98% repellency during repellent exposure (Figure 2). Hen repellency (y) was a function of anthraquinone concentration (x): $y = 10.746 \ln(x) - 12.029$ ($r^2 = 0.94$, $P = 0.030$). We therefore predicted a threshold concentration of 5,300 ppm anthraquinone (i.e. 80% repellency) for hens offered treated oats.