EFFICACY OF THE AERIAL APPLICATION OF METHYL ANTHRANILATE IN REDUCING BIRD DAMAGE TO SWEET CORN, SUNFLOWERS, AND CHERRIES

LEONARD R. ASKHAM, Washington State University, and Research and Development, Bird Shield Repellent Corporation, Pullman, Washington 99163.

ABSTRACT: Field trials using methyl anthranilate, formulated as Bird Shield® repellent, were performed by aerial applicators at one pint per acre on sweet corn in Colorado, and sunflowers in North Dakota, and at one, two, and four pints per acre on cherries in Washington. Nineteen corn fields ranging in size from 9 to 25 acres were treated twice, at five day intervals, prior to harvest and compared with six untreated fields during a two year study. During the same time period ten sunflower fields, along with their adjacent cattail marshes were treated twice, at seven day intervals when the birds began to feed on the ripening seed, and compared with six untreated counterparts. Five out of the six untreated corn fields were unharvestable, with greater than 75% damage, because of the severe damage caused by the resident populations of red-wing blackbirds (*Agelaius phoeniceaus*). Nine of the treated fields sustained no damage at all. The damage in the remainder was contained at pre-treatment levels (4% to 20%). The two applications of the repellent were sufficient to move the resident population of blackbirds out of the sunflower fields with no substantial damage to the crop. Untreated sunflowers sustained 78% to 90% damage. Treated sunflowers sustained between 2.6% to 3.4% damage. The difference in seed weights between untreated and treated plots was significant (P=0.01) with a mean weight of 0.018 g/cm^2 of seed per head within the former and 0.084 g/cm^2 of seed per head within the latter. Harvest weights ranged from 133 to 700 lbs/ac (mean=344) in the untreated plots while weights ranged from 1430 to 1909 lbs/ac (mean=1675) in the treated plots. No adverse effects were noted with fish or resident populations of ducks. The application of the repellent by helicopter reduced bird damage from just under 13% in one untreated cherry orchard to between 0.08% and 1.0% seven days later with 1, 2, and 4 pints/ac rates in comparable orchards. Greater differences were encountered when the repellent was applied at two additional sites. When 2 pints/ac was applied, bird damage was limited to 8% after 15 days when the untreated block sustained between 58% to 68% damage.

KEY WORDS: birds, starling, blackbird, robin, corn, sunflower, cherry, aerial application, helicopter, aircraft

Proc. 19th Vertebr. Pest Conf. (T.P. Salmon & A.C. Crabb, Eds.) Published at Univ. of Calif., Davis. 2000.

INTRODUCTION

Protecting agricultural crops from birds is as old as written history. Wherever humans have planted, birds have been there. Thus the battle has not just been joined, but continues as a series of skirmishes that the unfeathered, two legged counterpart loses more often than wins.

During the last four decades a great deal of time and money has been spent on assessing bird damage to and developing strategies for protecting corn, sunflowers, and cherries. Reporting all of them would be voluminous, taking up most of this paper, and hence counter-productive to the objectives of this report. There are, however, several which bear mention either because of their uniqueness or for their thoroughness. Most of the avian depredation research in the United States has centered on corn. Reports on the severity of damage have ranged from less than 1% (Stickley et al.) to greater than 95% (Dolbeer et al. 1982). Similar results were found for sunflowers which ranged from less than 1% to greater than 97% (Dolbeer et al. 1986) as well as cherries with less than 4% (Askham 1992) to 100% (Tobin et al. 1991).

Control has taken on many forms, all of which have been unproductive until the development of Bird Shield repellent; scare crows, "eye" balloons, reflective tape, exploding shells and fire works, propane fired cannons, and avalarms to name but a few. Some of the most interesting to me have been aerially-applied surfactants (Lefebvre 1967), citric acid solutions (Harriman 1968), sucrose octaacetate and lithium chloride (Rogers 1974), and 4-aminopyrodine (Knittle et al. ND). Considerable effort has also been placed on the development of bird resistant corn (Dolbeer et al. 1986a, b). Unfortunately, the results were not favorable enough to continue with their research or commercial development.

Bird Shield repellent has been shown to effectively reduce avian depredation to cherries, blueberries, and table grapes (Askham 1992) and control goose problems on turf (Askham 1997). Under the former, the repellent is applied at 1.15 to 4.58 lbs. ai/ac (1.29 to 5.13 Kg/ha). The question remained, however, was whether or not low volumes of the repellent would be an effective deterrent.

The research reported here centered on the application of methyl anthranilate, formulated as Bird Shield repellent to three crops with fixed winged aircraft and helicopters; corn, sunflowers, and cherries.

METHODS AND PROCEDURES

Test Sites

The corn research was conducted in and around the Uncompaghre Valley between Delta and Montrose; approximately 50 miles south of Grand Junction, Colorado. Sweet and seed corn, beans, and hay are the primary crops in the region. Of these, sweet corn produces the most revenue per acre. In 1998, 10 fields were treated with Bird Shield repellent and compared with 4 untreated fields. In 1999, 12 fields were treated with the repellent and compared with 4 untreated fields.

The sunflower studies were conducted in Range 55 and 56 West, Townships 130 and 131 North, Sargent

County, North Dakota; approximately 50 miles south of Fargo. Sunflowers, field corn, beans, and hay are the primary crops in the region. Of these, sunflowers grown for oil produce the most revenue per acre. In 1998, 6 fields were treated with the repellent while 4 were left untreated. In 1999, 8 fields were treated with the repellent and compared with 4 controls.

The cherry studies were conducted in three regions of the Pacific Northwest during 1999. The first test site was located approximately 1.5 miles north of Milton Freewater, Oregon on the James A. Reese Ranch. Within the ranch four blocks of mature trees were selected. Block Number 1 consisted of two acres of Bing, Rainer, and Utah Giants. Block Number 2 consisted of four acres of Bing, Rainer, Van, and Lambert trees. Block Number 3 consisted of Rainer. Block Number 11 consisted of two acres planted with Bing and Rainer.

The second site was located at Washington State University's Irrigated Agriculture Research and Extension Center (IAREC) in Prosser, Washington. Two, one-acre blocks were selected within the Rosa tract for the trial. The first one-acre block was planted with Bing, Chinook, and Rainier cherries and designated as the treatment site. The second one-acre block was planted with 15 different test varieties and was designated as the untreated control.

The third test was conducted on Washington State University's Columbia River View orchard (CVO) North of Wenatchee, Washington, along the Columbia River. Two adjoining one-acre blocks within the Smith tract were selected for the trial; one as an untreated control while the other as the treatment. Both blocks were a mixture of Bing, Van, and Lambert varieties.

Sampling Procedure

Corn. Each plot was approximately 150 feet wide by 300 feet long. Twenty-five stalks of mature corn, in five rows within the center of each plot, were sampled for damage. Sampled rows were approximately 30 feet apart. Sampling began by inspecting the first stalk 60 feet into the field from the edge. The remainder of the stalks were sampled at 60 foot intervals within each row. Only the top, or apical ear of corn on the stalk was examined. Each ear of corn was inspected for the presence or absence of bird activity (feeding). Bird activity was defined as a shredded husk and consumed kernel of corn. Each ear was categorized into one of the following classes: a) Undamaged—No evidence of bird feeding; b) Slightly Damaged (within grade)—Penetration of ear husk with eight or less kernels of corn consumed on a 12 inch ear; or c) Damaged—Severe husk shredding with eight or more kernels of corn on the cob consumed on a 12 inch ear. Any ear of corn with eight or more kernels of corn consumed or damaged did not fall within "grade" and was rejected by the packer.

Sunflower. Each plot was approximately 150 feet wide by 300 feet long. Sampling began a minimum of 60 feet into the field from the edge of the field. Within each block, 25 flowers were randomly harvested, five from each row; the seed head size, weight, and the amount of seed loss was measured in square inches. Bird activity was defined as a removed seed on each flower. Five seed heads, collected at random from within each sample plot, were dried, the seeds removed, cleaned to remove debris, and weighed. Harvest records from selected treated and untreated fields were recorded.

Cherries. Approximately 20% of the trees were randomly selected within the center of each block in the Reese and IAREC orchards for study. All of the trees were evaluated in the CVO orchard. Damage assessments were made by examining the distal 12 inches of a fruit bearing branch in the tops of the trees and recorded for the number of damaged and undamaged fruit observed. Damage assessments were conducted immediately prior to the first application and at harvest seven days after the application of the repellent. Bird damage was defined as a pecked, partially consumed, or removed cherry.

Materials and Equipment

Corn and sunflowers. Each field was treated twice with one pint (0.47 L) of Bird Shield repellent (0.286 lbs. ai/ac; 0.320 Kg ai/ha) with fixed wing aircraft that applied approximately 5 gallons of tank mix per acre (7.6 L/ha). The corn was treated at five day intervals beginning ten days prior to the date of anticipated harvest. Sunflowers were treated at seven day intervals when bird activity began.

Cherries. The Reese orchard was treated once with 1, 2, and 4 pints (0.47, 0.95, and 1.88 L) of Bird Shield (0.287, 0.572, and 1.145 lbs. ai/ac; 0.64, 1.28, and 2.56 Kg ai/ha). The IAREC and CVO orchards were each treated with 2 pints (0.95 L) of the repellent per acre. All treatments were made with helicopters which applied approximately 10 gallons (15.2 L/ha) of tank mix per acre.

RESULTS

Corn

In 1998, the four untreated fields, totaling a little over 74 acres, lost 49% to 75% (mean=68%) of their crop to Redwing blackbirds (Figure 1). Six of the treated fields, which had incurred damage ranging from 4% to 20% prior to treatment with the repellent, received a 2.4% increase in depredation. The remaining four fields, where no bird activity was recorded prior to the first application of Bird Shield, sustained less than 1% damage by the time the crop was harvested. In 1999, the four untreated fields sustained 45% to 98% damage. The remaining 12, treated with the repellent, had less than 1% damage by the time of harvest (Figure 2).

Sunflowers

In 1998, mean damage to the two untreated sunflowers by Redwing blackbirds was a little over 69% (range=56.32% to 82.84%) (Figure 3). Mean damage to the remaining four treated sunflower fields was a little less than 3% (range=2.68% to 3.37%); a 96% reduction. In 1999, the two untreated fields had 78% to 90% damage while the four treated with the repellent had an average of about 1% (Figure 4).

Cherries

Reese Orchard. Prior to the application of the repellent none of the fruit on the trees were damaged by robins (*Turdus migratorius*) or starlings (*Sturnus vulgaris*) (Figure 5). Seven days after the application 12.75% of

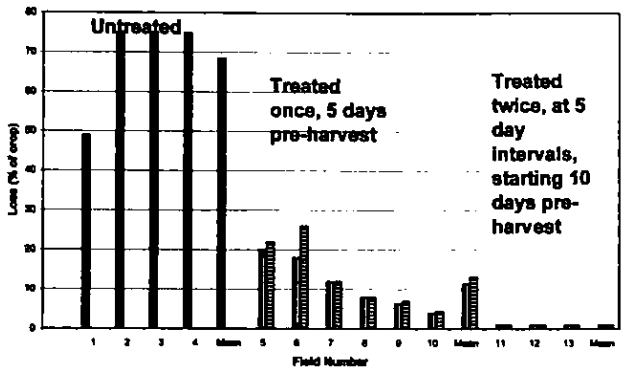

Figure 1. Efficacy of Bird Shield repellent, applied by air at 0.286 lbs. ai/ac to control blackbird damage in sweet corn, August 1998.

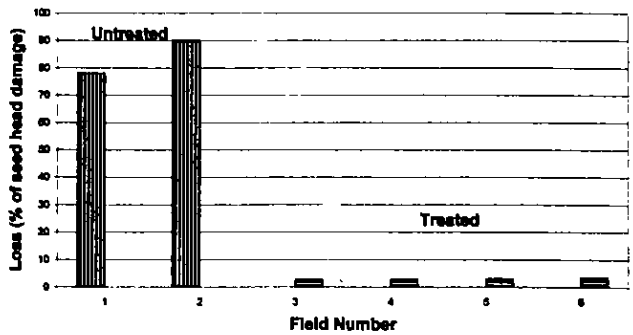

Figure 4. Efficacy of Bird Shield repellent applied twice by air at seven day intervals with 0.286 lbs ai/ac to control black bird damage in sunflowers, 1999.

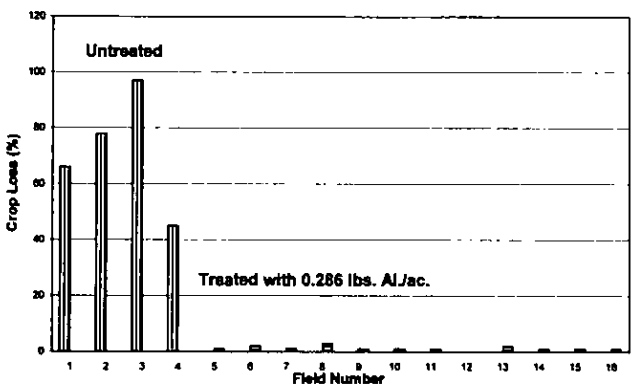

Figure 2. Efficacy of Bird Shield repellent applied by air at 0.286 lbs. ai/ac to control bird damge in sweet corn, 1999.

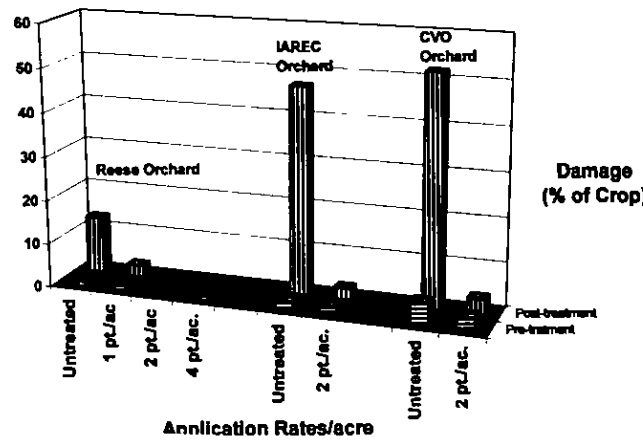

Figure 5. Efficacy of Bird Shield repellent applied by helicopter to control birds in cherry orchards, 1999.

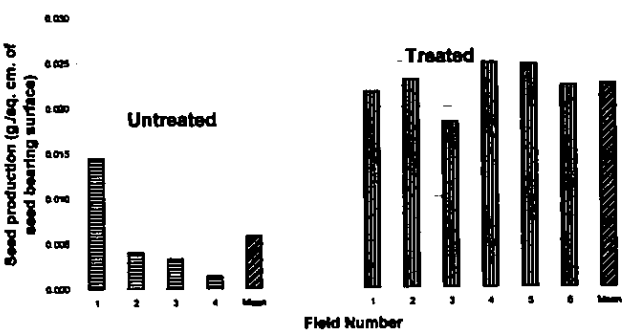

Figure 3. Efficacy of Bird Shield repellent applied by air at 0.286 lbs. ai/ac twice at seven day intervals to control blackbird damage in sunflowers, 1998.

the cherries in the control or untreated block could not be harvested. The site treated with 1 pint of the repellent per acre sustained about 2.5% damage, while the sites treated with 2 and 4 pints per acre sustained about 0.05% and 0.01% damage, respectively. Treatments were terminated after one week when the fruit was harvested.

IAREC. Prior to the first application of the repellent no bird damage was found in the control block, while 1.68% of the fruit in the treated block were damaged. Seven days post treatment, 24.58% of the fruit in the untreated block was damaged, while no increase in fruit damage was found in the treated block. Testing was terminated at seven days when the fruit was harvested.

CVO. Prior to the first application of the repellent, 0.77% and 0.81% of the fruit in the untreated control and treated orchards, respectively, was damaged by birds. Seven days post-treatment, 26.02% of the fruit in the untreated block was damaged, while 2.50% of the fruit in the treated block was damaged. Testing was terminated seven days post treatment when the fruit was harvested.

DISCUSSION OR SUMMARY

Birds have been a major contributing factor to corn, sunflower, and cherry losses for growers. Up until now most control techniques for the former two have been ineffectual or cost prohibitive while the latter has relied on large volumes of water as a carrier for the repellent when the crop is treated. It was found, however, that low volumes of water along with low concentrations of the repellent could be effective in reducing damage to these crops when applied by air. One of the contributing factors appears to be the size of the droplet. When the repellent is applied to orchards, vineyards, and turf with airblast and boom sprayers, the liquids droplet size is quite large. This coats the vegetation with an even layer of the repellent. Aerial applications, however, produce smaller droplets which appear to penetrate the vegetation more effectively. With this technology, reduced rates of repellent now appear feasible to achieve the desired results.

As the data show, crop damage can be reduced as much as 96% depending on when the repellent is used. As with prior studies, along with the experience gained during the last five years with the commercial use of the repellent on cherries, blueberries, and table grapes, the earlier the repellent is applied the more efficacious it becomes. At current retail prices control can be obtained from $10 to $20 per acre plus application costs.

ACKNOWLEDGMENTS

Three people, in particular, made this research possible: Leonard Felix, Rick Hoistad, and Jim Reese. Each contributed time, money, their aircraft, fields, and generous hospitality so that others would profit from our work. Without Leonard's insistence that the repellent worked or Rick's determination that I had to come look at his results, I would not have gotten the project off the ground. Also, to Dr. Mike Godfrey who loves to pick my papers apart. Thanks folks.

LITERATURE CITED

ASKHAM, L. R. 1992. Efficacy of methyl anthranilate as a bird repellent on cherries, blueberries and grapes. Pages 137-141 *in* Proc. 15th. Vert. Pest. Mgmt. Conf., R. E. Marsh, ed. Sacramento, CA. March.

ASKHAM, L. R. 1997. Efficacy of Turf Shield repellent to reduce goose and duck use of grass areas adjacent to ponds, lakes and rivers. Pages 52-62 *in* Proc., 13th Great Plains Wildl. Damage. Control. Workshop., C. D. Lee, and S. E. Hygnstrom, eds. April.

DOLBEER, R. A. 1981. Cost-benefit determination of blackbird damage control for cornfields. Wild. Soc. Bull. 9(1):44-51. Spring.

DOLBEER, R. A., P. P. WORONECKI, and R. A. STEHN. 1982. Effect of husk and ear characteristics on resistance of maize to blackbird (*Agelaius phoeniceaus*) damage in Ohio, U.S.A. Protection Ecology 4(1982):127-139.

DOLBEER, R. A., P. P. WORONECKI, and R. A. STEHN. 1986a. Blackbird-resistant hybrid corn reduces damage but does not increase yields. Wildl. Soc. Bull. 14:298-301.

DOLBEER, R. A., P. P. WORONECKI, and R. A. STEHN. 1986b. Resistance of sweet corn to damage by blackbirds and starlings. J. Amer. Soc. Hort. Sci. 111(2)306-311.

DOLBEER, R. A., P. P. WORONECKI, R. A. STEHN, G. J. FOX, J. J. HANZEL, and G. M. LINZ. 1986. Field trials of sunflower resistance to bird depredation. North Dakota Farm Research 43(6):21-24, 28.

HARRIMAN, A. E. Rejection thresholds for citric acid solutions in cowbirds, starlings and red-winged blackbirds. Pages 240-242 *in* The American Midland Naturalist. Notes and Discussion.

KNITTLE, C. E., J. L. GUARINO, O. E. BRAY, J. L. CUMMINGS, and M. R. OUELLETTE. No Date. Protecting ripening sweet corn from blackbirds in Wisconsin with 4-aminopyrodine. Pages 188-194 *in* Proc. 7th. Bird Control Seminar, Bowling Green State Univ., Bowling Green, OH.

LEFEBVRE, P. W., A. E. HESTER, B. MEANLEY, and D. P. FANKHAUSER. 1967. Effects of aerially-dropped surfactant solutions on roosting blackbirds and starlings in Arkansas, 1967. U.S. Dept. Int., Bureau of Sport Fish. and Wildl., Div. Wildl. Res. Petuxent Wildl. Res. Ctr. Section of Animal Depredation Control Studies, Stuttgart, AK, Substation. Special Report. 55 pp.

ROGERS, J. G. 1974. Responses of caged red-winged blackbirds to two types of repellents. J. Wildl. Manage. 38(3):418-423.

STICKLEY, A. R., D. L. OTIS, JR., and D. T. PALMER. 1979. Pages 169-177 *in* Evaluation and results of a survey of blackbird and mammal damage to mature field corn over a large (three state) area. American Society for Testing and Materials, Special Technical Pub. 680.

TOBIN, M. E., R. A. DOLBEER, C. M. WEBSTER, and T. W. SEAMANS. 1991. Cultivar differences in bird damage to cherries. Wildl. Soc. Bull. 19:190-194.