Bird Damage to Sprouting Corn in Kentucky and Tennessee

Jon F. Heisterberg, *U.S. Fish and Wildlife Service, Denver Wildlife Research Center, Kentucky Research Station, Bowling Green, KY 42101*

Abstract: Loss of corn sprouts to birds (predominantly common grackles, *Quiscalus quiscula*) was estimated in a 0.5-ha plot in each of 270 fields in 36 counties in Kentucky in 1978 and 215 fields in 21 counties in Tennessee in 1979. Estimated loss of sprouts to birds in Kentucky and Tennessee averaged 0.15% (SE = 0.03) and 0.95% (SE = 0.41), respectively, for a maximum projected grain harvest loss of about 4,600 metric tons in Kentucky and 12,400 metric tons in Tennessee. Although maximum calculated bird damage to sprouts for both states was $1.8 million, 453 (93%) of the 485 plots surveyed had relatively minor (<1%) losses. However, those 32 plots receiving ≥1% sprout loss accounted for 82% of all bird damage losses and would have benefitted from recently developed bird repellent seed treatments.

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 37:41–48

Although bird damage to sprouting field corn in Kentucky and Tennessee has been considered by farmers and other agricultural interests as a serious problem, losses have never been objectively measured. In a questionnaire survey of wildlife and agricultural specialists in 25 states (Stone and Mott 1973), respondents indicated that damage to corn sprouts by birds in the southeastern and mid-atlantic states was a serious problem; Kentucky respondents indicated that birds were responsible for "moderate" damage to sprouting corn. A 1976 opinion survey of 2,051 randomly selected farmers in 72 Tennessee counties set annual sprout losses at $8 million, the highest dollar loss of any of the bird-related farm losses reported (R. Hobson and J. Geuder, Tennessee blackbird damage survey, October 1976, unpubl. report, Tennessee Crop Reporting Service).

Because of the purported magnitude of corn sprout losses to birds in these 2 states, objective surveys of bird damage in Kentucky and Tennessee were undertaken to better estimate the extent of overall losses so that man-

agement recommendations and research objectives could eventually be formulated to reduce the problem. Kentucky was surveyed in 1978 and Tennessee in 1979. To our knowledge these surveys represent the first time that bird damage to sprouting corn has been objectively measured over a large (2-state) area.

I thank J. F. Besser, F. L. Boyd, O. E. Bray, L. S. Clark, C. S. Cooper, R. M. Fisher, J. F. Glahn, T. D. Grandpre, M. Hilliard, J. J. Karrenbrock, J. M. Morgan, G. A. Murphy, B. S. Muszar, A. R. Stickley, S. Suddarth, D. J. Twedt, G. W. Warren, and C. A. Williams for field assistance. D. L. Otis and J. F. Besser of the Denver Wildlife Research Center, U.S. Fish and Wildlife Service, provided valuable input in the design and implementation of the survey.

Methods

Sampling Scheme

Damage to sprouting corn in Kentucky and Tennessee was assessed by a 3-stage cluster sample similar to that used by Stickley et al. (1979). A first-stage sampling unit was a county in the state; a second-stage, a 0.5-ha plot of corn within the county; and a third-stage, a 50-m length of corn row in the 0.5-ha plot. In each state, counties were selected with replacement and with probability proportional to the area planted in corn the previous year. Within counties, either 5 (Kentucky) or 8 (Tennessee) 0.5-ha plots were located by means of simple random sampling without replacement. More plots per county were used for the 1979 Tennessee survey because of the high within-county variability in bird damage encountered in the 1978 Kentucky survey.

For sampling, maps of each county selected were gridded into 2.6 km^2 (1 mi^2) blocks. In each selected block, a 0.5-ha plot was located in the first cornfield encountered after entering the block on the most convenient road. Kentucky and Tennessee fields containing plots averaged 6.3 ha and 7.3 ha in size, respectively. Only cornfields with no emerged sprouts or those with sprouts just emerging were selected. If no cornfield could be located along the roads in the block, the nearest cornfield to the block was selected. In the Kentucky survey, 22% of the 0.5-ha plots were located within the selected block, whereas only 8% of the Tennessee plots were located within this block.

To locate the 0.5-ha plot in each cornfield, a random point along the width of the field was chosen from which the length of the field was paced. The line paced represented the length of the plot, and the width of the plot was chosen to provide a plot size of 0.5 ha. In each plot, 5 50-m sections of corn row (Kentucky) and 8 50-m sections of corn row (Tennessee) were located by means of simple random sampling without replacement. To lessen the within-plot variability in bird damage determined for the Kentucky sur-

vey, the number of corn row samples per plot was increased to 8 for the Tennessee survey.

From 14 April to 24 June 1978, 270 0.5-ha plots in 36 Kentucky counties were surveyed; 216 0.5-ha plots in 21 Tennessee counties were surveyed from 27 April to 18 June 1979. One of the 216 Tennessee fields was replanted during the assessment observations and was not included in the analyses.

Damage Assessment

Damage assessment in Kentucky began as soon as possible after first sprout emergence in a plot; subsequent assessments were made every other day. During the Kentucky survey there was circumstantial evidence that birds possibly could unearth newly planted corn before actual emergence so Tennessee assessments were begun the day the field was located. Because of increased logistical problems, Tennessee plots were assessed once every 3 days. Assessments of plots in both states continued until most sprouts were at least 7 to 10 cm high and receiving little, if any, new bird damage. Plots in Kentucky and Tennessee were assessed an average of 4.2 and 4.0 times, respectively; and final assessments were made an average of 7.8 to 8.4 days, respectively, after first sprout emergence. Twenty-one percent of the Tennessee assessments were made before first sprout emergence.

During each assessment, destroyed sprouts in each corn row sample were categorized as 1 of the following types of damage: bird, weather, insect or disease, and other. To avoid recording the same damage again on subsequent assessments, all evidence of destroyed sprouts was erased. Partially damaged sprouts were each marked with a small wooden marker on which was recorded the type of damage. On the final assessment, the survival of partially damaged sprouts was judged, and the remaining intact sprouts were counted in each corn row sample. During each assessment investigators also recorded any birds observed in the 0.5-ha plot or surrounding field.

Statewide sprout loss estimates for each damage type was determined in the following sequence: Percent sprout loss in each plot was determined by summing the total sprout loss of a given damage type to all corn row samples, dividing by the number of sprouts lost to all causes plus the number of sprouts intact in the samples, and multiplying by 100. Percent sprout loss for each county-unit was obtained by averaging the percent sprout losses in all plots in the unit. Percent sprout losses for all county-units were averaged to obtain the statewide estimate.

Farmers who owned or leased the selected cornfields were asked about use of bird repellent seed corn treatments, past corn sprout losses to birds, and planting dates. Two-by-two contingency table analysis was used to test for associations between variables in severity of corn sprout loss to birds in the 0.5-ha plots and a farmer's perception of past corn sprout losses to birds.

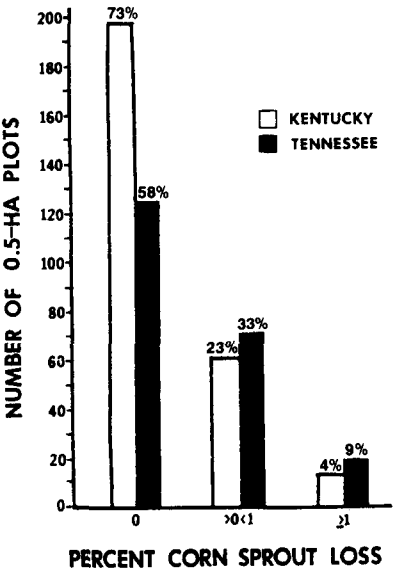

Figure 1. Percent sprout loss to birds in 0.5-ha plots of field corn in Kentucky in 1978 and Tennessee in 1979. The number at the top of each sprout loss category indicates the percentage of plots, by state, represented by that category.

Average sprout loss estimates to birds determined for the Kentucky and Tennessee surveys were compared by *t*-test statistics.

Results

Loss of Sprouts to Birds

Statewide sprouting corn loss to birds averaged 0.15% (SE = 0.03) in Kentucky and 0.95% (SE = 0.41) in Tennessee. Equating sprout loss to harvest loss, 4,567 metric tons of grain valued at $422,000 (Kentucky Crop and Livestock Reporting Service, Kentucky Agricultural Statistics, 1978–79) were lost in Kentucky and 12,418 metric tons valued at $1.37 million (Tennessee Crop Reporting Service, Tennessee Agricultural Statistics, 1980) in Tennessee. In Kentucky and Tennessee, 73% and 58%, respectively, of the plots surveyed had no sprout loss to birds (Fig. 1). Only 12 (4%) of the 270 Kentucky plots had sprout loss ≥1% (maximum 6%), whereas 20 (9%) of the 215 Tennessee plots had ≥1% loss (maximum 64%). No Kentucky counties averaged ≥1% loss, whereas 5 Tennessee counties did (Fig. 2).

Of the 539 assessments of those Kentucky and Tennessee 0.5-ha plots receiving bird damage (excluding those assessments conducted prior to first sprout emergence), common grackles were observed in the plot or surrounding field on 89 assessments, red-winged blackbirds (*Agelaius phoeniceus*) on 30 assessments, common crows (*Corvus brachyrhynchos*) on 23 assessments, and 12 other bird species on 53 assessments. Grackles were the only species

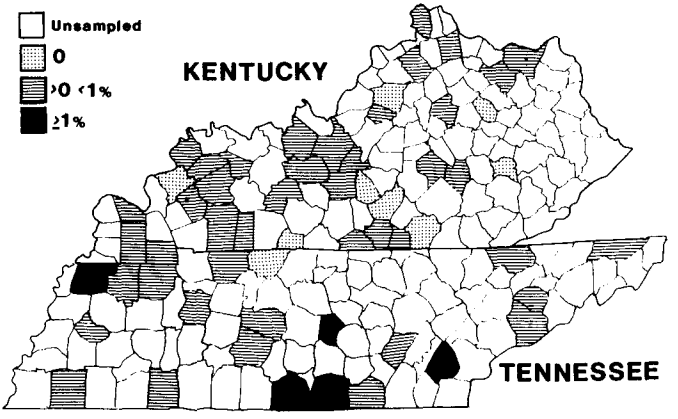

Figure 2. Percent of sprouting corn loss to birds for counties surveyed in Kentucky in 1978 and Tennessee in 1979.

actually observed pulling or digging corn sprouts; however, crows were probably responsible for losses in the 2 most heavily damaged plots in Kentucky, because they were consistently observed in and around these plots.

Birds usually used their beaks to excavate around corn sprouts to get the seed. Occasionally, birds attempted to pull sprouts, sometimes breaking the stem off above the surface of the ground. After breaking the stem, there was usually no attempt to unearth the seed. Beak marks on the stem of broken sprouts verified that the sprout was damaged by birds and not insects. Of 366 partially damaged sprouts marked before the final assessment, 165 (45%) were considered to be fully recovered by the final assessment. The other 201 sprouts were considered to be destroyed by birds.

In both states, 75% of the sprout loss occurred within an average 6.5 days after first sprout emergence. Most (79%) loss occurred to sprouts <10 cm high; however, sprouts up to 23 cm high were destroyed by birds. No detectable bird damage occurred during the preemergence assessments in the Tennessee survey.

Most of the serious sprout losses occurred in fields associated with wet weather. Eight of the 9 most seriously damaged plots in Kentucky and Tennessee received >5 cm rainfall within 3 days before or during much of the bird damage. Sprout loss in these 8 plots continued for an average of 13.5 days (range 9 to 20) after first sprout emergence. Most of this damage occurred to newly emerging sprouts where rate of germination was slow and varied because of adverse growing conditions. Wet soil facilitated pulling rather than digging sprouts. Sprouts with seeds partially exposed by erosion and those growing in waterlogged areas of a field also appeared more vulnerable to attack.

In Kentucky, 8 (3%) of 247 farmers contacted used a federally registered bird repellent treatment on their seed corn, whereas 24 (12%) of 195 Tennessee farmers used a bird repellent treatment. Fourteen of the Kentucky and Tennessee farmers used a methiocarb (3,5-Dimethyl-4-(methylthio) phenol methylcarbamate) seed corn treatment; the other 18 used other types of chemical seed corn repellents. The 14 plots treated with methiocarb averaged 0.1% (range 0 to 0.9%) sprout loss; the other 18 plots averaged 3.2% loss (range 1% to 63.7%).

Of the 224 Kentucky farmers asked about past problems with birds destroying corn sprouts, 198 (88%) reported no or only minor problems and 26 (12%) moderate or serious problems. Of the 195 Tennessee farmers asked this same question, 122 (63%) reported no or only minor problems and 73 (37%) moderate or serious problems. The 320 Kentucky and Tennessee farmers reporting no or only minor past sprout losses to birds averaged 0.3% bird damage to plots in their fields, whereas the 99 farmers reporting moderate or serious past losses averaged 1.5% bird damage. There was an association ($P = 0.003$) between how serious farmers considered past sprout losses to birds (none or minor, moderate, or serious) and sprout losses ($<1\%$, $\geq 1\%$) in plots in their fields. Farmers indicating that past sprout losses to birds were a moderate or serious problem had a higher chance of receiving $\geq 1\%$ sprout losses to birds than farmers indicating no or only minor past problems with birds. A value of 1% was chosen to categorize sprout loss because 1% sprout loss was considered the damage level below which a cost-effective bird repellent seed treatment is unavailable (see Discussion and Management Implications).

Loss of Sprouts to Other Factors

Sprout losses due to weather, insect or disease, and other causes amounted to 0.17% (SE = 0.06), 0.21% (SE = 0.03), and 0.05% (SE = 0.01), respectively, for Kentucky; and 0.46% (SE = 0.14), 0.21% (SE = 0.03), and 0.14% (SE = 0.007), respectively, for Tennessee. Flooded sprouts made up the greatest weather-related damage, whereas cutworms were responsible for most insect or disease-related losses. Sprout losses due to weather and insects or disease should be considered minimum estimates, because the surveys were not designed to record preemergent losses due to these damage types. This was especially true for weather-related damage where losses due to poor germination and erosion were not recorded.

Discussion and Management Implications

Sprout losses to birds in Tennessee in 1979 were estimated at more than 6 times the losses determined in Kentucky in 1978, a significant difference ($P = 0.004$). Although this comparison is somewhat confounded by 2 different years of sampling, the data and observations indicate that it is likely to

be real in any given year. Not only did a much higher percentage of Tennessee versus Kentucky corn growers consider past sprout losses to birds to be more than just a minor problem, the Tennessee growers also used bird repellent seed corn treatments much more often. Differences in damage severity for the 2 states may be partially due to fields in Tennessee being more isolated than fields in Kentucky, which could result in heavier bird pressure. This isolation is shown by the lower success in locating survey fields within the 2.6 km^2 blocks in Tennessee versus Kentucky, and, given the similar sized cornfields for Kentucky and Tennessee, is indicated by the smaller corn growing area in Tennessee (2.3% of land area) compared with Kentucky (5.5% of land area).

When considering all the types of sprout damage encountered during the surveys, bird damage accounted for 26% and 54% of all sprout losses recorded during the Kentucky and Tennessee surveys, respectively. Given that losses to weather and insect or disease are minimum estimates, the relative importance of bird loss is probably even less. However, to those 32 farmers receiving 1% bird damage or more the loss to birds in conjunction with other losses could be significant.

Several observations can be made regarding survey methodology. Cluster sampling to survey bird damage was chosen because of the practicality of the method. Simple random sampling is generally more efficient than cluster sampling (Kish 1965); however, the increased manpower and transportation costs involved would have been prohibitively expensive. Increasing the assessment period from every other day for the Kentucky survey to once every 3 days for the Tennessee survey had a minor effect on the ability to identify fresh damage occurring since the previous assessment. Occasionally, heavy rains between assessments made identification of damage difficult; however, some sprout remains and probe holes could usually still be observed.

Statewide dollar loss estimates projected from sprout losses to birds should be viewed as maximum potential losses, since percent sprout loss does not equate directly to percent harvestable grain loss. Replanting of damaged fields and increased compensatory corn production by undamaged plants adjacent to removed sprouts are factors that modify this equation. Although overall bird damage to sprouts in both States was estimated at $1.8 million, 453 (93%) of the 485 plots surveyed had relatively minor (<1%) sprout losses. Although additional surveys could improve the precision of these estimates, these results are felt to be sufficiently precise to put the problem of sprouting corn loss to birds in proper economic perspective and to formulate specific management recommendations.

Application of a chemical repellent seed corn treatment is 1 of the most frequently and successfully used methods for reducing sprout losses to birds (Stone and Mott 1973). Seed corn treatments containing methiocarb have been highly successful in reducing blackbird depredations on sprouting corn (Guarino and Forbes 1970, Stickley and Guarino 1972). The 2 commercially available products containing methiocarb, Mesurol 50% Hopper Box

Treater®[1] (Mobay Chemical Corp.) and Borderland Black® (Borderland Products, Inc.), have both proven effective in protecting corn sprouts from grackle depredations (Heisterberg and Otis 1982). Based on an average corn planting rate of 15.7 kg seed corn/ha and the 1983 suggested retail price of Mesurol 50% Hopper Box Treater (0.25% active ingredient per seed weight), treatment costs averaged $3.24/ha. Assuming an average grain harvest of 5.3 metric tons/ha valued at $100/metric ton, a field would have to have received at least a 0.6% sprout loss to birds before a methiocarb treatment could be considered cost-effective. However, given the aforementioned compensatory variables and the fact that seed corn treatments never totally protect all sprouts from birds, I recommend that Kentucky and Tennessee farmers use a methiocarb seed treatment only if they anticipate 1% or more sprout loss to birds.

Although only 7% of the plots surveyed received ≥1% sprout loss to birds, these plots accounted for 82% of all the bird damage losses. Thus, much of the bird damage recorded during the surveys could probably have been reduced cost-effectively using a methiocarb seed treatment. Such a treatment should be considered by those farmers who feel that past sprout losses to birds have been more than just a minor problem.

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[1] Reference to trade names does not imply U.S. Government endorsement.