

# Bird Damage to Ripening Field Corn Increases in the United States from 1971 to 1981

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# Bird Damage to Ripening Field Corn Increases in the United States from 1971 to 1981

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Surveys have shown that birds cause greater monetary losses to corn than to any other agricultural crop in the United States (Stone 1973). Bird damage to field corn in the major corn-producing States in the United States was surveyed in 1981 for the third time. Budgetary constraints limited the 1981 survey to 10 States: Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Nebraska, Ohio, South Dakota, and Wisconsin. These 10 States were also surveyed for bird damage in 1970 (Stone et al. 1972) and 1971 (Stone and Mott 1973). An additional 14 States in 1970 and 9 in 1971 were surveyed those years. In 1970 and 1971, the States surveyed grew 98.0% and 95.5%, respectively, of the acreage of field corn harvested in the United States. In 1970, the 10 States surveyed in 1981 had 61.8% of the bird damage estimated in the 24 major corn-producing States and in 1971, 62.5% of the damage in the 19 States surveyed. The 10 States surveyed again in 1981 grew 79.4% (59,260,000 acres) of the corn harvested for grain in 1981 (Statistical Reporting Service 1982).

Red-winged blackbirds (*Agelaius phoeniceus*) and common grackles (*Quiscalus quiscula*) are responsible for most bird damage to ripening corn in the United States (Mitchell and Linehan 1967; De Grazio et al. 1969a; Dolbeer 1980). These blackbird species were probably responsible for most of the damage found in the 1981 survey and earlier surveys as well.

The purpose of the 1981 survey in the major corn-producing States was to determine whether the amount, distribution, and intensity of damage had changed in the decade since the last survey.

## Methods

The 1981 bird damage survey was conducted under an interagency agreement between the U.S. Fish and Wildlife Service and the Statistical Reporting Service

(SRS) of the U.S. Department of Agriculture. Enumerators, employed by the SRS to conduct the annual Objective Yield Survey for corn, were shown examples of bird damage to corn in different stages of maturity by using slide series and handouts identical to those used in the 1971 survey. The sampling frame employed by the SRS during their final preharvest yield survey in October was also used for sampling bird damage.

In 1981, as in previous surveys, enumerators were asked to complete an additional form recording bird damage for each field surveyed. The number of fields sampled in a State was proportional to acres in corn in the State. Two 15-foot sampling units of two rows each were randomly established in each field. In the first row in each unit, enumerators recorded the number of ears of corn with kernels and measured the average length of bird-damaged and undamaged kernel rows to the nearest 0.1 inch for each damaged ear. Bird damage was not measured on ears in the second row; those ears were used by the SRS to elucidate factors affecting prediction of yields.

We converted the length data to weight (grams) of corn lost using the empirical table developed by De Grazio et al. (1969b) to estimate bushels lost. These estimates were weighted according to acres of corn grown in each State to calculate the overall mean loss and to estimate confidence intervals. Paired *t*-tests were used to determine the significance of changes in losses between 1971 and 1981 in the 10 States.

## Results and Discussion

### *Amount of Loss*

For the 10 States surveyed in 1981, the average corn loss to birds was estimated to be 0.13 ( $\pm$  SE 0.02) bushels per acre, or a total of 7.7 ( $\pm$  SE 1.0) million bushels (Table 1). This estimate was 2.5 times as great as the estimate of 3.1 million bushels lost in these States

Table 1. *Corn loss to birds in 10 major corn-producing States, 1981.*

State	Acres harvested (1,000)	No. fields surveyed	Mean loss <sup>a</sup> (bu/acre)	Total <sup>b</sup> ± SE (bu)
Michigan	2,850	81	0.3575 <sup>a</sup>	1,018,862 ± 267,859
Wisconsin	3,500	127	0.2036 <sup>a</sup>	712,483 ± 177,503
Ohio	3,750	137	0.1931 <sup>a</sup>	724,234 ± 222,936
Minnesota	6,700	140	0.1581 <sup>ab</sup>	1,059,116 ± 346,684
Nebraska	6,980	183	0.1244 <sup>ab</sup>	867,980 ± 287,436
Illinois	11,260	215	0.1230 <sup>ab</sup>	1,384,521 ± 856,655
Indiana	6,000	166	0.1136 <sup>ab</sup>	681,886 ± 286,460
South Dakota	2,580	82	0.0996 <sup>b</sup>	256,850 ± 104,256
Missouri	1,940	112	0.0920 <sup>b</sup>	178,573 ± 72,929
Iowa	13,700	210	0.0566 <sup>b</sup>	775,227 ± 303,621
Totals and weighted means	59,260 <sup>c</sup>	1,453	0.1293 ± SE0.0174	7,659,732 ± 1,031,073

<sup>a</sup> Means with the same superscript are not significantly different at the 5% level (one-way ANOVA and separation of means by Duncan's new multiple-range test).

<sup>b</sup> Product of mean bushel-per-acre loss and total acres grown in each State.

<sup>c</sup> 79.41% of U.S. total.

in 1971 ( $P = 0.005$ ; Table 2). The percentage of ears and fields damaged by birds and the bushel loss also increased in these 10 States in 1981 compared with 1971. In 1981, the percentage of ears damaged was 2.2 times as great, the percentage of fields damaged was 2.1 times as great, and the unweighted mean bushel loss was 1.6 times as great as in 1971 (Table 2).

The highest bushel-per-acre loss in the 10 States sampled in 1981 was 0.36 in Michigan, whereas the lowest was 0.06 in Iowa (Table 1). Wisconsin and Ohio followed Michigan with estimated losses of 0.20 and 0.19 bushels per acre. The greatest total loss in the 10 States sampled in 1981 was 1,385,000 bushels in Illinois, and the lowest was 179,000 bushels in Missouri (Table 1). Minnesota and Michigan followed Illinois, each having estimated total losses of more than 1 million bushels.

### Intensity of Losses

From an economic standpoint, bird damage to corn to the average grower in the 10 States sampled is still of little general concern, even though the percentage of fields with no damage in the samples taken decreased from 92.1% in 1971 to 83.5% in 1981 (Table 3). Most of the increase in damage between 1971 and 1981 occurred in fields that lost <3 bushels per acre. Stone

and Mott (1973) considered losses of >3 bushels per acre a "serious" bird problem but this loss is at a level that we believe can be economically combated with chemical protection methods. The category <3 bushels per acre of loss was 2.2 times as great (15.8 vs. 7.4%) in 1981 as in 1971 (Table 3). Fortunately for growers, the percentage of fields with >3 bushels per acre loss was only slightly greater in 1981 than in 1971 (0.69 vs. 0.57%). However, the 10 States surveyed in 1981, perhaps because they have the largest corn acreages, probably do not contain the greatest proportion of fields with losses to birds of >3 bushels per acre. In the 1970 and 1971 surveys, the 16 States not sampled in the 1981 survey had 70.6% (48 of 68) of the samples with >3 bushels per acre damage, despite containing only 42.7% of all samples taken (Table 4). Thus in 1970-71 the 16 States not surveyed in 1981 had 3.2 times the proportion of fields losing >3 bushels per acre as the 10 States surveyed in 1981 ( $\chi^2 = 2.19$ ;  $P < 0.005$ ).

### Extrapolation to National Losses

To obtain an estimate of the national loss of ripening corn to birds in 1981, an estimate of the losses occurring in the other 31 States that grew the remaining 20.6% (15.4 million acres) in 1981 is needed. To obtain

Table 2. *Bird damage to corn in 10 States, 1981 vs. 1971.*

State	Year	Acres harvested (1,000)	Bird damage (%)		Bushel loss	
			Ears	Fields	Per acre	Per State (1,000)
Michigan	1981	2,850	4.5	39.5	0.3575	1,019
	1971	1,700	1.3	10.5	0.3371	573
Wisconsin	1981	3,500	4.8	42.5	0.2036	712
	1971	2,099	3.9	22.0	0.1737	365
Ohio	1981	3,750	3.6	30.7	0.1931	724
	1971	3,526	2.4	22.0	0.2635	929
Minnesota	1981	6,700	3.5	16.4	0.1581	1,059
	1971	5,725	1.0	13.1	0.0793	454
Nebraska	1981	6,980	2.3	7.7	0.1244	868
	1971	5,356	0.1	1.1	0.0012	6
Illinois	1981	11,260	1.3	10.2	0.1230	1,385
	1971	10,170	0.2	2.9	0.0231	235
Indiana	1981	6,000	1.4	10.8	0.1136	682
	1971	5,509	0.1	2.9	0.0248	137
South Dakota	1981	2,580	1.2	11.0	0.0996	257
	1971	2,679	0.8	7.1	0.0277	74
Missouri	1981	1,940	0.6	8.0	0.0920	179
	1971	3,092	0.2	1.3	0.0365	113
Iowa	1981	13,700	0.5	8.1	0.0566	775
	1971	11,570	0.4	4.2	0.0153	177
Means and totals	1981	59,260 <sup>a</sup>	2.4	18.5	0.1522	766
	1971	51,426 <sup>a</sup>	1.1	8.7	0.0982	306
<i>P</i> <sup>b</sup>			0.003	0.005	0.013	0.005

<sup>a</sup> Total.<sup>b</sup> Paired *t*-test.

this estimate we compared 1970 and 1971 losses in the 16 States (sampled in those years but not in 1981) with the 10 States sampled all 3 years. The mean loss per field in these 16 States was 0.22 bushels per acre compared with 0.10 bushels per acre for the 10 States, or 2.2 times as much (2.3 and 2.1 times as much in 1970 and 1971, respectively). If one estimates the loss on the 15.4 million acres not surveyed in 1981 by multiplying the loss of the weighted mean of surveyed acres in 1981 (0.13 bushels per acre) by 2.2, one obtains an additional estimated loss of 4.3 million bushels. The combined loss estimate for surveyed and nonsurveyed corn acreage is then 12.0 million bushels. At the November 1981 average price of corn in Chicago, Illinois, of \$2.60 per bushel, 1981 loss to birds amounted to \$31.2 million, or \$0.43 per acre harvested.

Similarly, the acres of corn in 1981 that had >3 bushels per acre loss can be extrapolated. Only 10 of 1,453 (0.69%) cornfields sampled in the 10 major corn-producing States in 1981 had losses to birds of >3 bushels per acre (Table 4). This loss represents only 408,000 acres of the 59,260,000 sampled in these 10 States. As previously noted, the 16 States not surveyed in 1981 had 3.2 times the proportion of fields with >3 bushels per acre loss in 1970 and 1971 surveys as the 10 States surveyed in 1981 (Table 4). Thus, one can estimate that 2.1% of the 15,364,000 acres lost >3 bushels per acre or 323,000 acres. Combining the estimates for the 10 States surveyed and the 31 States not surveyed gives a total of 731,000 acres of corn that is estimated to have lost >3 bushels per acre in the United States in 1981.

Table 3. *Intensity of bird damage to corn in 10 States, 1981 vs. 1971.*

State and year	No. fields surveyed	Bu/acre loss (%) <sup>a</sup>						
		0	0-1	1-2	2-3	3-5	5-9	9-21
<b>Michigan</b>								
1981	81	60.5	28.4	4.9	4.9		1.2	
1971	105	89.5	6.7	1.0	1.0		1.0	1.0
<b>Wisconsin</b>								
1981	127	57.5	35.4	5.5	0.8		0.8	
1971	118	78.0	17.8	2.5	0.9			
<b>Ohio</b>								
1981	137	69.3	24.1	4.4	1.5	0.7		
1971	150	78.0	17.3	0.7	1.3	1.3	0.7	0.7
<b>Minnesota</b>								
1981	140	83.6	12.1	2.1		2.1		
1971	175	86.9	10.9	1.7	0.6			
<b>Nebraska</b>								
1981	183	92.4	2.2	2.7	1.6	0.6	0.6	
1971	177	98.9	1.1					
<b>Illinois</b>								
1981	215	89.8	9.3	0.5				0.5
1971	209	97.1	2.4		0.5			
<b>Indiana</b>								
1981	166	89.2	7.2	2.4	0.6		0.6	
1971	171	97.1	2.3			0.6		
<b>South Dakota</b>								
1981	82	89.0	7.3	3.7				
1971	98	92.9	6.1	1.0				
<b>Missouri</b>								
1981	112	92.0	4.5	1.8	1.8			
1971	150	98.7		0.7		0.7		
<b>Iowa</b>								
1981	210	91.9	5.7	1.4	1.0			
1971	213	95.8	3.8	0.5				
<b>Totals and means</b>								
1981	1,453	83.5	12.2	2.6	1.0	0.3	0.3	0.1
1971	1,566	92.1	6.3	0.7	0.4	0.3	0.2	0.1

<sup>a</sup> Rounding of decimals sometimes results in the sum of percentages not equaling 100.0.

## Distribution of Losses

Losses, as determined by the percentage of ears damaged by blackbirds per county, were not uniformly distributed in any of the 10 States surveyed in 1981 (Fig. 1). They were clustered (a) along major river drainages, (b) along the northern limit of the range for growing corn, and (c) near certain large marshes, perennially used by molting assemblages of blackbirds. Where losses to blackbirds were not clustered, they appeared to be spotted along corridors in a general north-to-south

arrangement, suggestive of late summer-early fall drift or migrational paths.

## Reasons for Increase in Damage in the Last 10 Years

The increased loss in the 10 major corn-producing States in 1981 over the 1971 level does not seem to be caused by increases in breeding populations of red-winged blackbirds and common grackles in these States. Data

Table 4. Losses of > 3 bushels per acre to birds in States surveyed in both 1970-71 and 1981 and in those surveyed only in 1970-71.

Year	10 States surveyed in 1981			16 States not surveyed in 1981		
	Fields	> 3 Bu/acre loss		Fields	> 3 Bu/acre loss	
		No	(%)		No	(%)
1981	1,453	10	0.69			
1970-71	3,061	20	0.65 <sup>a</sup>	2,281	48	2.10 <sup>a</sup>

<sup>a</sup> In 1970-71 the 16 States surveyed in 1981 had 3.2 times the proportion of fields losing > 3 bushels per acre as the 10 States surveyed in 1981 ( $\chi^2 = 2.19$ ,  $P < 0.005$ ).

taken from unpublished North American breeding bird surveys show that indices of breeding red-winged blackbirds and common grackles, compiled from 472 roadside routes in the 10 major corn-producing States,

indicated increases of only 5.1% for red-winged blackbirds and 10.3% for common grackles from the years 1966-1969 to 1977-1980. Reduction of noncrop foods due to more intensive cropping and greater use of herbi-

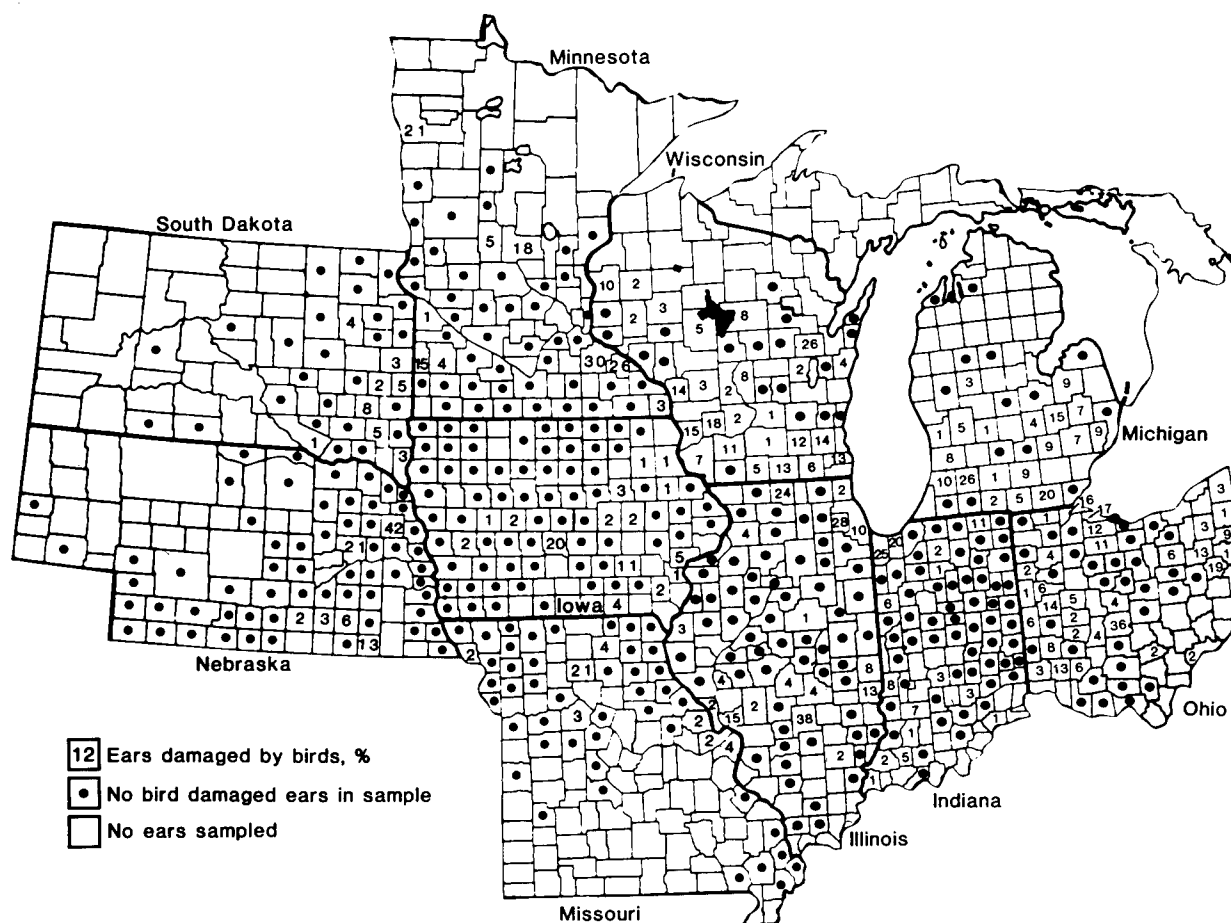


Fig. 1. Frequency of damage by birds to ears of corn sampled in counties of the 10 major corn-producing States of the United States in 1981.

cides is a more likely reason. Corn acreage increased 19.5% in the United States, and 15.2% in the 10 major corn-producing States from 1971 to 1981 (Table 2); herbicide use with corn in the United States increased 114.4% (from 97.7 to 209.5 million pounds) from 1971 to 1980 (Eichers and Serletis 1982). We speculate that ripening corn is becoming a larger component of the late summer and early fall diet of red-winged blackbirds and common grackles, as weedy cornfields, weed patches, and other alternate feeding habitats such as haylands and small-grain stubbles diminish.

In a food habits study of the red-winged blackbirds from 1959 to 1965 in South Dakota, Mott et al. (1972) found that 41% (by volume) of the diet of red-winged blackbirds was seed of bristle grass (*Setaria* sp.) at the peak of the corn damage season, and only 28% was corn. We believe that a food habit study in 1981 of the August-September diet of the red-winged blackbird in major corn-producing States might show a trend approaching that found by Hintz and Dyer (1970) for an intensively cropped area in Ontario, Canada. They reported that 81% (by volume) of the diet of red-winged blackbirds in August and September was corn and only 19% consisted of insects, weed seeds, and small-grain gleanings. Thus increased corn consumption could be suspected in such States as Iowa, where corn acreage increased from 11.6 million acres in 1971 to 13.8 million acres in 1981. This 2.2 million acre increase came from lands previously planted in small grains and hay and from formerly wooded areas, many of them riparian (L. J. Altenhofen, personal communication). We have observed similar land-use changes in other mid-western States.

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In 1981, bird damage to ripening field corn in the major corn-producing States in the United States was surveyed. The percentage of fields damaged by birds and the bushels of corn lost had increased in 10 States since 1971. Blackbird populations causing the damage had not increased at a similar rate, probably because of greater use of herbicides and increases in corn acreage along with a reduction in other feeding habitats such as haylands and small-grain stubbles.

**Key words:** Bird damage, blackbird, crop depredation, ripening corn.

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