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ABSTRACT: Damage caused by birds to ripening sunflower was evaluated in 60 fields (about 70% of all planted fields) in the Sacramento Valley, California, during 1980 and 1981. Overall monetary losses were roughly $6,800 (24 fields) and $7,400 (36 fields) in 1980 and 1981, respectively. The percentage losses estimated for the individual fields were low, ranging from 0 to 5.4% of the crop; in about two-thirds of the fields, losses were <0.5%. For the 12 fields with the highest (≥1.0%) damage, the average per acre monetary loss was roughly $18. Damage levels within local areas were relatively constant between the two years. Although several species of birds caused damage, house finches (Carpodacus mexicanus) were apparently most important. Their foraging behavior differed from that of blackbirds, which fed extensively on insects in addition to sunflower. The presence of large numbers of blackbirds or finches in fields was not always an indication of bird damage. Additional research may lead to recommendations for alleviating the moderate losses which a few growers now incur.

INTRODUCTION

During the past decade, the production of sunflower for processing has become an important agricultural activity in North Dakota, South Dakota, and Minnesota. As the acreages of this crop expanded, so did the amount of damage done by birds—especially blackbirds--which sometimes feed on the ripening seed. Losses of up to 21% in some local areas (Besser 1978) and at least several million dollars in one state (North Dakota) have been estimated (Henne et al. 1979). Research on the problem by the U.S. Fish and Wildlife Service has been underway for several years.

California also produces some sunflower, but it is grown primarily for use as seed rather than for processing. As a result, the fields are usually composed of alternating sets of female plants (6-20 rows) and male plants (2-8 rows), with the exact f:m ratio generally determined by the capability of the planting machinery (Beard 1981). The male plants are generally knocked to the ground after pollination, leaving only the female plants to dry for harvest.

Sunflower grown for seed is worth 4-5 times more per pound than sunflower grown for processing, and the area of California where sunflower is grown have large seasonal concentrations of blackbirds which damage other crops such as rice (DeHaven 1971). Thus, the potential for an economically important bird depredations problem on ripening sunflower exists in California. To quantify the extent and severity of this problem, we conducted an extensive survey of bird damage in sunflower fields during 1980 and 1981. The results are presented here.

METHODS

Damage Assessment

In 1980, we attempted to assess bird damage in each of the sunflower fields located in Butte, Colusa, and Glenn counties of the Sacramento Valley, California; only a few fields inadvertently missed or harvested before we found them were not included. Thirty randomly located plots, with each plot consisting of five consecutive sunflower heads (a total of 150 heads/field) along one row, were examined within 2 wk of harvest in each of the 24 fields. A gridded, clear plastic template was used to estimate both the total surface area of harvestable seed and the total surface area of seed damaged by birds on each head (Dolbeer 1975). From these estimates, the percentage of damage was then calculated for each plot. The estimated percentage loss for each field was determined by averaging the 30 plot values.

During 1981, 36 fields were surveyed in the same manner, except that (1) the survey area within the valley was expanded to include Yolo and Solano counties, and (2) a variable number of plots was assessed in the fields, depending on their expected level of bird damage. The 1980 results showed that when about 25% of the heads examined had bird damage, the estimated field loss was about 1%. Thus, for the 1981 survey, a brief pre-assessment examination was first made by walking through each field and visually examining about 100 heads selected at random. When ≥25% of those examined were damaged, 48 plots (240 heads) were assessed; otherwise, only 24 plots (120 heads) were taken. We thought that this procedure would improve the accuracy of loss estimates for the fields having high (≥1%) bird damage, in which the sample variances were expected to be large.

To determine if the damage levels in specific locales were consistent between the two years, the estimated damage for each of the 1980 fields was compared to that of the nearest 1981 field. Fields were compared only if they were<3 mi apart. When a single field in one year was the closest field to several in the other year, the mean damage estimate of the several fields was used. The Wilcoxon signed-ranks test was used to test the null hypothesis of no similarity between years in level of damage.

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Bird Observations

Incidental to the damage assessments, general observations of bird numbers and activity, including the responses of birds to avian predators, were made during both years. In addition, during 1981 a few fields were more intensively studied. Individual birds were observed for as long as possible, and their instantaneous activity and location were recorded at 15 s intervals.

RESULTS AND DISCUSSION

Damage Levels

Estimates of percent damage in the 24 fields for 1980 ranged from 0 to 4.7%; for the 36 fields surveyed in 1981 the range was from 0 to 5.4%. Of the 60 assessed fields, only 12 (20%) had losses ≥1.0%, 7 (12%) were from 0.5% to 1.0%, and 41 (68%) had losses <0.5% (Table 1).

For the six fields with the highest damage in 1980, projected monetary losses averaged roughly $890/field and $17/acre (Table 2). Comparable projections for the six most heavily damaged fields in 1981

Table 1. Distribution of percent bird damage estimates by damage category for 60 sunflower fields in the Sacramento Valley, California, during 1980 and 1981.

Bird damage (%) category	Number of fields		
	1980	1981	Total
≥1.0	6	6	12
0.5 - 1.0	0	7	7
<0.5	18	23	41
Total	24	36	60

Table 2. Estimated yield and dollar loss to bird damage in the 12 sunflower fields with highest damage in the Sacramento Valley, California, during 1980 and 1981.

Field number	Size (acres)	Bird damage (%)	Yield loss (lbs/acre)[a]	Monetary loss[a]	
				/field	/acre
		1980			
7	20	1.9	28	$ 247	$12
8	65	2.4	35	1013	16
10	150	2.0	30	1948	13
12	15	3.3	49	321	21
16	50	4.7	69	1526	31
23	20	2.2	32	286	14
Means	53	2.8	38	$ 890	$17[b]
		1981			
G2	42	3.6	57	$1164	$28
G10	60	1.0	16	464	8
C1	50	3.3	53	1271	25
Y1	40	1.4	22	429	11
S1	20	5.4	85	819	41
S8	15	2.2	35	255	17
Means	38	2.8	45	$ 734	$19[b]

[a] Estimated based on average yield and value data from the 1980 and 1981 Glenn County Annual Crop and Livestock Report as follows: 1980=1467 lbs/acre, $0.44/lb; 1981=1585 lbs/acre, $0.48/lb.

[b] Weighted by field size.

were $734 and $19, respectively. The highest monetary loss/acre recorded was $41 for field S1 in 1981; the greatest overall field loss—$1948--occurred at field 10 (150 acres) in 1980. The total monetary loss for all assessed fields (about 70% of all planted fields) was projected at about $6,800 in 1980 and $7,400 in 1981. These dollar loss estimates are all quite approximate, however, since they are based on the average overall sunflower yields and values from only Glenn county. Nevertheless, they do give an indication that even in the fields with the highest levels of bird damage, damage control efforts which cost more than about $20/acre would only occasionally be cost-effective, and then only if they were 50-100% effective.

Damage between years was compared for 10 different locations in Glenn, Colusa and Butte counties (Table 3). At the 1035 level of probability, there was no significant difference in damage between 1980 and 1981. Thus, the annual distribution and severity of damage is probably not a random factor and may be related to some relatively constant, but as yet undetermined, habitat factors.

Table 3. A comparison of estimated percent bird damage for sunflower fields at 10 locations in the Sacramento Valley, California, during 1980 and 1981[a/].

1980		1981	
Field number(s)	Bird damage (%)	Bird damage (%)	Field number(s)
4	0.03	0.36	B1/B2
7/8	2.15	0.75	C3
10	2.00	1.80	C1/C2
14/15	0.02	0.05	G18
16	4.70	3.62	G2
18	0.02	0.52	G4/G11
19	0.16	0.16	G3/G6/G7/G8
21	0.07	0.08	G12
22	0.15	0.42	G9/G10/G16/G17
23/24	1.30	0.03	G13

[a/] Only fields < 3 mi apart in the two years are included. Where more than one field is listed, the mean field loss is given.

Bird Species Observed

House finches (Carpodacus mexicanus), blackbirds (Agelaius spp.), and American goldfinches (Carduelis tristis) were the principal species observed in 39 of the 60 fields. House finches were present in 10 of the 12 fields with ≥1.0% loss. Blackbirds were only found in 7 of these same fields. Also, in 10 of the 11 fields where only blackbirds (and no finches) were recorded, the bird loss estimates were all relatively low (0 to 0.5%).

Several less abundant species were also observed feeding on sunflowers: brown-headed cowbirds (Molothrus ater), Brewer's blackbirds (Euphagus cyanocephalus), house sparrows (Passer domesticus), and blue grosbeaks (Guiraca caerulea). The other species which were commonly observed, but probably not involved in damage, included ring-necked pheasants (Phasianus colchicus), mourning doves (Zenaida macroura), savannah sparrows (Passerculus sandwichensis), and vesper sparrows (Pooecetes gramineus).

Feeding Behavior: House Finches

House finches foraged in the sunflowers by several methods. Many birds landed on the uppermost part of the head, reached down over the disc to take a seed, and then turned around to eat it while perched in the "bowl" formed by the concave back side of the head. Other birds (17 of the 92 for which at least 45 s of continuous observations were made) fed on the seed fragments which remained in the bowls where other birds had eaten. This fragment-feeding behavior appeared most prevalent among the juvenile finches, which perhaps were not yet adept at acquiring and eating whole seeds.

Finches often fed on the standing male sunflower plants, and we commonly observed extensive damage among the heads of male plants while adjacent female plants were virtually undamaged. Where the male plants had already been knocked down, many finches also foraged on the ground, perhaps consuming weed and grass seeds in addition to the male sunflower seeds. Such ground-foraging may indicate (1) a preference for the male seeds (which are smaller) compared to the female seeds; (2) a thermoregulatory response to gain protection from solar radiation and the high (up to 106°F) daytime temperatures which occur in the valley; or (3) an antipredator response to gain protection from the relatively large numbers of American kestrels (Falco sparverius) and loggerhead shrikes (Lanius ludovicianus) present in the vicinity of the fields.

Avian predators had a definite effect on the behavior of foraging house finches. In each of two fields frequented by several hundred house finches and numerous raptors, interactions between these two groups were common. Mass "fly-ups" of finches occurred at about 6-min intervals in one field and at about 15-min intervals in the other. The raptors which elicited these fly-ups included red-tailed hawks (Buteo jamaicensis), marsh hawks (Circus cyaneus), white-tailed kites (Elanus leucurus), turkey vultures (Cathartes aura), and American kestrels. However, only the kestrels were observed actually pursuing finches; the other raptors merely passed overhead. Many fly-ups also occurred when raptors were not observed. More detailed analysis of such interactions might yield information which would be of value in designing effective damage reduction programs, including schemes employing raptor models.

Feeding Behavior: Blackbirds

Actively foraging blackbirds were difficult to keep in view, thus only a few extensive observations were obtained. Nevertheless, three diverse feeding behaviors were evident. In some fields, blackbirds appeared to eat only the female sunflower seeds. Five red-winged blackbirds (Agelaius phoeniceus) and two Brewer's blackbirds were observed removing and eating seeds while perching on the upper rim or front disc of the head. Unlike previous reports (Besser 1978), these birds did not use the back side of the head as they fed.

Blackbirds in another field did not eat sunflower seeds. One flock of several hundred redwings was observed for 3 h one morning as it repeatedly moved across the field from south to north in somewhat of a "leap frog" fashion. Upon reaching the north edge, the flock flew back to the south end, loafed in an adjacent cornfield for several minutes, then reentered the sunflower field. Each of eight birds in this flock was watched continuously for at least 60 s; they each foraged exclusively among the foliage of the plants where they consumed green caterpillars and other insects from the leaves, petioles, and phyllaries. Briefer observations of other birds from this flock indicated that this foraging behavior was typical of the entire flock. Almost no bird damage was found in this field.

We also frequently observed blackbirds foraging on the ground in the sunflower fields. The reasons for ground-foraging may have been the same as those suggested for house finches, or the blackbirds may have been searching for insect prey.

CONCLUSIONS AND RECOMMENDATIONS

During 1980 and 1981, bird damage to ripening sunflower in the Sacramento Valley, California, was, as with most other bird-agricultural conflicts, an example of a majority of growers having little or no damage, but a few growers experiencing moderate losses. The severity of losses within local areas of the valley was similar between the two years, suggesting that damage is related to habitat factors. More study of such habitat factors could lead to guidelines for the placement of fields to prevent or reduce damage. Other possible means of reducing the damage in the few fields where it is economically important include: (1) reducing the susceptibility period by earlier harvesting, and (2) managing the male plants (e.g., leaving them standing) so as to reduce the losses to the female plants. Additional study is needed to better assess the feasibility of each of these approaches.

Although blackbirds cause some damage to sunflower, their relative importance appears to be much less than reported elsewhere (Besser 1978). House finches are probably the most important depredating species. However, more study of the bird populations present in California's sunflower fields throughout the entire period of damage susceptibility, including the dough stage of maturity when the seed is apparently most preferred by blackbirds (Besser 1978), is needed to further clarify the importance of various species to damage. On the basis of our study, the mere presence of house finches or blackbirds in sunflower fields does not ensure that damage is occurring or that any control measures are justified.

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