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BIRD DAMAGE TO WINE GRAPES IN CENTRAL CALIFORNIA, 1973

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ABSTRACT: Bird damage to wine grapes was surveyed in nine counties in the coastal area of central California in 1973. Damage to 90 bunches of grapes in each of 140 randomly selected plantings was visually estimated according to seven damage classes. Results indicated that birds damaged or destroyed 1.99% ± 1.08% (95% confidence interval) of the crop, or about 1,547 to 5,219 tons of grapes worth more than $0.75 million. Napa, San Benito, and Sonoma Counties had the highest dollar losses. Upper bunches on grapevines were more heavily damaged than lower ones, and dark-colored varieties were more heavily damaged than light-colored ones. Early-maturing and late-maturing varieties were not differentially damaged. Of the birds observed in the sampled plantings, 51.5% were house finches (Carpodacus mexicanus) and 25.8% were starlings (Sturnus vulgaris); 16 other species made up the remaining 22.7%. Modifications of the survey methods are suggested for similar surveys of bird damage to grapes and for surveys where higher accuracy is desired.

Early in 1973 a questionnaire survey was conducted by Crase and DeHaven (1973) on statewide bird damage to raisin, table, and wine grapes in California. The results indicated that damage was widespread but was most severe in wine varieties grown in the coastal counties of central California. To more accurately assess losses to wine grapes and to help set bird damage research and management priorities, a survey of bird damage was conducted during the 1973 grape harvest with the help of County Agricultural Commissioners in nine of these coastal counties. The results are reported here.

METHODS

A list of about 5,000 wine-grape plantings, which represents all bearing plantings in the nine counties, was provided by the California Crop and Livestock Reporting Service, and 290 were randomly chosen for sampling. For each planting, we obtained the size, location, variety, year planted, and name and address of the grower, then wrote the grower requesting a sketch of the exact planting location, expected harvest date, and permission to enter the planting. About 78% (226) of the growers responded, and 140 of their plantings (about one planting for each 336 acres grown) were sampled as time permitted. The number of plantings sampled in each county was roughly proportional to the county's bearing acreage (Table 1). The total area sampled was 47,107 acres, about 32% of California's bearing wine-grape acreage and about 10% of its total bearing acreage in raisin, table, and wine grapes.

Each planting was surveyed as near to harvest as possible--usually 1 to 4 days before. In each planting, one plot consisting of 30 consecutive vines was randomly chosen from planting dimensions. On each vine, one bunch of grapes each was randomly chosen from near the top, the center, and the bottom, and bird damage to each bunch was visually estimated according to seven percentage classes: 0, 1-5, 6-20, 21-50, 51-80, 81-95, and 96-100. These procedures were based largely on results of surveys of bird damage to corn (De Grazio et al. 1969; Stone et al. 1973) and grapes (Stevenson and Virgo, 1971) and the need for a rapid, inexpensive method. Other data obtained at plantings included the number and species of birds seen during the survey and the predominant type of damage (pecked or missing grapes) on each bunch.

Table 1. Wine grape acreages and estimated bird damage to wine grapes in nine coastal counties of central California in 1973 (based on data from 90 bunches per plot, one plot per planting).

County	County's wine grape acreage[a]	Plantings		Bunches		Mean loss		
		Number sampled	Percent damaged	Number sampled	Percent damaged	Percent of crop[b]	Pounds per acre[c]	Dollars per acre[c]
Alameda	1,629	10	80.0	900	10.0	2.41	202	50.94
Contra Costa	960	4	0.0	360	0.0	0.00	0	0.00
Mendocino	6,217	17	47.1	1,530	3.7	0.62	61	6.76
Monterey	3,762	7	85.7	630	11.4	0.46	40	10.73
Napa	13,479	37	70.3	3,330	16.9	1.13	126	32.12
San Benito	4,543	19	89.5	1,710	17.8	1.85	93	30.45
Santa Clara	2,271	4	100.0	360	54.7	25.47	2,574	438.42
Solano	794	4	50.0	360	11.7	0.63	100	7.85
Sonoma	13,452	38	68.4	3,420	14.7	1.57	131	39.12
Totals and means (weighted)	47,107	140	69.3	12,600	14.3	1.99	178	40.99

[a] Total bearing acreage; data from California Crop and Livestock Reporting Service (1973).
[b] Mean of damage class mid-point for all bunches sampled.
[c] Based on value and yield data supplied by growers of damaged plantings.

Analysis of chi-square contingency tables was used to test for damage differences among counties, among heights of bunches (top, center, and bottom), between early- and late-maturing grape varieties, and between light-colored and dark-colored varieties; $P < 0.05$ was accepted as the criterion of significance. Mean percentage losses were calculated from the midpoints of the damage classes for all bunches sampled, and mean losses, in pounds of grapes and dollars, were calculated for plantings and counties by using total yield and price data obtained from growers of damaged plantings.

RESULTS AND DISCUSSION

Damage Distribution and Severity

About 31% of the plantings had no damage, 35% had negligible damage (<1%), and 34% had slight to serious damage (<1%). Table 1 summarizes the damage data and calculated losses in the nine counties. The estimated overall mean loss was 1.99% ± 1.08% (95% confidence interval) of the crop, which is in general agreement with the 1.0% statewide loss estimated by Crase and DeHaven (1973) from questionnaire data. On the basis of the 95% confidence limits and an estimated wine-grape crush of 170,000 tons for the area in 1973, birds damaged or destroyed from 1,547 to 5,219 tons of grapes. The dollar loss this tonnage represents cannot be exactly determined, but assuming prices paid to growers averaged $490 per ton in the sampled area, losses would exceed $0.75 million.

Chi-square analysis indicated at least one significant difference in damage among counties. Loss calculations (Table 1) suggested that Alameda, Napa, San Benito, Santa Clara, and Sonoma Counties had higher than average relative losses and that absolute losses were very large in Napa, San Benito, and Sonoma Counties because of their large acreages. The largest losses per unit area were in Santa Clara County.

Calculated dollar losses in damaged plantings ranged from $0.44 to $438 per acre, and all counties except Contra Costa (where none of the four sample plots showed any damage) had at least one planting with losses of more than $25 per acre. The most heavily damaged planting (in Santa Clara County) had 82.5% damage. However, since it was unprofitable for the grower to harvest the few remaining grapes, the actual loss was total and equal to about $1,200 per acre, and the calculated dollar loss was based on this figure.

Damage to early- and late-maturing varieties was not significantly different, but dark-colored varieties received significantly more damage than light-colored varieties. Thirty varieties of grapes were not tested individually for damage differences because of their small sample sizes, but the earlier questionnaire results (Crase and DeHaven 1973) suggested that no specific ones were damaged more than others. More likely, as suggested by Boudreau (1972) and Stevenson and Virgo (1972), levels of bird damage to grape plantings are largely related to proximity of roosting, loafing, and perching cover.

Sampling bunches at three different heights on the vines showed a distinct stratification in damage. Mean damage values were 2.01% for bunches near the top, 1.45% for those near the center, and 0.82% for those near the bottom. Chi-square analysis showed at least one significant difference among the three heights, and the chi-square test for trend showed a significant relationship between height and damage. This result was all the more striking because about one-third of the plantings sampled were trellised; in these, stratification was apparent, but comparatively small, because all bunches grew within a narrow, vertical zone (1 to 2 feet). In untrellised vineyards, however, where bunches grew from ground level up to 6 feet, damage stratification was usually quite obvious. Stratification may be related to foliage density: Boudreau (1972) found that heavy foliage, which usually occurs near the bottom of vines, deters most birds except starlings, and in our study, upper bunches appeared to receive the heaviest damage when the foliage there was sparse. This general preference of birds for sparsely covered upper bunches increases the probability that damage can be reduced by spraying a repellent such as methiocarb (Guarino 1972); although a spray might not penetrate to densely covered lower branches, it would adequately cover upper ones.

Of the 1,806 damaged bunches of grapes examined, 76.6% (1,383) had more grapes pecked than missing and 23.4% (423) had more missing than pecked. It is difficult to assign dollar losses to bird-pecked grapes. Although they may not represent a total loss to the winemaker, they may start to mold or attract insects, causing serious secondary losses. In calculating losses, we made no attempt to weigh these factors and treated pecked grapes as if they had been missing.

Species Causing Damage

The bird counts (Table 2) agreed with the observation that pecked grapes were more numerous than missing ones. House finches, which usually peck grapes, were about twice as abundant as starlings, which generally pluck whole grapes. Other less numerous species that probably contributed to both types of damage were robins (*Turdus migratorius*), California quail (*Lophortyx californicus*), western bluebirds (*Sialia mexicana*), and several species of sparrows and goldfinches. Of the 18 species observed, most are listed by Boudreau (1972) as damaging grapes in California.

The relatively low overall abundance of starlings (half that of house finches), despite their rapidly expanding winter populations in California (DeHaven 1973), may be due to extensive starling trapping and poisoning programs employed for crop protection by County Agriculture Commissioners.

Table 2. Birds observed in 127[a] wine-grape plantings in nine coastal counties of central California in 1973.

Species	Total seen	Frequency (% of plantings in which seen)	Average number per planting
House finch	1,153	44.1	9.1
Starling	577	12.6	4.5
Robin	29	6.3	0.2
California quail	179	5.5	1.4
Goldfinches (various)	85	5.5	0.7
Sparrows (various)	88	5.5	0.7
Western bluebirds	36	8.7	0.3
Others (11)	90	-	0.7
Total	2,237		17.6

[a] Bird counts were not available for all 140 plantings sampled.

Evaluation of Sampling Design

In addition to determining losses caused by bird damage to California wine grapes, we were interested in developing and testing a simple, economical procedure for estimating such losses in future surveys. Analysis of the damage data (for mean percentage loss) showed an estimated total variance of 0.3055; 98.8% of this (0.3018) was estimated as variation from among plots and only 1.2% (0.0004) as variation from within plots (among bunches). This indicates that more bunches were taken per plot than needed to efficiently estimate overall damage. Reducing the 90 bunches to 30 (10 each at the top, center, and bottom) would increase the total variance only about 2%, but considerably decrease the cost of conducting the survey.

Another problem was the unequal size of the damage classes. Although the seven percentage classes were similar to those used by Stevenson and Virgo (1971) and were meaningful in economic terms, the resulting data were most easily analysed statistically by nonparametric methods. If more sensitive statistical methods, such as analysis of variance, are to be used, some adjustments would be necessary in designing future surveys.

The primary measurement parameter--estimated percentage loss per bunch--is only a relative measure of bird damage losses because it is influenced by the yield of each planting and the value of the variety grown. For example, a certain tonnage of bird-damaged grapes would represent a greater percentage of loss in a low-yield planting than in a high-yield one. And, of course, a certain percentage of loss would represent a greater dollar loss in a high-value variety than in a low-value one. Future surveys could improve estimates of percentage and dollar loss if sampling was stratified by age of planting (which largely determines value). If still greater accuracy is desired and cost is not a factor, absolute bird losses could be determined by measuring the actual yield lost on each plot such as De Grazio et al. (1969) have done in assessing bird damage to corn.

There are, of course, other possible sources of bias (such as dollar value for bird-pecked grapes), but a procedure to take them into account would be prohibitively complex. In addition, since they have the potential to both under- and over-estimate bird losses, they may largely negate one another.

CONCLUSIONS

This quantitative survey, the first of its kind for California, showed that bird damage to wine grapes in the central coastal counties probably amounted to more than $0.75 million in 1973. If the dollar loss per acre to wine, table, and raisin grapes in other parts of the state was at least one-fourth of that found in this survey (a reasonable assumption from the results of the Crase and DeHaven questionnaire), the total loss to California grape growers in 1973 probably exceeded $3 million.

The survey procedure is a simple one and, we feel, reasonably effective. With modifications (smaller subsamples, adjusted damage classes, and stratified sampling), it could be used for extensive surveys in other counties. Or, by increasing the number of plots per planting to 10 or more, it could be used to carefully estimate damage to individual plantings or to evaluate bird control techniques on small areas. However, where greater accuracy is required or a measure of yearly trends in damage is sought, methods should be developed to actually measure bird damage in terms of the yield and value lost.

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LITERATURE CITED

BOUDREAU, G. W. 1972. Factors related to bird depredations in vineyards. Am. J. Enology and Viticulture 23(2):50-53.

CALIFORNIA CROP AND LIVESTOCK REPORTING SERVICE. 1973. California grape acreage 1973. U.S. Dept. Agric. and Calif. Dept. Food and Agric., Sacramento. 39 p.

CRASE, F. T., and R. W. DeHAVEN. 1973. Questionnaire survey of bird damage to grapes in California. Unpub. Tech. Rept. No. 9. Work Unit DF-102.3, Denver Wildlife Research Center. 29 p.

DE GRAZIO, J. W., J. F. BESSER, J. L. GUARINO, C. M. LOVELESS, and J. L. OLDEMEYER. 1969. A method for appraising blackbird damage to corn. J. Wildl. Manage. 33(4):988-994.

DeHAVEN, R. W. 1973. Winter population trends of the starling in California. Am. Birds 27(5):836-838.

GUARINO, J. L. 1972. Methiocarb, a chemical repellent: a review of its effectiveness on crops. Proc. 5th Vertebrate Pest Conf., Fresno, Calif. p. 108-111.

STEVENSON, A. G., and B. B. VIRGO. 1971. Damage by robins and starlings to grapes in Ontario. Can. J. Plant Sci. 51(3):201-210.

STONE, C. P., D. F. MOTT, J. E. FORBES, and C. P. BREIDENSTEIN. 1973. Bird damage to field corn in New York in 1971. New York Fish and Game J. 20(1):68-73.