

UC Agriculture & Natural Resources

Proceedings of the Vertebrate Pest Conference

Title

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Permalink

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Journal

Proceedings of the Vertebrate Pest Conference, 25(25)

ISSN

0507-6773

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Publication Date

2012

DOI

10.5070/V425110533

The Net Benefits of Controlling Bird and Rodent Pests in Wine Grape and Avocado Production

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ABSTRACT: The objective of this analysis was to estimate the net benefits of controlling bird and rodent pests in California production of wine grapes and avocados. These two crops were chosen because of the expected differences in types and extent of pest damage and methods of pest control used by growers, as well as their importance in California agriculture. A web-based survey was designed to capture grower experiences with current levels of pest damage and their expectations about damage levels without control. Information on the methods of pest control and associated costs was also solicited from growers. We obtained 83 responses from avocado growers and 84 responses from wine grape growers. Results indicate that rodenticide use and trapping are the predominant methods of rodent control in both crops, while netting and visual scare devices are the most common methods used to control birds. The net benefits of bird and rodent control were measured on a per-acre basis and accounted for crop savings, avoided property damage, and control costs. In avocado production, the net benefit of bird control was estimated to be \$60 to \$196 per acre, and the net benefit of rodent control was estimated to be \$574 to \$1,117 per acre. In wine grape production, the net benefit of bird control was \$956 to \$1,600 per acre and the estimate for rodent control was \$390 to \$832 per acre.

KEY WORDS: avocado, benefits, birds, costs, damage, grape, pest, rodents

Proc. 25th Vertebr. Pest Conf. (R. M. Timm, Ed.)
Published at Univ. of Calif., Davis, 2012. Pp. 353-356.

INTRODUCTION

Agriculture is a key sector of the California economy, with revenue of \$37.5 billion in 2010. The state is responsible for nearly half of domestically produced fruits, vegetables, and nuts and accounted for 16% of national receipts for crops in 2010 (USDA 2011). Yet California growers face many challenges, including bird and rodent damage, a perennial problem for many growers. Damage is diverse and includes consumption of the fruit, vine and tree damage, and equipment damage. While the direct impacts of damage fall on growers, consumers and the broader economy are also affected.

Numerous studies have estimated and valued current levels of damage (Gebhardt et al. 2011, Hueth et al. 1997). Although it is valuable to understand how current levels of damage are affecting growers and consumers, previous studies have often stopped short of estimating the value of bird and rodent control as it is currently being employed. Such information is valuable from both a grower perspective and a social perspective. Growers may understand that the benefits of controlling bird and rodent pests outweigh the costs, but the extent to which this is the case may be unknown. From a social standpoint, such information is valuable because it makes the benefits of allowing control explicit to policymakers. Growers of many crops in California have faced increasingly strict pest control regulation and certain types of control used in the past are no longer permissible (CDPR 2011). Presumably, a ban on specific methods of pest control is based on the belief that the costs and risks outweigh the benefits. Therefore, it is important to estimate the benefits of current methods of control if continued use is to be justified.

The objective of this analysis was to estimate the net benefits of controlling bird and rodent pests in California production of wine grapes and avocados. These two crops were chosen because of the expected differences in types and extent of pest damage and methods of pest control

used by growers, as well as their importance in California agriculture. A web-based survey was designed and implemented with assistance of the California Department of Food and Agriculture (CDFA) staff to capture grower experiences with current levels of pest damage and their expectations about damage levels without control. Information on methods of pest control and associated costs was also solicited from growers. Data from the survey was used to calculate control costs per acre, the value of crop savings, and avoided property and equipment damage. The net benefit was calculated as the sum of crop savings and avoided property and equipment damage minus control costs.

METHODS

To gather data on pest control and damage needed for this analysis a web-based survey was distributed in cooperation with the California Farm Bureau Federation and various producer groups that represent California growers. Growers were made aware of the survey by an email containing a link to it. The survey solicited answers to the following key questions:

1. How many acres of this crop do you harvest in a typical year?
2. What methods do you use to control birds/rodents in this crop? (check all that apply)
3. In a typical year, how much do you spend on bird/rodent control in this crop? (all acres)
4. What percentage of your production of this crop do you lose to birds/rodents?
5. How much property damage (related to the production of this crop) by birds/rodents do you incur in a typical year?
6. If growers were prohibited from controlling bird/rodent pests in this crop, what percentage of your production of this crop would be lost to birds/rodents?

Equation 1

$$\text{crop saved by control} = \text{current yield} + \left(\frac{100 - \text{yield loss \% without control}}{100 - \text{current \% yield loss}} \right)$$

Equation 2

$$\text{net benefit of control} = (\text{value of crop saved} + \text{reduction in property damage}) - \text{cost}$$

7. If growers were prohibited from controlling bird/rodent pests in this crop, how much property damage (related to the production of this crop) by birds/rodents would you incur?

The results from the survey were used to calculate the percentage of growers using each method of control, control costs per acre, and yield and property damage with and without control. This data allowed the net benefit of control to be calculated. Specifically, the amount of crop saved by controlling bird/rodent pests was calculated according to Equation 1, which reflects the fact that current yield incorporates current damage levels. With crops savings calculated, the net benefit of control was calculated according to Equation 2, where each term is expressed per acre. The net benefit of control should be interpreted as the change in grower profit per acre that results from the use of bird or rodent control.

For all estimates derived from survey data, both a low value and high value was calculated. These were based on the method of handling survey respondents that provided an acreage estimate, but failed to answer the question of interest. For example, to produce the low estimate for control cost per acre, it was assumed that respondents who provided an acreage estimate but did not provide total control costs spent nothing on control. To produce the corresponding high estimate, surveys that did not include responses to both the acreage and total control cost questions were eliminated from the sample.

RESULTS

The web-based survey resulted in 83 responses from avocado growers and 84 responses from wine grape growers. In avocado production, rodent control was more frequently used than bird control, with rodenticides, trapping, and shooting being the three most commonly used methods. These methods were also commonly used in wine grape production, but promotion of predators was used much more often than in avocado production; only rodenticides were more commonly used by wine grape growers. Bird control was more prevalent in wine grape production than in avocado production, with nearly half of growers using netting and/or visual scare devices. Figure 1 and Figure 2 present the percentages of growers using each method.

The average cost of controlling bird and rodent pests was calculated by dividing total control costs by the number of acres under production. The estimates are reflective of whatever combination of control methods growers were using. Again, it is clear that rodents are a relatively larger concern for avocado growers, although wine grape growers incur similar costs from rodent control. Bird control costs in avocado production are very low, reflecting the fact that many growers do not engage in bird control,

while wine grape growers spend an average of about \$40 per acre controlling birds. Estimates of control costs are presented in Table 1.

The benefits of bird and rodent control arise from two sources: reductions in property damage and increases in yield. Table 2 shows average current yield loss and property damage, as well as potential yield loss and property damage if no attempt is made to control bird and rodent pests. In avocado production, failure to control bird and rodent damage would increase yield loss to these pests by 8.4 to 17 percentage points, and property damage would increase by \$37.80 to \$74.80 per acre. In wine grape production, the increase in yield loss that would result from not controlling birds and rodents ranges from 30.4 to 51.4 percentage points, while property damage would increase \$91.80 to \$204.60 per acre.

While property damage estimates were already expressed in terms of dollars, the yield benefits of bird and rodent control had to be converted to a dollar amounts. In

Figure 1. Percentage of avocado growers using pest control.

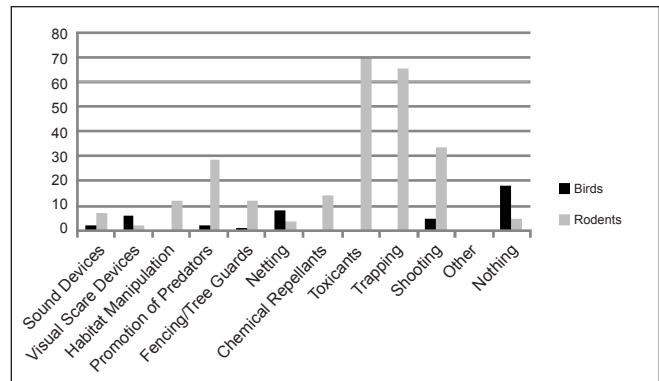


Figure 2. Percentage of wine grape growers using pest control.

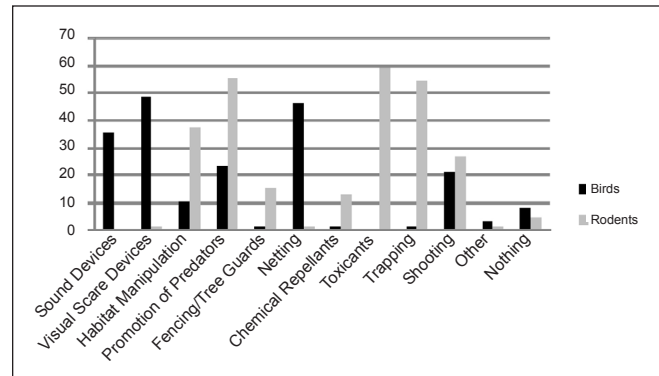


Table 1. Current control costs (per acre).

	Low Estimate	High Estimate
Avocado		
Birds	\$0.21	\$0.63
Rodents	\$25.81	\$25.89
Wine Grape		
Birds	\$39.99	\$42.03
Rodents	\$21.70	\$27.75

Table 2. Current and potential yield loss and property damage.

	Current Yield Loss		Current Property Damage (per acre)	
	Low Estimate	High Estimate	Low Estimate	High Estimate
Avocado				
Birds	0.5%	1.4%	\$0.50	\$1.40
Rodents	4.6%	5.2%	\$20.20	\$20.40
Wine Grape				
Birds	6.0%	6.6%	\$4.20	\$4.90
Rodents	3.9%	4.6%	\$9.10	\$9.90
	Yield Loss Without Control		Property Damage (per acre) Without Control	
	Low Estimate	High Estimate	Low Estimate	High Estimate
Avocado				
Birds	1.3%	4.0%	\$3.70	\$11.30
Rodents	12.2%	19.6%	\$54.80	\$85.30
Wine Grape				
Birds	26.6%	39.6%	\$78.70	\$161.00
Rodents	13.7%	23.0%	\$26.40	\$58.40

2009 and 2010, the average avocado yield in California was 4.7 tons per acre, and the average price received per ton was \$1,510. Average wine grape yield was 7.3 tons, and the average price received per ton was \$576 (USDA 2011). The results of converting yield loss percentages to quantities and values are presented in Table 3. Finally, the total benefits were calculated by adding the value of crops savings to the property damage avoided. Subtracting the control costs yields the net benefits of bird and rodent control reported in Table 4.

DISCUSSION

Results from the survey indicate growers use a range of tools to minimize bird and rodent damage. Growers often employ more than one method, and these efforts have a significant impact on production costs. Wine grape growers, for example, may spend as much as \$70 per acre controlling birds and rodents. However, it is important to consider the benefits that these expenditures provide. Our analysis indicates that crop savings and property damage

Table 3. Per acre yield benefits of bird and rodent control.

	Quantity of Crop Saved (tons)		Value of Crop Savings	
	Low Estimate	High Estimate	Low Estimate	High Estimate
Avocado				
Birds	0.038	0.124	\$57	\$187
Rodents	0.374	0.714	\$565	\$1,078
Wine Grape				
Birds	1.600	2.579	\$921	\$1,485
Rodents	0.744	1.408	\$428	\$811

Table 4. Net benefits of bird and rodent control.

	Low Estimate	High Estimate
Avocado		
Birds	\$60	\$196
Rodents	\$574	\$1,117
Wine Grape		
Birds	\$956	\$1,600
Rodents	\$390	\$832

avoided by controlling birds and rodents in avocado and wine grape production easily outweigh the control costs. While the net benefit of bird control in avocado production might be as low as \$60 per acre, bird control in wine grape production yields a net benefit per acre as high as \$1,600. When these net benefits are weighed against typical revenue earned per acre, it is apparent that controlling birds and rodents can have a significant impact on the profitability and viability of growing these crops in California. The net benefit of controlling birds in avocado production is 1% to 3% of average revenue per acre, while rodent control provides net benefits equal to 8% to 16% of average revenue per acre. In wine grape production, the numbers are even larger, with bird control net benefits equaling 23% to 38% of typical revenue per acre, and rodent control net benefits representing 9% to 20% of typical revenue per acre.

Although not examined in this study, the large net benefits of bird and rodent control in these crops make it clear that this control has a significant impact at the market level. In absence of the ability to control these pests, many growers would stop production, and those that do not would produce less. This would impact consumers across the country, causing higher prices and substitution to less-desirable alternatives. The impact to the California and U.S. economies would also be significant because production would shift to other states or international imports would increase.

ACKNOWLEDGEMENTS

We wish to extend our sincere thanks to the California Department of Food and Agriculture's Vertebrate Pest Control Research Advisory Committee for providing the funding for this study and Victoria Hornbaker, in particular, for her assistance. We would also like to thank Noelle Cremers and the California Farm Bureau Federation for their

assistance with the survey, and we greatly appreciate the feedback and guidance we received from Fred Rinder, Dennis Orthmeyer, Ryan Jacobsen, John Aguirre, and Dr. Robert Timm.

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