Crop Protection 52 (2013) 103–109

Contents lists available at SciVerse ScienceDirect

Crop Protection

journal homepage: www.elsevier.com/locate/cropro

Bird damage to select fruit crops: The cost of damage and the benefits of control in five states

A. Anderson [a,*], C.A. Lindell [b], K.M. Moxcey [a], W.F. Siemer [c], G.M. Linz [d], P.D. Curtis [c], J.E. Carroll [c], C.L. Burrows [e], J.R. Boulanger [c], K.M.M. Steensma [f], S.A. Shwiff [a]

[a] USDA/APHIS/WS National Wildlife Research Center, 4101 LaPorte Ave., Fort Collins, CO 80521, USA
[b] Michigan State University, 1405 S. Harrison Rd., East Lansing, MI 48823, USA
[c] Cornell University, 226 Mann Drive, Cornell University Ithaca, New York 14853, USA
[d] USDA/APHIS/WS National Wildlife Research Center, 2110 Miriam Circle, Suite B, Bismarck, ND 58501, USA
[e] Washington State University 1000 N Forest Street, Suite 201, Bellingham, WA 98225, USA
[f] Trinity Western University, 7600 Glover Road, Langley, BC V2Y 1Y1, Canada

ARTICLE INFO

Article history:
Received 13 March 2013
Received in revised form
21 May 2013
Accepted 22 May 2013

Keywords:
Fruit crops
Bird damage
Survey
Economics
Pest management

ABSTRACT

Fruit loss to birds is a long-standing and costly problem for many producers. We conducted a survey of Honeycrisp apple, blueberry, cherry, and wine grape growers in California, Michigan, New York, Oregon, and Washington to estimate costs of bird damage and benefits of bird damage management. We also assessed grower perceptions of impacts on profits and effectiveness of bird management techniques. Current yield-loss estimates provided by growers and market price data were used to monetize current bird damage in each crop and growing region. Data on expected damage without management were used to estimate the benefits of bird damage management as it is currently being employed in the different crops and growing regions. We estimated that current bird damage costs per hectare ranged from $104 in Oregon tart cherries to $7267 in Washington Honeycrisp apples. Estimated benefits of bird management ranged from $299 per hectare in Oregon tart cherries to $36,851 in California blueberries. Aggregate bird damage in the five crops and states was estimated at $189 million, and the aggregate benefits of managing that damage were estimated at $737 million to $834 million. Growers viewed most techniques for bird damage management as ineffective, or only slightly effective, and a majority of blueberry and sweet cherry growers viewed bird damage as having a significant impact on profits. Enhancing the effectiveness of bird damage management would increase both the efficiency and profitability of fruit production.

Published by Elsevier Ltd.

1. Introduction

The US is one of the top five fruit-producing nations in the world, accounting for over 29 million metric tons of production in 2009 (FAO, 2012; USDA ERS, 2011). Annual cash receipts from US fruit production currently exceed $15 billion, making fruit agriculture an important sector of the US economy. Rising incomes, both domestic and foreign, as well as better transportation technologies and growing awareness of health and nutrition, will only serve to increase the importance of fruit agriculture to the US economy. Thus, addressing threats posed by fruit crop pests and improving productivity and profitability is of great economic and social importance.

Fruit loss to birds is a long-standing and costly problem (Virgo, 1971; Dolbeer et al., 1994; Simon, 2008) affecting producers across the globe (Somers and Morris, 2002; Ahmad, 2010; Ribot et al., 2011). USDA NASS (1999) reported that US growers lose tens of millions of dollars each year through direct losses and often-ineffective efforts to deter birds, although the study was limited to two crops and seven states. In addition to outright consumption, birds damage fruit, leading to increased susceptibility to other pests and pathogens, and reduced product quality (Pritts, 2001; Duffy and Schaffner, 2002; Holb and Scherm, 2008).

* Corresponding author. Tel.: +1 970 266 6264.
E-mail addresses: aaron.m.anderson@aphis.usda.gov, Aaron.M.Anderson@aphis.usda.gov (A. Anderson), lindellc@msu.edu (C.A. Lindell), Karen.M.Moxcey@aphis.usda.gov (K.M. Moxcey), wfs1@cornell.edu (W.F. Siemer), george.m.linz@aphis.usda.gov (G.M. Linz), pdc1@cornell.edu (P.D. Curtis), jec3@cornell.edu (J.E. Carroll), cburrows@wsu.edu (C.L. Burrows), jrb69@cornell.edu (J.R. Boulanger), Steensma@twu.ca (K.M.M. Steensma), Stephanie.A.Shwiff@aphis.usda.gov (S.A. Shwiff).

0261-2194/$ – see front matter Published by Elsevier Ltd.
http://dx.doi.org/10.1016/j.cropro.2013.05.019

The economics of bird damage to fruit crops has received relatively little research attention compared to other agricultural pest problems (Gebhardt et al., 2011). Yet for many producers the impacts can be severe and management costly. Previous research on bird damage is mostly comprised of individual studies on either a single bird species or multiple species impacting a single crop (Crase et al., 1976; Hothem et al., 1981; Gadd, 1996; Cummings et al., 2005; Berge et al., 2007; Delwiche et al., 2007), or a single species impacting multiple crops (DeHaven, 1974), and thus a limited focus. A multi-crop, multi-region analysis allows investigation of the broader impact of bird pests, permits examination of damage differences between regions, and provides a better assessment of the benefits of employing various methods for bird damage management. A more comprehensive study would also allow growers to choose more effective management techniques and allow policymakers to make better-informed decisions about regulation and resource allocation. Few studies have attempted to evaluate multiple pest species' damage to multiple crops (Razee, 1976; USDA NASS, 1999; USDA NASS, 2002; Hueth et al., 1997; Gebhardt et al., 2011).

Our objective was to estimate bird damage to Honeycrisp apples, wine grapes, blueberries, and sweet and tart cherries in five important fruit-growing regions within the US. California (CA), Michigan (MI), New York (NY), Oregon (OR), and Washington (WA) together are responsible for over 70% of U.S. fruit production (USDA ERS, 2012). All five states produce apples (although Honeycrisp apple production is negligible in California and Oregon), wine grapes, blueberries, and sweet cherries, and four of the five states also produce tart cherries (USDA NASS, 2012b), allowing for regional comparisons. All of these crops are susceptible to bird damage and the states represent a range of production systems and potential bird pests. While planning the project we talked with numerous growers and extension personnel about the crops to include in the survey. Honeycrisp was singled-out because these individuals expressed a strong interest in the variety because of its perceived high susceptibility to bird damage and the high financial losses of damage given that it is a fresh market apple.

We surveyed fruit growers to provide data on the current threat posed by bird damage, as well as the benefits of mitigation efforts. Solicitation of growers' estimates of current damage and their expectations of the extent of damage without management allowed estimation of the benefits of bird management as it is currently being used. Additionally, both the current cost of bird damage and the benefits of management were monetized based on recent market prices. Monetization of these estimates allows comparison not only across growing regions, but also across the different crops. Results provide important information to policymakers, scientists, growers, and other stakeholders by highlighting those crops and regions where bird damage poses the most severe threat to grower profitability.

2. Methods

2.1. Survey instrument

The survey instrument consisted of 21 questions that solicited information about the locations and size of the grower's farm, growers' level of fruit production experience, production area and yield data for the crops of interest, bird damage, bird management methods, and estimated costs for bird damage management. The instrument is available from the authors by request.

2.2. Survey implementation

Members of the Human Dimensions Research Unit (HDRU) at Cornell University assisted with survey implementation. Members of the research team suggested potential groups (e.g. New York Apple Association) that might have membership lists containing fruit growers in the target audiences in each state. HDRU staff and other members of the project team contacted those groups and obtained mailing lists as possible or secured cooperation from groups to complete survey implementation on behalf of the study team. Ultimately, a total of 17 groups agreed to participate at some level: 8 groups provided a mailing list for use by HDRU, 5 groups would not release their mailing lists but agreed to implement a mail survey to their members, and another 4 groups would not release their mailing lists but agreed to conduct a web-based survey of their members.

All survey mailings were completed between March 5 and May 1, 2012 (Table 1). Members of all groups received an identical questionnaire and similar cover letters. In 4 of 5 mail surveys implemented by HDRU, members of each sample were contacted up to four times (i.e., (1) an initial letter and questionnaire, (2) a reminder letter, (3) a third reminder letter and replacement questionnaire, and (4) a final reminder about one week after the third mailing). In one mail survey implemented by HDRU, and all mail surveys implemented on behalf of the research team, non-respondents received up to three mailings (i.e., (1) an initial letter and questionnaire, (2) a reminder letter, and (3) a final reminder letter and replacement questionnaire 1–2 weeks after the follow-

Table 1
Survey method, source of survey implementation, and number of contacts, by state and fruit crop.

State	Targeted growers	Method	Implementor	# of contacts	Dates of implementation
CA	Blueberries	Web	California Blueberry Commission	3	March 15–April 5
CA	Cherries	Mail	California Cherry Advisory Board	3	March 15–April 5
CA	Grapes	Mail	HDRU	3	April 3–May 1
MI	Apples	Mail	Michigan Apple Committee	3	March 13–April 3
MI	Blueberries	Mail	Ottawa County MSU Extension	3	March 13–April 3
MI	Cherries	Mail	HDRU	4	March 5–April 2
MI	Grapes	Mail	HDRU	4	March 5–April 2
NY	Apples/Cherries	Mail	New York Apple Association	3	March 13–April 10
NY	Blueberries	Mail	HDRU	4	March 5–April 2
NY	Grapes	Mail	HDRU	4	March 5–April 2
OR	Apples	Mail	Columbia River Growers–Shippers Assn.	3	March 13–April 3
OR	Blueberries	Web	Oregon Blueberry Commission	3	March 16–April 6
OR	Cherries	Mail	Oregon Sweet Cherry Commission	3	March 13–April 3
OR	Grapes	Web	Oregon Winegrowers Association	3	March 16–April 6
WA	Apples/Cherries	Mail	Good Fruit Grower Magazine	3	March 13–April 3
WA	Blueberries	Mail	Washington Blueberry Commission	3	Mar 20–April 10
WA	Grapes	Web	WSU Viticulture & Enology Program	3	March 13–April 3