



Prevalence and cost of on-farm produce safety measures in the Mid-Atlantic



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ARTICLE INFO

Article history:

Received 15 February 2016

Received in revised form

28 April 2016

Accepted 30 April 2016

Available online 3 May 2016

Keywords:

Food safety

Produce safety

Food safety modernization act

Tomatoes

Leafy greens

Compliance cost

Regulatory burden

Mid-Atlantic

Vegetable growers

ABSTRACT

We use data from a survey of leafy green and tomato growers in the Mid-Atlantic region to investigate the prevalence and cost of produce safety practices required under the Produce Rule of the Food Safety Modernization Act. Majorities of our respondents currently employ most of the food safety practices that will be required under the Produce Rule. But the Produce Rule will nevertheless require changes on the part of some growers. We find that farm size has a statistically and quantitatively negligible relationship with the use of most produce safety practices except for the sampling and testing of water, soil amendments, and product samples. Contrary to the theoretical literature suggesting that traceability increases incentives to take precautionary measures, we find little evidence that the use of produce safety practices is correlated with any marketing channel. We do find that all of these practices exhibit substantial increasing returns to scale, implying that the burden of complying with the provisions of the Produce Rule is much lower for large operations than small ones.

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1. Introduction

In January of 2011, President Barack Obama signed into law the Food Safety Modernization Act [FSMA], the most sweeping reform of food safety law in over 70 years. Now, for the first time, the Food and Drug Administration [FDA] has legislative authority to require comprehensive, science-based preventive controls across the food supply, including the growing, harvesting, packing, and holding of fresh fruits and vegetables. The rule for produce safety, *Standards for the Growing, Harvesting, Packing, and Holding of Produce for Human Consumption* [Produce Rule] finalized in November 2015 and effective January 2016, sets standards associated with

identified routes of microbial contamination, including: (1) agricultural water; (2) biological soil amendments of animal origin; (3) health and hygiene; (4) animals in the growing area; and (5) equipment, tools, and buildings.¹ The Produce Rule applies to all fresh produce farms with annual produce sales over \$25,000; farms with produce sales of \$25,000 or less are exempt. Also exempt—thanks to a provision of FSMA introduced by Senators Jon Tester and Kay Hagan—are farms with total food sales of less than \$500,000 based on a three-year average that sell the majority of food directly to a qualified end-user located within state or within 275 miles of the farm. Additionally, the rule grants small farms extra time to come into compliance (for a more complete discussion of the Rule see [Food and Drug Administration, 2015](#)).

The Produce Rule will undoubtedly require many farms to undergo operational changes in order to adhere to the requirements and to reduce health risks associated with foodborne illness. Impacts on small farms, in particular, have been of special concern. Some of that concern has been addressed by the exemptions from the Rule for very small and small farms and extended times to come into compliance for others. Even so, many small farms fear that the on-farm safety measures required will prove to be too costly and burdensome and could ultimately put small producers out of

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¹ The Produce Rule is one of five rules established to form an extensive food safety framework; the other four rules are the Current Good Manufacturing Practice and Hazard Analysis and Risk-Based Preventive Controls for Human Foods, the Current Good Manufacturing Practice and Hazard Analysis and Risk-Based Preventive Controls for Animal Food, Foreign Supplier Verification Programs for Importers of Food for Humans and Animals, and the Accredited Third-Party Certification Program. In addition, the Produce Rule includes specific provisions related to sprouts.

business (Farm and Ranch Freedom Alliance 2013).

This paper investigates the extent to which small farm concerns about the burdens of the Produce Rule are likely to be realized. We use data from an original grower survey to estimate current prevalence and costs of produce safety practices among leafy green and tomato growers in the Mid-Atlantic region on farms of the different size classes specified by the Produce Rule. We then conduct an econometric analysis of those same data to examine systematic differences in both the prevalence of produce safety practices and the imposed cost burden across farms of different sizes.

The commodities we investigate, leafy greens and tomatoes, number among the highest risk produce items and are thus a target of special interest under FSMA. Leafy greens, in particular, are of special concern. Using data from outbreak-associated illnesses from 1998 to 2008, the Centers for Disease Control and Prevention concluded that more foodborne illnesses were attributed to leafy vegetables (22%) than to any other single commodity, including poultry and meat (Painter et al. 2013). Additionally, Mid-Atlantic agriculture represents an important sector of the industry as it serves a large, dense population with multiple urban centers (Washington, DC; Baltimore, MD; Philadelphia, PA; New York, NY) and a growing interest in local food.

For the food safety measures required by the Produce Rule, very little information exists about the extent to which produce growers currently employ those measures, the costs of those measures, and the potential burden requiring those measures would place on operations of different sizes. There have been only a handful of studies on the prevalence and cost of produce safety measures to date, each addressing a limited set of practices.

Among studies examining the prevalence of produce safety measures, Rangarajan, Pritts, Reiners, and Pedersen (2002) use data from a 1998 survey of 213 New York state fruit and vegetable growers to study the prevalence of safety practices related to testing and sanitation of agricultural water, manure management, composting processes, and recordkeeping. They find that only 15% of growers tested surface water for bacterial contamination and 88% used manure and compost practices that would reduce food safety risks. Cohen, Hollingsworth, Olson, Laus, and Coli (2005) use data from a survey of 297 New England fruit and vegetable growers to study the prevalence of safe food handling practices. Only 20% of the growers in their sample reported testing irrigation sources at least once a year, while 68% used practices to discourage wildlife from foraging in fields, 93% washed harvest and storage containers prior to use, and 89–93% had toilet and/or hand washing facilities accessible for fieldworkers. Hultberg, Schermann, and Tong (2012) use data from a 2008 survey of 246 Minnesota vegetable growers to investigate the prevalence of equipment and employee sanitation practices. They find that 66% of the growers in their sample followed safe manure and composting practices, 69% incorporated manure if applied raw, 68% took measures to keep wildlife out of growing areas, 84% cleaned harvest containers before use, and 73–94% provided various protections for worker health and hygiene. Bihn, Smart, Hoepting, and Worobo (2013) use data from a winter 2008–2009 water-use survey of 84 New York State fruit and vegetable growers and find that 27% of those who applied surface water overhead tested the water for any indicators of contamination. Harrison et al. (2013) use data from an online survey 226 small-to medium-sized farms in Georgia, Virginia, and South Carolina. They find that 59% of manure users composted manure prior to application and 73% waited at least 90 days between application and harvest. Additionally, 52% of growers reported that crops were harvested with bare hands, 33% always cleaned the containers used to transport produce to market between uses, and 66% had restrooms and hand washing facilities near the field or packing shed.

Two other studies examine the effects of Extension training on

subsequent implementation of Good Agricultural Practices [GAPs] like written food safety plans, food safety self-audits, and formal GAP certification (which requires costly third party audits). Tobin, Thomson, LaBorde, and Radhakrishna (2013) use data from a survey of 144 Pennsylvania growers who had attended Penn State Extension GAP workshops on in 2011 to evaluate the impact of the workshops on GAP implementation. Data from the survey conducted 6 months after the Extension workshops indicated that 37% were likely to conduct a self-audit, 30% were likely to write a food safety plan, and 16% were likely to seek third-party certification. Marine, Martin, Adalja, Mathew, and Everts (2016) use data from 2010 and 2013 surveys of 313 mid-Atlantic vegetable growers participating in GAP training to study the effects of farm size and marketing channel on the use of GAPs. They find that the use of GAPs did not vary significantly with farm size, but did vary with marketing channel: growers selling into wholesale markets were more likely to have written growing and handling policies, complete GAP certification, and test irrigation water, while growers selling through direct-to-consumer channels were less likely to have completed GAP certification. Marketing channels did not have a statistically significant effect on monitoring for wildlife access, sanitization of harvest containers, or GAP training, however.

We are aware of only two published studies investigating grower-reported costs of implementing produce safety practices. Both examine how those costs vary with farm size. Hardesty and Kusunose (2009) use data from a 2008–2009 survey of 49 California growers to estimate the costs of compliance with food safety requirements imposed by the Western Growers' Leafy Greens Marketing Agreement, which are similar to those required under the Produce Rule. They find that compliance costs per acre were higher for medium-size operations (defined as those with annual sales between \$1 million and \$10 million) than for smaller or larger operations. However, compliance costs as a share of revenues or total production costs were lower for medium-size operations than smaller ones and lower for large operations than medium-size ones. Becot, Nickerson, Conner, and Kolodinsky (2012) use data from a 2011 online survey of 17 GAP-certified Vermont vegetable and apple growers to estimate the costs of compliance with GAP requirements. They find that smaller operations (defined as those with annual sales less than \$0.5 million) spent more time on recordkeeping than larger ones, although that difference was not statistically significant. They did not find statistically significant differences in the costs of any other sanitation or preventive practices.

2. Materials and methods

2.1. Survey design and implementation

We analyze the prevalence and cost of produce safety measures required under the Produce Rule using data from an original survey of leafy green and tomato growers. The questionnaire included background information about farm acreage, employment, revenues, expenditures, and marketing channels as well as questions regarding microbial testing, field monitoring, remedial food safety actions, and preventive food safety actions. For microbial testing, respondents were asked if they collected water, soil amendment, and/or crop samples for testing and, if so, at what cost (including employee wages, materials, etc.). For field monitoring, respondents were also asked if their fields were monitored for wildlife encroachment and/or flooding and, if so, the costs associated with field monitoring. And for preventive actions, respondents were asked if harvest containers were sanitized prior to harvest, whether crops were washed prior to sale, whether precautions were taken with regards to employee sanitation and hygiene (e.g. training,

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