



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

SUPPLY CHAINS: LINKED TO SAFER FOOD?

Vertical integration and coordination have often been cast as villains in agriculture, but do they actually contribute to enhanced food quality, particularly in the area of pesticide residues?

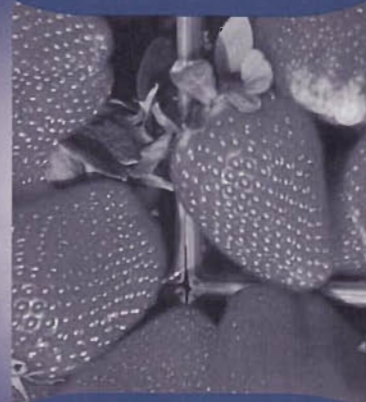
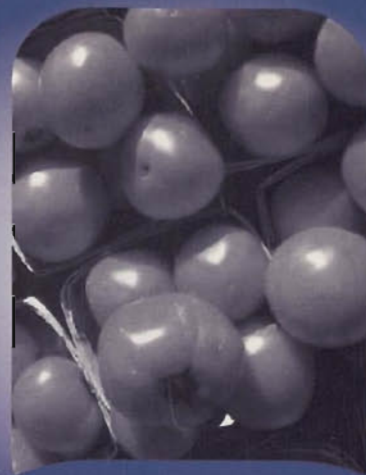
Scientific advances continue to expand and refine our knowledge of the subtle aspects of food quality and food safety aspects of pesticide residues, pathogenic serotypes of *E. coli*, and most recently, genetic modification, along with other contemporary food attributes. Many of these qualitative aspects of food are highly sophisticated, as well as imperceptible to human senses, so some qualitative attributes can only be determined through costly laboratory analysis. Others can be found by collecting, synthesizing, and sharing detailed information on how the attribute was produced, processed, and distributed.

Economic research suggests that increased vertical coordination and integration between stages in the supply chain may result in more control and flexibility over product quality (Caswell, Roberts and Jordan; Hennessy). We discuss our efforts to evaluate the relationship between vertical coordination (or integration)

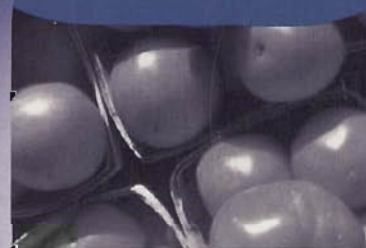
and one qualitative attribute: the occurrence of pesticide residues in fresh produce.

The Role of Pesticides

The use of pesticides in food production is one of a number of activities that influence food quality. If the levels of pesticide residues in food are unknown or uncertain, and may negatively impact a firm's profits, then economic theory suggests that producers and marketers (especially the latter) will consider this unknown level as a risk factor and will incorporate this into decisions on how to produce and market their products. This result might include strategic decisions such as the adoption of integrated pest management practices, the use of precision agriculture techniques, or an increase in the degree of coordination or information-sharing with adjacent market stages.



BY RICHARD L. KILMER AND
THOMAS J. STEVENS III





Strawberries and tomatoes coming from vertically integrated growers were more uniform in quality than those from non-vertically integrated growers.

The (New) Tools of the Trade

Integrated pest management helps minimize the number of necessary chemical applications, thereby reducing the likelihood of high pesticide residues (as well as reducing overall input costs, a factor important to growers). By fine-tuning the level of inputs to the needs of each section of a field, precision agriculture helps minimize over-application. Precision practices first saw wide use in corn and soybeans in the mid-1990s, and are just becoming popular in so-called “specialty” agriculture, such as fresh produce. Furthermore, when growers coordinate pest control practices with handlers who market the food, society’s food may be safer. In fact, many such firms specify production programs (including allowable product selections) for contract grower use.

A look at tomato and strawberry growers and marketers in Florida offers some hints.

Data on fungicide and insecticide residues found on Florida strawberries and tomatoes between October 1990 and June 1993 were acquired from the Florida Department of Agricultural and Consumer Services’ Chemical Residue Laboratory (FDACS-CRL). FDACS-CRL routinely monitors chemical residues that may be on or in human food produced and/or marketed in Florida. FDACS-CRL’s sample collection is weighted toward crops and growing seasons that have a high potential for accumulating chemical residues. As a result, its sampling procedure is not random, and may not provide a representative picture of the overall occurrence of chemical residues in all fresh Florida produce.

We used the tomato and strawberry data to see whether there is an empirical relationship between vertical coordination and the level and variability of pesticide residues on these two crops. The data were grouped by specific pesticides and then re-grouped into insecticides and fungicides. The growers whose crops appeared in the samples were then interviewed to determine what production and handling practices they employed for their crops. Information on demographic and business characteristics was also collected.

Of the 55 tomato growers interviewed, 16 reported that they were not formally affiliated with the packing, distribution, or marketing stages — they were not coordinated or integrated with suppliers or processors. Thirty-nine shared common ownership with one or more suppliers or processors: they were vertically integrated. Of the 50 strawberry growers in the study, 30 were not formally affiliated with the packing, distribution or marketing stages. The other 20 shared common ownership with the downstream (processing or marketing) stages.

Integration and Pesticides

Technological, environmental, and management factors can influence residue levels, so we used a statistical regression model to control for other factors that might affect residue levels. Results show that strawberries from vertically integrated growers are of higher quality, as we define it here (in other words, they have lower residue levels), because the average fungicide residue level among firms was lower than residue levels on berries produced by non-vertically integrated growers. On the other hand,



the notion that it is clearly in the interest of retail produce marketers with high brand recognition and public visibility to control as much as possible the circumstances of production, in order to ensure the desired level of product quality. In fact, the case of fungicide and insecticide residues in Florida strawberries and insecticide residues in Florida tomatoes confirm the positive relationship between safer food and increased coordination in the food supply chain cited in a growing number of qualitative studies in this area.

we found that the average fungicide levels among firms in tomatoes did not differ because of a vertical integration or coordination arrangement. (Kilmer, Flambert, Stevens, pp. 222-223).

We then analyzed the variability of the residue levels among firms by looking at the unaccounted errors from the statistical regression model. The variation among fungicide residues in strawberries grown by vertically integrated producers was significantly smaller than for those grown by non-affiliated producers. In other words, the strawberries coming from vertically integrated growers were more uniform in quality than those from non-vertically integrated growers. In contrast, vertical integration appears to be significantly associated with greater variation in fungicide residues in tomatoes (Kilmer, Flambert, Stevens, p. 224). Tomatoes go to processors who wash away any fungicides present on their skin. Thus, fungicide levels are not a critical issue for tomato growers or the processors with whom they contract.

Insecticide residue levels were found to be less varied and more uniform in tomatoes and strawberries grown by vertically integrated growers. Strawberries and tomatoes coming from vertically integrated growers were more uniform in quality than those from non-vertically integrated growers (Kilmer, Flambert, Stevens, p. 224).

The Search for Meaningful Links

This study represents the first-known attempt to quantify the relationship between food safety and vertical coordination in food supply-chains. There is a certain logic to

For more information

Caswell, J. A., T. Roberts and C.T. Lin. "Opportunities to Market Food Safety." *Food and Agricultural Markets: The Quiet Revolution*. L. P. Schertz and L. M. Daft, Eds. Washington, D.C.: National Planning Association, 1994.

Hennessy, D. A. "Information Asymmetry as a Reason for Food Industry Vertical Integration." *Amer. J. Agr. Econ.* 78(November 1996):1034-1043.

Kilmer, Richard L., Anouk M. Flambert, and Thomas J. Stevens III. "Pesticide Residues and Vertical Integration in Florida Strawberries and Tomatoes," *Agribusiness: An International Journal* 17 No.2 (2001): 213-226.

Stevens, T. J. III and R. L. Kilmer. "Empirical Relationships Between Pesticide Residues, Producer Attributes, and Production Practices for Florida Grown Strawberries and Tomatoes." Florida Agricultural Experiment Station Research Bulletin No. 329, Gainesville: February 1999.

Richard L. Kilmer is Professor in the Department of Food and Resource Economics at the University of Florida.

Thomas J. Stevens III is a Post-Doctoral Associate in the Department of Food and Resource Economics at the University of Florida.

