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SUPPLY CHAINS MAY DELIVER SAFER TOMATOES AND STRAWBERRIES

By

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MISSION AND SCOPE: The International Agricultural Trade and Policy Center (IATPC) was established in 1990 in the Food and Resource Economics Department (FRED) of the Institute of Food and Agricultural Sciences (IFAS) at the University of Florida. Its mission is to provide information, education, and research directed to immediate and long-term enhancement and sustainability of international trade and natural resource use. Its scope includes not only trade and related policy issues, but also agricultural, rural, resource, environmental, food, state, national and international policies, regulations, and issues that influence trade and development.

OBJECTIVES:

The Center's objectives are to:

- Serve as a university-wide focal point and resource base for research on international agricultural trade and trade policy issues
- Facilitate dissemination of agricultural trade related research results and publications
- Encourage interaction between researchers, business and industry groups, state and federal agencies, and policymakers in the examination and discussion of agricultural trade policy questions
- Provide support to initiatives that enable a better understanding of trade and policy issues that impact the competitiveness of Florida and southeastern agriculture specialty crops and livestock in the U.S. and international markets

Supply Chains May Deliver Safer Tomatoes and Strawberries

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Scientific and technological advances continue to expand and refine our knowledge of increasingly subtle aspects of food quality and safety, such as pesticide residues, pathogenic serotypes of *E. coli* and most recently, genetic engineering. Many of these new or technological qualitative aspects of food are imperceptible to human senses and can only be determined through costly laboratory analysis and/or the collection and sharing detailed information on how it was produced, processed and distributed. Research suggests that increased vertical coordination and integration between supply-chain stages results in better control and flexibility over product quality as well as quantity (Caswell, Roberts and Jordan; Hennessy). The more obvious and sensational cost incentives to improve coordination for food producing and marketing firms are those associated with product safety and liability. The intent of this article is to discuss the results of our efforts to evaluate the relationship between vertical integration and the occurrence of pesticide residues in fresh produce.

The application of pesticides in food production can be viewed as one of a number of inputs that influence its quality. If the levels of pesticide residues in food are unknown or uncertain, and may negatively impact a firm's profits, then producers and handlers will consider them as quality risk factors and will incorporate this fact into their decisions on how to produce and market their products. This includes strategic decisions as to the adoption of integrated pest management practices, precision agriculture techniques, or the degree with which to coordinate or share information with adjacent market stages.

Widely recognized economic theory on risk and uncertainty can be employed in evaluating and optimizing a firm's decisions under such conditions (Robison and Barry). This theory shows that there is a very clear incentive for a firm facing uncertain input quality to seek to both increase the level of input quality and decrease input quality variability. Greater vertical coordination between supply-chain stages may be one means for firms closer to consumers to accomplish this. Given the *inverse* relationship between input quality and pesticide residues, it was anticipated that producers who are vertically

integrated with firms closer to consumers might have a lower level and variance of pesticide residues in their food products.

To verify this hypothesis, data on fungicide and insecticide residues found in Florida strawberries and tomatoes between October 1990 and June 1993 were acquired from the State Department of Agriculture. The growers who produced these samples were subsequently interviewed to determine the production and handling practices they employed for their crops, as well as their socio-economic characteristics. Of the 55 tomato growers interviewed, 16 reported that they were not formally affiliated with the packing, distribution or marketing stages and 39 shared common ownership with one or more of these stages, i.e., were vertically integrated. Of the 50 strawberry growers interviewed, 30 were not formally affiliated with the packing, distribution or marketing stages and 20 shared common ownership with the downstream stages.

Statistical analysis of these data found that the variability of fungicide and insecticide residues in strawberries grown by vertically integrated producers was significantly lower 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. Furthermore, strawberries from vertically integrated growers were of higher quality because fungicide residue levels were, on average, lower than those from non-vertically integrated growers. In contrast, vertical integration appears to be significantly associated with greater variation in fungicide residues in tomatoes; however, insecticide residue levels were found to be less varied and more uniform in tomatoes grown by vertically integrated growers.

This study represents the first known attempt to quantify the relationship between food safety and vertical coordination in food supply-chains. The case of fungicide and insecticide residues in Florida strawberries and the 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.

For more information

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