Title Models for planning the supply chain of agricultural perishable products

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Abstract

The supply chain of agricultural products is an important component of the U.S. economy, which accounted in the year 2000, for over over 9% of the US gross domestic product. Within the supply chain of agricultural products, fresh produce is one of the most dynamic sectors of the industry. For example, the US market for fresh agri-foods represents nearly a quarter of all US food expenditures, with annual consumption of over a $100 billion in products related to fruits and vegetables.

The present research develops a planning framework designed for managing the supply chain of fresh agri-foods, from the perspective of the agricultural producers. The objective of the planning framework is to help the farmers make decisions based on historical price information, resource availability, and other factors that are not usually considered by the farmers such as price dynamics, transportation and inventory costs. Since the fresh produce market is highly dynamic and uncertain, this research decomposes the overall planning problems into two phases: tactical and operational. At the core, the planning system integrates an analytical supply chain model that takes the relevant information to render a plan for growing (when and how much to produce), harvesting and distributing products in a planning cycle.

The planning tools considered limited resources, such as available land and financial resources and the uncertainty of yields and prices. The particular solution is obtained through mixed integer programming and stochastic programming applied to agricultural decisions. The usefulness of this approach is demonstrated using real data from growers of fresh produce.

The contribution of this research includes the development of an integrated hierarchical planning system for the tactical and operational planning of fresh agricultural products. This planning system applies operations research models for the planning of highly perishable products, such as tomatoes and bell peppers. The benefit of the proposed planning system is the coherent management of risk, the coordination of operational and tactical decisions, and the tradeoffs between costs and quality of perishable products.