Developing a green and bipolar fuzzy inventory-routing model in agri-food reverse logistics with postharvest behavior

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Abstract

A novel periodical mixed-integer mathematical model in the field of fresh agri-food product's distribution (tomato product for instance) is developed in this paper. Green topics and two significant features of fresh agricultural products, namely freshness and ripeness, are added to the inventory routing problem (IRP) with simultaneous pickup and delivery for perishable products. The objective function tends to optimize the system total interest. In this model, traditional costs such as transportation and holding costs are considered besides up-to-date points such as expired products and customer's dissatisfaction costs. To compute the customer's dissatisfaction costs, the level of deviation from ideal quality should be measured to specify the biological postharvest behavior of fresh products. To determine the fair pricing, the patterns of quality decay have been applied. Considering the environmental effects and recycling requirements of expired crops, the reverse logistics notion has been applied to collect and reuse the wasted products. The level of greenhouse gas (GHG) emission has been controlled to reduce the harmful impressions of this gas and protect the environment. In the optimization procedure, the system total costs are developed by assuming fuzzy quality levels and fuzzy holding costs. Also, a bipolar approach has been applied for fuzzy programming. Finally, a numerical example besides sensitivity analysis and managerial insights is presented. Results show that remarking fuzzy parameters lead to lower profit and different routing and transmission. Also, applying less pollutant vehicles and increasing plant's delivery levels can be noted to reach a green environment and higher level of profit.