EASTERN BROCCOLI SUPPLY CHAIN MODEL

Shady S. Atallah¹, Miguel Goméz¹ and Thomas Björkman²


1-Abstract

Background: Broccoli is a major specialty crop in the United States (U.S.) with a farm-gate value of over $700,000,000. Rise of transportation costs and interest in local and regional food has led to efforts in the Eastern U.S. aiming at insuring a reliable, year-round supply of Eastern-grown broccoli that will be welcomed in East Coast markets.

Data: We collected data on fresh broccoli acreage, yields, production, and transportation costs from emerging broccoli-producing region in the East Coast (Maine, New York, New Jersey, Pennsylvania, Virginia, Maryland, North Carolina, South Carolina, Georgia, Florida) and the mainstream producing regions of California, Arizona in addition to imports from Mexico and Canada. Wherever data were not available, we visited growers and packer/shippers to complement it.

Methods: We develop a mathematical programming model of the Eastern broccoli distribution system to examine optimal production sites and flows for broccoli grown in the East. The optimization model inputs are: seasonal supply in the aforementioned producing regions; seasonal demand in Eastern metropolitan areas; regional production costs, and seasonal transportation costs. Given these inputs, the model minimizes the total costs of producing and transporting broccoli from supply sites to markets and solves for cost-effective seasonal product flows.

Analysis: We use the model to simulate the impact of increased localization (reduction in the weighted average source distance or WASD), increased producing and transporting broccoli from supply sites to markets and solves for cost-effective seasonal product flows.

2-Baseline production and transportation model

3-Baseline solution and localization scenarios

Table 1. Comparison of Weighted Average Source distance (WASD) and costs under cost-minimization (baseline), distance-minimization and WASD reduction

4-Spatial and seasonal increase in broccoli marginal values in the metropolitan Eastern U.S. due to a 1% WASD reduction/localization under current acreage

5-Scenarios of increase in Eastern broccoli acreage

Table 2. Scenarios of increase in Eastern broccoli acreage compared to baseline acreage

6-Conclusion

A 30% increase in Eastern acreage has the potential to reduce the system costs by 5 million dollars a year under current diesel fuel prices and 12 million dollars if fuel prices increase by 50%. It also reduces the system’s carbon footprint: WASD is reduced by 5%, which roughly translates into a reduction in diesel fuel usage of 63,000 gallons/year that is equivalent to a reduction in CO2 emissions of 1.4 million lbs/year.

7-Acknowledgements

This work was funded by the USDA’s National Institute of Food and Agriculture through the Specialty Crop Research Initiative.