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The Economic Feasibility of a New Jersey Fresh Tomato Packing Facility: A Stochastic Simulation Approach

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This study evaluates the economic feasibility of establishing a packing house for the New Jersey Tomato Council Cooperative Association. Several scenarios were evaluated using a comprehensive firm-level, dynamic, stochastic, multiple-year, capital-budgeting computer model. Results indicate that the packing house would have difficulty sustaining itself if it packed tomatoes only during the three months a year that local tomatoes are produced. Economic performance of the packing house improved, however, when additional tomatoes were repacked from another supplier during the months that tomatoes are not produced in New Jersey.

Introduction

Although New Jersey produces excellent tasting vine-ripened tomatoes and ranks in the top eight states for fresh tomatoes in total farm value and production, competition from other states and countries is fierce. Technology is constantly changing, and consumers are demanding a quality, aesthetically appealing product. Moreover, marketing techniques for competing vine-ripened tomatoes are being tailored specifically to meet customer wants and needs. New Jersey farmers must explore new marketing channels to compete effectively.

The high cost of production for New Jersey farmers is a major obstacle to maintaining and increasing their market viability. High production costs are a result of factors including high cost of land resulting from suburbanization, increased minimum wage ($5.05 versus $4.25 nationally), shorter shelf life than mature green tomatoes, lack of uniformity of the tomatoes' appearance, and low volume supply for supermarkets (Lininger 1989).

Because most New Jersey farmers own small operations of approximately 104 acres (New Jersey Agricultural Statistics Annual Report 1993) they often lack the ability to supply large wholesale and retail chains. This is a significant problem for the small farmer who cannot guarantee delivery on a consistent basis throughout the growing season.

In October 1993, the New Jersey Agricultural Cooperative Service (ACS) assisted farmers in organizing the New Jersey Tomato Council Cooperative Association. Its members seek to improve the production, packaging, promotion, and marketing of fresh New Jersey Tomatoes. In 1994, approximately 55 growers renewed their membership in the New Jersey tomato cooperative. A total of 396 acres have been committed to the cooperative for packaging fresh tomatoes (214 acres staked production and 192 acres for ground production). Staked production yields approximately 1200 boxes per acre, while ground production yields approximately 600 boxes per acre. At 100 percent production, the New Jersey Tomato Council Cooperative Association will produce 372,000 twenty-five-pound boxes of fresh tomatoes to be packed in one season (not considering culls).

DNA Plant Technology (DNAP), a biotechnology company, has expressed an interest in contracting with the New Jersey Tomato Cooperative as a possible

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repacker of DNAP's Florida tomatoes in the fall and winter months, packing up to 30,000 boxes weekly.

Objectives

This study attempts to evaluate the cost effectiveness of cooperatively packaging and distributing New Jersey tomatoes through the use of a central packing house. The objectives of this study are (1) to conduct a feasibility study for a fresh tomato packing house, looking at packing New Jersey tomatoes three months a year (Case 1) and packing both New Jersey tomatoes three months and repacking tomatoes from DNAP the other nine months (Case 2), under various scenarios; (2) to determine and analyze investment and operating costs for the single-use facility under different scenarios; and (3) to recommend feasible scenarios for the packing facility.

Methodology

Most studies of packing facilities use a simulation model to assess the feasibility of such a venture by incorporating risk analysis. This study used the Financial Agribusiness Simulator (FABSIM), a comprehensive, firm-level, dynamic, and stochastic capital-budgeting model developed using CHICKSIM I (Gempesaw et al. 1988) to model the production and financial performance of multiple input, multiple output, vertically or horizontally integrated farms (Gempesaw et al. 1992).

FABSIM provides detailed results regarding the economic and financial viability of the representative cooperative over a ten-year horizon with a maximum of 300 iterations. At the end of each iteration, it calculates values for each of the key production and financial variables. If the firm experiences a negative cash flow during the planning horizon, deficits are automatically covered by the model by obtaining a loan secured by existing equity, if available. If the firm avails itself of this option and still cannot cover the cash flow deficit, the firm is declared insolvent and the model stops and prints the results. FABSIM provides a flexible technique for taking risk and uncertainty, along with the time value of money, in the investment decision-making analysis into consideration (Bacon et al. 1994).

Primary data were collected from focus groups and discussions with New Jersey farmers, extension agents, and other professionals. Interest rates were collected from The WEFA Group, an econometric consulting firm. Data included both fixed and variable costs of the packing facility. Initial financial condition assumptions specified were the minimum cash reserve, the debt-to-asset ratio at the beginning of the cooperative's operation, the solvency ratio, the interest rates for various loans, and the discount rate. These assumptions reflect prevailing costs of borrowing available to U.S. agricultural firms (see Table 1).

The solvency ratio, reflecting the lending practices for agricultural firms, of 40 percent which means that the operation cannot borrow over 60 percent of its total assets. The discount rate used (15 percent) represents the minimum rate of return of an alternative investment; the investor must generate more than 15 percent return from the packing facility to consider it profitable. During the simulation, all machinery was replaced at the end of its operating life: packing equipment, 20 years; office equipment, five years; and forklifts, 15 years. To measure the economic and financial viability of the simulated packing facility, we studied five variables: net present value (NPV), the annual net income, the internal rate of return (IRR), the probability of economic survival, and the probability of economic success. The investment assumptions for the packing facility are exhibited in Tables 2 and 3.

The stochastic model analyzed the feasibility of a packing facility packing tomatoes over 10 years. Besides the items listed in Table 3, additional operating costs, which vary with each scenario, include the following: electricity and water costs: $0.048 per box; packing materials and labels: $1.15 per box; delivery costs (applicable to N.J.): $0.50 per box; wood pallets, strips: $0.10 per box; part-time laborers (~20): $6.50/hr or $0.32 per box. These initial costs estimates are based on 100 percent production, packing N.J. tomatoes three months out of the year. Detailed estimates and assumptions of the model are published in Peacock, et al.

Results and Discussion

To pinpoint the cost of successfully running a tomato packing facility the break-even point was held constant (10 years) for each scenario. Sensitivity analysis was performed to find the point at which farmers could survive with 100 percent probability of both economic survival and economic success. These percentages, however, do not guarantee success, in part because the model is dynamic, and different scenarios could come into play during the 300 iterations. The break-even amount charged to New Jersey farmers, considering 100 percent production, was $3.13 per box. This price was found by using the criteria of NPV, IRR, Annual Net Income, CV, 100 percent probability of economic survival and 100 percent economic success.

Two break-even amounts were charged when incorporating the repacking of DNAP tomatoes. New Jersey farmers own the cooperative and, therefore,

Table 1. Financial Variables and Values used for Stochastic Simulation, FABSIM.

Financial Variable	Value
Beginning Cash Reserve ($)	515,000
Minimum Cash Reserve ($)	5,000
Beginning Debt-to-Asset Ratio (%)	60.0
Solvency Ratio (%)	40.0
Discount Rate (%)	15.0
Interest Rate (%)	7.0

Table 2. Summary of Investment Costs of Tomato Packing Facility

Component	Cost ($)
Land (5 acres @ $10,000/acre)	50,000
Equipment room (18,000 @ $20.00/sq. ft.)	360,000
Office (2,000 @ $25.00/sq. ft.)	50,000
Office (HVAC) (2,000 sq. ft.)	7,500
Storage (5,000 @ $15.00/sq. ft.)	75,000
Cool storage room (5,000 sq. ft.)	84,123
Packing line equipment	314,772
Packing line installation	25,182
Delivery of equipment	5,832
Macro bins	33,100
Wiring	80,000
Forklifts (two)	30,000
Office Equipment	22,563
Professional start-up fees	16,000
Total:	1,154,072

Table 3. Summary of Annual Operating Costs

Component	Cost ($)
Full-time manager*	40,000
Full-time salesperson*	75,000
Full-time secretary*	20,000
Repairs	12,000
Out building insurance	4,281
Equipment/machinery insurance	3,038
Liability insurance	1,500
Health Insurance (3 full time employees)	5,400
Real estate tax	10,313
Telephone expenses	3,000
Office supplies	1,800
Professional fees	9,200
Total:	185,532

*Payroll tax ~11%.
Note: Workers' compensation for labor and for full-time employees were 6.5% and 0.46%, respectively.

Table 4. Stochastic Simulation Analysis for New Jersey production. Charging $3.13 per box to package tomatoes.

Economic Performance Variable	Scenario 1 100% production	Scenario 2 75% production	Scenario 3 50% production	Scenario 4 25% production
NPV ($000) CV	84871.55 35.01	-122446.60 - 18.21	-196571.70 -15.39	-170907.50 -6.92
Ann. Net Income CV	1212651.00 9.91	374022.70 24.08	-58821.37 - 22.80	-60627.02 - 11.23
* IRR (%) CV	14.49 5.45	9.62 9.14	23.71 58.06	0.00 .00
Probability of Economic Survival	100%	100%	0%	0%
Probability of Economic Success	100%	0%	0%	0%
Avg. yrs. operation	10	10	2.743	1.00

were charged $2.03. Repackers were charged $2.50 per box at 100 percent production.

When the above break-even prices had 100 percent probability of both economic survival and economic success, they were held constant and production percentages were varied in the following scenarios: scenario 1: 100 percent production, scenario 2: 75 percent production, scenario 3: 50 percent production, and scenario 4: 25 percent production. The results generated using the FABSIM model are summarized in Tables 4 and 5.

If New Jersey tomatoes are packed three months a year in Scenario 1 (Table 4) the cooperative was successful at 100 percent production when a packing cost of $3.13 was charged per 25-pound box. Both the probability of economic survival and economic success were 100 percent. The cooperative operated for the full ten years studied.

In Scenario 2 the cooperative still had 100 percent probability of economic survival and operated for the full ten years studied. While the Annual Net Income was positive, the NPV was negative and the probability of economic success was zero percent (indicating that the investor did not generate more that 15 percent return from the packing facility). The IRR was 9.62 percent. At 75 percent production $3.36 would have to be charged to have 100 percent probability of both economic success and economic survival.

Scenario 3, at 50 percent production, resulted in both a negative NPV and Annual Net Income. The IRR (23.71 percent) was unusually high; in this case the IRR should be disregarded because the NPV is negative. Both the probability of economic success and economic survival were zero percent. The cooperative operated only 2.743 years of ten. To achieve 100 percent success in all areas, $3.82 per box would have to be charged.

Scenario 4, at 25 percent production, resulted in both a negative NPV and Annual Net Income. The IRR was zero. Both the probability of economic survival and economic success were zero percent. The cooperative operated only 1 year of ten studied. At 25 percent production, $5.22 per box would have to be charged for 100 percent chance of survival and success.

If tomatoes were packed 12 months a year (Table 5), the model showed more promise for successful operation. Scenario 1, at 100 percent production, charged the minimum amount of $2.03 (New Jersey) and $2.50 (Florida) to pack 25-pound boxes of tomatoes. This resulted in both a positive NPV and Annual Net Income and an IRR of 24.86 percent. Both the probability of economic survival and economic success were 100 percent. The cooperative operated for the full 10 years studied.

Scenario 2, at 75 percent production, again resulted in both a positive NPV and Annual Net Income. The IRR was 21.68 percent. The probability of economic survival and economic success decreased slightly to 97.00 percent. The cooperative operated 9.73 years out of the 10 studied. To increase the probability of economic success to 100 percent, without increasing the repacking charge of $2.50, New Jersey farmers would have to pay $2.18 per box to package their tomatoes.

Scenario 3, at 50 percent production, indicated a negative NPV and positive Annual Net Income. The IRR, 22.44 percent, should be disregarded, because the NPV is negative. The probability of economic survival was 55.67 percent. The probability of economic success was zero. The firm remained in operation 6.01 years out of the ten studied. For economic survival and success probabilities of 100 percent, break-even costs of $2.47 must be charged to New Jersey and $2.50 for repacking.

Scenario 4, at 25 percent production, resulted in both a negative NPV and Annual Net Income. The IRR was zero percent. Both the probability of economic survival and economic success were zero percent. The firm operated only one year of the ten studied. Both New Jersey and Florida growers would have to be charged $2.92 a box to have 100 percent economic survival and success.

Two scenarios looked feasible in each case (both at 100 percent production): operating three months a year packing New Jersey tomatoes at $3.13, or packing both New Jersey and Florida tomatoes 12 months a year charging $2.03 and $2.50 respectively (Table 6).

Concluding Remarks

This packing simulation produced several important results. First, capital requirements would be substantial. Currently each of the 55 members participating would have to supply approximately $15,000 in capital and stock requirements to finance the operation. Second, the economic performance of the packing house improved when repacking Florida (DNAP) tomatoes. Third, keeping the facility at close to 100 percent of the committed volumes is a way to insure success. Fourth, if New Jersey tomatoes are packed for three months a year, $3.13 per box (between $0.33 and $0.63 higher than the industry norms) should be charged. If New Jersey were to pack three months a year and repack the other nine months, $2.03 per box (for New Jersey) and $2.50 per box (for repacking) should be charged. The New Jersey packing cost would be between $0.47 and $0.77 below the norm.

Table 5. Stochastic Simulation Analysis for New Jersey & Florida production. Charging $2.03 for N.J. and $2.50 for repacking.

Economic Performance Variable	Scenario 1 100% Production	Scenario 2 75% Production	Scenario 3 50% Production	Scenario 4 25% Production
NPV ($000)	733899.10	321698.70	-97999.10	-223412.20
CV	7.59	27.33	-47.05	-10.13
Annual Net Income	3838472.00	2158994.00	324731.30	-90817.22
CV	5.86	19.37	104.33	-14.33
* IRR (%)	24.86	21.68	22.44	0.00
CV	5.29	16.87	45.12	.00
Probability of Economic Survival	100%	97.00%	55.67%	0%
Probability of Economic Success	100%	97.00%	.67%	0%
Avg. yrs. operation	10	9.73	6.01	1.00

*Note: IRR calculated from only solvent iterations. Mean Net Present Values (NPV), Mean Annual Net Income, Mean Internal Rate of Return (IRR), Coefficients of Variation (CV), Probability of Economic Survival and Probability of Economic Success for a New Jersey Fresh Produce Packing House. Based on FABSIM Calculations.

Table 6. Break-even prices maintaining 100% success and survival

Stochastic Models	NJ only (Case 1)	NJ w. FL (Case 2)	FL w. NJ (Case 2)
100% Production	$3.13	$2.03	$2.50
75% Production	$3.36	$2.18	$2.50
50% Production	$3.82	$2.47	$2.50
25% Production	$5.22	$2.92	$2.92

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