The Financial Feasibility of Establishing a Fresh Produce Packing House in Jordan

Raed F. Hattar; J. R. Bacon; U. C. Toensmeyer; and C. M. Gempesaw II

Historically, Jordan's traditional markets for fresh produce have been the Persian Gulf countries. However, these exports have declined in recent years and new markets in Europe have been tapped. One of the main constraints to expanding the European market is the lack of quality-oriented packing houses in Jordan. This study considers the feasibility of a vegetable packing house designed to meet the quality requirements of the European market. The overall objective is to evaluate the economic viability of packing and transporting various fresh produce items to the European market. Specifically, four transportation scenarios were evaluated using a comprehensive firm-level, dynamic and stochastic, multiple-year, capital budgeting computer simulation model. Simulation provides a very flexible technique that can easily incorporate risk and uncertainty into the investment decision-making process. The results show that the medium sized vegetable packing house is viable when serving the European markets. Also, the economic performance of the packing house improved when shipping by refrigerated truck. Furthermore, the stabilizing effect of land transport was captured in the much lower variability in the expected returns.

Introduction

During the last three decades, the Jordanian economy has shown significant growth in all sectors. The agricultural sector is among those. Agricultural production has increased from 30 million Jordan Dollars (JD) in 1974 to 184.9 million JD in 1990 at current prices. Despite this significant increase in agriculture production, agriculture's contribution to Jordan's GDP has not increased as much (Central Bank of Jordan, 1992). Growth in agricultural exports have declined due to several factors. These include: (1) the loss of several importing markets such as the Syrian, Iraqi, and Lebanese markets in 1985; (2) growth in non-agricultural exports; (3) increased local production in the gulf countries which were the main export markets for Jordanian produce; and (4) the increased competition in the Persian Gulf market from other exporting countries, such as Turkey and Syria (Marketing Potential for Fresh Produce Exporters to the EC After 1992, 1992).

A recent study found that Jordanian agricultural exports to these markets increased rapidly between the years 1978 and 1982, and began to decline thereafter. The study also showed that the overall reduction in the agricultural exports from the year 1982 to 1987 was from 550,000 metric tons to 350,000 metric tons, corresponding to a 32 percent decrease. Focusing on the Saudi market, the reduction in exports amounted to about 37 percent. Consequently, Jordanian farmers experienced increasing marketing problems resulting from the excess supply in the local market (AlHyari et al., 1989).

One way to increase the Jordanian exports is to target new markets in Europe. A major constraint to increasing exports to Europe is the poor quality of the produce reaching the European market. The reduction in quality is due to the poor post harvest handling techniques, the lack of good packaging and grading facilities, and the lack of cost effective transportation. It is essential to conduct an economic and financial viability study of delivering fresh quality produce so that information can be provided to producers to make the necessary investments to improve the quality of Jordanian produce. Improvements in the quality of the delivered produce will increase Jordan's potential for competing in the targeted European markets. Once the quality problems are solved, the comparative advantage of Jordan becomes more apparent especially when the Jordanian climate and geographical location are considered. Jordan has the advantage of being able to produce during the winter time which is the off season

Raed F. Hattar, J. R. Bacon, U. C. Toensmeyer, and C. M. Gempesaw II are with the Department of Food and Resource Economics, University of Delaware, Newark, Delaware.

for local production in the European markets. This allows the producers in Jordan to capture the higher market prices and pay minimum tariffs.

Objectives

The overall objective of this study is to estimate the economic and financial viability of establishing produce packing facilities for fresh tomatoes, cucumber, squash, sweet and hot peppers, green beans, and eggplant, designed to meet the quality requirements for export to various markets in Europe. Specifically, this paper will analyze the impact of four alternative transportation scenarios on the profitability of a quality-oriented packing house. The first scenario assumes that the firm ships the fresh produce into Europe tariff-free by government subsidized airlines within the specified governmental quota of 365 metric tons annually per exporter. Shipping by refrigerated trucks, which is not subject to any government quota, is assumed for the remaining scenarios. The second scenario is the same as the first except that the quantity of fresh produce shipped under the rules of the quota is transported by refrigerated truck instead of air. The third scenario assumes that the enterprise transports 820 metric tons of fresh produce year-round using refrigerated trucks and incurring a tariff penalty imposed by the EC countries on imported produce during the local growing season in Europe. The final scenario is the same as the second except that the 820 metric tons of the year-round shipping are being transported by refrigerated truck during the duty-free and tariff-free periods of the first two scenarios.

Methodology

Computer Simulation Model

Computer simulation is appropriate for this study since the economic feasibility analysis involves a complex produce packing facility to be evaluated over a multiple year planning horizon. The computer simulation model used in this study, Financial Agribusiness Simulator (FABSIM), is a comprehensive, firm-level, dynamic, and stochastic capital budgeting computer simulation model. Simulation is an analytical technique that quantifies and describes the behavior of a complex economic system. In a capital budgeting framework, simulation provides a flexible technique for incorporating risk and uncertainty along with the time value of money in the investment decision making analysis. Using the accounting and tax subroutines from FLIPSIM V (Richardson and Nixon, 1986), CHICKSIM (Gempesaw et al., 1988), and AQUASIM (Gempesaw et al., 1991) additional subroutines were written to model the production and financial performance of multiple output, multiple input, vertically or horizontally integrated agribusiness firms.

One attractive feature of FABSIM is that it can model enterprises that produce outputs to be used as inputs in subsequent stages of the operation. The model permits the simulation of multiple output/multiple input enterprises. FABSIM has the capability of simultaneously modelling products with different time periods. All system variables such as output prices and quantities, variable input cost, product losses, etc. per stage can be simulated randomly using different probability distributions.

Since packout rates for fresh produce are estimated per time period, annual variable costs for the packing operation can be estimated using pre-, average, or post-packing quantities. The estimate of the operational costs can be evaluated on a per unit or per weight basis and the allocation of costs can be distributed over time. FABSIM also is designed to keep the production and processing cycles of the firm in balance. For example, if a packing house also has a farm that is supplying its produce and the farm has excess (deficit) production, the model will automatically sell (buy) excess (deficit) produce on the open market to keep the packing house operating. The model provides the analyst with additional options designed to evaluate the impact of various marketing barriers such as production quotas, tariffs, and other restrictions on trade.

FABSIM provides considerable detailed results regarding the economic and financial viability of the representative firm. The firm is simulated over a 10-year planning horizon with a maximum of 300 iterations. At the end of each iteration, values for each of the key production and financial variables are calculated. 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 availed of this option and still cannot cover the cash flow deficit, the firm is declared insolvent and the model stops and prints the results. The complete model results include a 10-year projection of the income statement, balance sheet, and cash flow statement as well as descriptive statistical measures and cumulative probability distribution functions of the key output variables and probabilities of economic success and survival. In addition, the model also prints stochastic annual output and prices, variable costs, packout rates and other random variables per production/processing stage by enterprise.

Past studies of whole-firm simulation using FLIPSIM V have relied on empirical distributions of yield and output prices using historical data (Richardson and Nixon, 1986). In the absence of historical cost and return data, particularly for new

enterprises or technologies, the nonsymmetric triangular probability distribution was used to represent the randomness of the control variables. The triangular distribution is generally used as a first approximation of situations where there are very little or no available data (Taha, 1988).

Data Sources

In order to conduct the simulation analysis using FABSIM, appropriate data regarding the financial conditions, along with the packing house activities and production factors associated with the operation are needed. The data required for this study were collected from Jordanian sources in August 1992. Fixed costs including the cost of land, building, packing lines, and others were taken from the records of the Agricultural Marketing & Exports Company. A survey of eighteen fresh produce exporters, representing 75 percent of the fresh produce exporters specializing in export to the European market, was conducted in order to collect the variable costs involved in the operation of the packing shed (A Guide for Importers From Jordan, 1991). Interest rates were collected from the handbook of the Agricultural Loan Organization of Jordan and input prices (farm gate prices) were collected from various issues of the Agricultural Prices Survey.

Initial financial condition assumptions that need to be specified are the minimum cash reserve, the debt-to-asset ratio at the beginning of the firms operation, the solvency ratio, the interest rates for various loans, and the discount rate. These assumptions are reported in Table 1. The solvency ratio, reflecting the lending practices for agricultural firms in Jordan, was set at one percent, which means that the operation cannot borrow over 99 percent of its total assets. During the simulation experiment, if the enterprise faces cash flow problems, the simulation model allows the enterprise to borrow money using existing assets as the collateral. The cost of debt capital was assumed to be eight percent, reflecting the prevailing cost of borrowing available to agricultural firms in Jordan from government sources.

The discount rate was specified at 15 percent to represent the minimum rate of return of an alternative investment. This means that the investor must generate more than 15 percent return from the packing house to judge the system profitable. Since the investors are assumed to be farmers, under Jordanian law they do not have to pay income taxes on the income from the packing house. Therefore, the tax subroutines of FABSIM were not used in this analysis.

The detailed investment assumptions for the packing house are presented in Table 1. To accommodate two packing lines, a 24 to 28 metric ton capacity cooling room and a small office in a 6,272 square meter building was assumed. The total cost of the packing house investment is $228,361. The packing lines used are typical of Jordanian produce packing houses where semi-manual lines pack all the produce commodities. Each of the two packing lines assumed is 34 meters long and one meter wide, and requires 18 people to operate under normal packing conditions.

During the simulation experiment, any machinery or equipment that required replacement was automatically replaced based on its specified operating life. The operating costs for the production process consist of fixed cost and variable cost. Fixed costs are defined as those costs which do not vary with the amount of produce packed. Variable cost, on the other hand, depend on the quantity of produce packed by the enterprise. The initial-year annual fixed operating cost for the packing house was estimated at about $17,869. The variable costs per kilogram associated with each commodity packed are shown in Table 2.

An examination of the feasibility of a Jordanian fresh produce packing operation requires some delineation of the packing season. A system of 'Ad valorem' Common Custom Tariff (CCT) is used by the EC to protect local EC produce growers. However, during certain time periods, the tariffs are waived due to a recent trade agreement between Jordan and the EC market (Jordan-Europe Protocol Agreement, 1977). Even though year-round production in Jordan is possible for the seven produce items considered in this study, knowing the quantities and time periods during which produce can be packed and shipped duty-free under the Jordanian quota is essential. The various marketing dates and prices for the seven selected commodities are given in Table 3. During the tariff-free marketing dates, local production in the importing EC countries is at a minimum, and therefore prices are at their highest. Estimates for the amount of produce to be packed each month during the tariff-free season were restricted to the Jordanian government air shipment quota of 365 metric tons per year per exporter. In order to use the Jordanian-supported air freight, scenario one was restricted to a total of 9,100 kg/month for each selected produce item during the duty-free marketing season. Scenario two operated under the same constraints as scenario one, but shipped the fresh produce by refrigerated truck rather than air.

In addition to tariffs, the EC market sets minimum prices at which certain agriculture products may be sold in the EC during the main local EC marketing season. The net effect of the price and tariff system for scenario three was assumed to be a 22 percent reduction in the prices received by Jordanian exporters for fresh produce during this time of the year. Scenario four is the same as scenario two, except the

Table 1: Financial Condition and Investment Assumptions for the Jordanian Fresh Produce Packing House

Financial Variables	Value	Investment Assumptions*	Value ($)
Beginning Cash Reserve ($)	1,481.00	Building (6,272 m^2)	134,834
Minimum Cash Reserve ($)	740.00	Land (13,000 m^2)	29,634
Beginning Debt to Asset Ratio (%)	95.0	Cooling Room (24-28 mt)	19,262
Solvency Ratio (%)	1.00	Two Packing Lines	17,758
Discount Rate (%)	15.00	Forklift	12,226
Interest Rate (%)	8.00	Office Equipment	4,647

*Agricultural Marketing & Exports Co.

Table 2: Mean Variable Costs for Packing Selected Fresh Produce Items

Initial Var. Cost ($/kg)	Tomato	Cucumber	Hot Pepper	Sweet Pepper	Squash	Green Beans	Egg-plant
Input Price	0.1541	0.2400	0.1022	0.2297	0.1956	0.3986	0.1008
Empty Boxes	0.0919	0.0948	0.1827	0.1571	0.0948	0.1378	0.1600
Elec & Water	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001	0.0001
Wood Pallets	0.0207	0.0237	0.0385	0.0385	0.0237	0.3260	0.0267
Repair	0.0059	0.0059	0.0622	0.0062	0.0062	0.0062	0.0062
Labor	0.0044	0.0044	0.0089	0.0074	0.0044	0.0548	0.0059
Air Trans.	0.4200	0.4200	0.4200	0.4200	0.4200	0.4200	0.4200
Land Trans.	0.2889	0.2697	0.4490	0.4949	0.2697	0.4949	0.4104

Table 3: Marketing Schedule Packing Seasons and Prices for Selected Fresh Produce Exported to Europe

Produce Item	Marketing Schedule			
	Packing Seasons		Mean Prices[a] ($/kg)	
	No Tarrif	Tarrif	No Tarrif	Tariff
Green Beans	Oct. - June	July - Sept.	1.422	1.109
Tomato	Nov. - May	May - Oct.	0.957	0.746
Hot Pepper	Nov. - April	May - Nov.	1.234	0.963
Sweet Pepper	Nov. - April	May - Nov.	1.234	0.963
Squash	Dec. - Feb	March - Nov.	1.067	0.832
Eggplant	Jan. - April	May - Jan.	1.223	0.954
Cucumber	Jan. - Feb.	March - Dec.	0.502	0.392

[a]All prices reflect a 10 percent marketing fee assessed by the EC wholesale sector.

Table 4: Mean Net Present Values (NPV), Mean Annual Net Income, Mean Internal Rate of Return (IRR), Probability of Survival, and Probability of Economic Success for a Jordanian Fresh Produce Packing House Exporting to the Europe

Economic Performance Variable	Scenario 1 Air Trans Quota=365 mt No Tariff Period	Scenario 2 Land Trans Quota=365 mt No Tariff Period	Scenario 3 Land Trans All Year 820 mt Tariff	Scenario 4 Land Trans 820 mt No Tariff Period
Net Present Value ($000) CV	667.0 (50.86)	1,012.1 (24.04)	1,669.8 (14.64)	2,503.4 (20.26)
Annual Net Income ($000) CV	185.3 (57.90)	288.1 (25.55)	484.4 (14.57)	708.2 (20.45)
Internal Rate of Return (%) CV	44.1 (64.09)	51.9 (43.88)	60.6 (25.48)	57.2 (44.37)
Probability of Economic Survival (%)	85.00	96.67	99.00	98.00
Probability of Economic Success (%)	85.00	96.67	99.00	98.00

quantities shipped increased to the 820 metric ton level of scenario three. This scenario will evaluate the economic potential of increasing shipments during the tariff-free period versus shipping year-round and paying the tariff.

For the purpose of this study, five performance variables were selected to measure the economic and financial viability of the simulated packing houses. These variables are the 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 NPV is defined as the present value of the producer's annual cash withdrawals plus the present value of the change in net worth. The annual net income is not discounted, and represents total revenues minus cash expenses and depreciation. The IRR is defined as the discount rate that equates the NPV equal to zero. The probability of economic survival is defined as the probability that the firm will maintain the minimum financial ratios required for solvency over the planning horizon. The probability of economic success is defined as the probability that the firm will have a positive NPV using a 15 percent discount rate. Another statistical measure of risk is the coefficient of variation (CV). The CV is defined as the standard deviation divided by its mean. This measure is used to compare the variability of returns from the different strategies.

Results and Discussion

The simulation results for the Jordanian fresh produce packing house are presented in Table 4, and show that the packing house under the four transportation scenarios generated returns which were, in most cases, higher than the specified discount rate. The results indicate that packing fresh produce to meet the quality requirements of the European market can be profitable for packing houses in Jordan. Shipping fresh produce by land clearly generated higher NPVs and lower CVs than shipping by air in all three land scenarios. This indicates that shipping by refrigerated truck is more profitable and less risky than the current practice of air shipments employed by most exporters. Although Jordan has plenty of trucks, the country lacks the trucks with the proper suspension necessary to ship fresh produce covering long distances and deliver quality product. Among the land transportation scenarios shipping 820 metric tons, the fourth scenario produced the highest NPV, but the third scenario had the lowest CV. These results show that shipping larger quantities by land during the non-tariff period is more profitable, but also carries a higher degree of risk. This is further supported by the annual net income of scenarios three and four. Shipping large quantities by truck year-round and paying the tariff may result in reduced income when compared to scenario three, but if the operator is risk averse then scenario three may be preferred.

Land transport of fresh produce scenarios generated higher IRRs than the air transport scenario. The mean IRR for the land transport scenario two was close to 52 percent, compared to the air transport scenario's 44.1 percent. Like the NPVs, the IRRs varied less in the land transportation scenarios than in the air transportation scenario. When shipping larger quantities (820 mt), year-round shipments generated a higher IRR with less variation than the strategy of scenario four, namely shipping the same quantity but only during duty-free periods. At first glance these IRRs appear higher than expected. However, the reader needs to keep in mind that the IRR is calculated only on solvent iterations and based on the relatively low equity investment of the owners. The lower expense associated with shipping by truck and the lack of any income taxes on the additional income significantly increased the IRR for the land transport scenarios.

Shipping fresh produce by air resulted in an 85 percent probability of survival and economic success for the packing house. This means that the firm had a 15 percent chance of not being in business after ten years of operation. Likewise, the owners had a 15 percent likelihood of not earning at least a 15 percent rate of return on the proprietor's initial investment. Transporting fresh produce by truck improved the odds of survival and economic success over the 10-year planning horizon for the packing house simulated in this study. Shipping the quota quantity of 356 metric tons by land resulted in improving the probabilities of economic survival and success to 96.67 percent. When shipping the larger quantities (820 mt), shipping year-round and paying the tariff had a slightly greater chance of economic survival and success (99%) than shipping the same quantities during the duty-free period (98%).

To summarize, several important results were found from the results of this study. First, the simulation results show that a medium-sized fresh produce packing house in Jordan can ship quality produce into the European markets profitably. Second, the economic performance of the packing house improved when shipping by refrigerated truck. Third, the stabilizing effect of land transport was captured in the much lower variability in the expected returns. Furthermore, when shipping larger quantities of fresh produce, shipping during the duty-free period was found to be more profitable, but presents a greater risk than shipping year-round and paying the tariff. Finally, this study has shown the importance of simulation in modelling a fresh produce packing house under a stochastic and

dynamic environment, and measuring the risks associated with alternative decision strategies. This information is needed by existing and potential packing house firms in their investment and expansion decisions.

References

Agricultural Marketing Organization of Jordan (AMO). *A Guide for Importers From Jordan.* Amman, Jordan, 1991.

Agricultural Marketing & Exports Company. Personal Communications, 1992.

Agricultural Prices Survey. The Hashemiti, Kingdom of Jordan, Dept. of Statistics, 1988-1991.

AlHyari, A. M., A. Zu'bi, A. Jabarin, M. Arabiate, Y. Quat, and N. Abdalat. *Jordan Fresh Produce Export Position in Some Arab Countries, Markets.* AMO, Amman, Jordan, 1989.

Central Bank of Jordan. Monthly Statistics, vol. 28, no. 6, June 1992.

Gempesaw, C. M. II, L. C. Munasinghe, and J. W. Richardson. *Description of CHICKSIM: A Computer Simulation Model for Broiler Growers.* Delaware Agricultural Experiment Station Bulletin No. 477, Newark, DE, 1988.

Gempesaw, C. M. II, F. F. Wirth, J. R. Bacon, and G. F. Vaughn. *The Economics of Integration Versus Specialization: The Case of Hybrid Striped Bass Pond Culture.* Delaware Agricultural Experiment Station Bulletin No. 492, Newark, DE, 1991.

Jordan-Europe Protocol Agreement. Section B, Article 17, 1977.

Marketing Potential for Fresh Produce Exporters to the EC After 1992. Paper presented for the regional seminar in Nicosia, Cyprus. AMO, (authors unidentified), 1992.

Richardson, J. W. and C. J. Nixon. *Technical Description of the Firm Level Income Tax and Farm Policy Simulation Model (FLIPSIM V).* Texas Agricultural Experiment Station Bulletin B-1528, College Station, TX, 1986.

Taha, H. *Simulation Modelling and Simnet.* Englewood Cliffs, NJ, Prentice Hall, 1988.