

A Profitability Analysis of Investment of Peach and Apple Growing in Turkey

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Abstract

This study was conducted to determine profitability and feasibility of fruit farms by investment analysis in Tokat - Turkey. The criteria of Net Present Value (*NPV*), Cost-Benefit Ratio (*CBR*) and Internal Rate of Return (*IRR*) were used for investment analysis. Three different discount rates (10%, 8% and 5%) were used to get the *NPV* and *CBR* for peach and apple. The *NPV* for peach were found to be positive (1113.6 \$/da; 1454.7 \$/da; and 2156.2 \$/da). Also the *NPV* for apple were found to be positive (574.2 \$/da; 805.4 \$/da; and 1342.9 \$/da). In addition to that, the *CBR* for peach were bigger than 1 (1.38; 1.43 and 1.51) and the *CBR* for apple were bigger than 1 (1.23; 1.27 and 1.33). The *IRR* for peach was 25.05 percent and 22.12 for apple. According to the results that were achieved by the study, it could be conducted that the investment is economically feasible. In the light of the findings of the present study, it can be perceived that the fruit farming can be one of the most important income sources for the farmers growing fruit in the research region in Turkey.

Keywords: fruit, internal rate of return, investment analysis, net present value, sensitivity analysis

1 Introduction

Turkey lies in the 36-42° north latitude and 26-45° east longitude and possesses a wide range of climatic conditions from mild Mediterranean to cold continental that enable the cultivation of more than 75 crop species. Peach and apple can be grown in various regions of Turkey (HAKAN, 2003; SPO, 2001; ENGINDENİZ *et al.*, 2004). They are widely grown in Tokat province in Middle Blacksea Region and cover 28,1 percent of total planted fruit area.

An orchard is a long-term including establishment and maturity period investment and careful planning is essential to ensure economic success (MARINI, 1997). The producer would like to know the results of his economic activity by working out a detailed cost-benefit analysis of the investment in the project. Although the technical aspects of fruit production have been studied extensively, quantitative studies related to the economics

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of such farms are limited in literature. Therefore there is still a need for further study; especially at the local level. The main objective of the study is to analyze the feasibility and profitability of investment in fruit farms.

2 Materials and Methods

In the study, the data were obtained from the annual cost table prepared by the Research Institute of Rural Services in the region for the year of 2003. The economic life of the activity is taken as 20 years for peach and 30 years for apple. Establishment period for peach and apple are 5 and 7 years respectively. The profit was calculated and compared with real interest rate to find opportunity costs of enterprise.

Investment in an orchard will generate income and expenses for many years into the future. Discounting these future streams of money is the recommended analytical technique that determines the Net Present Value (*NPV*) in today's money. By comparing the *NPV* of each investment, the most profitable investment over time can be determined by selecting that investment with the highest *NPV* (KELSEY and SCHWALLIER, 1999). In other words the *NPV* is the total present value of future revenues and costs of an activity (CASTLE *et al.*, 1987) and among the measures of investment returns over time, *NPV* offers the better measure of project worth (SWINTON *et al.*, 1997). The consensus in the investment literature is that if the objective of a firm is the maximization of profit or wealth of a business, then the *NPV* model is the appropriate procedure to evaluate investment decisions (TAUER, 2002). The *NPV* was calculated by the formula $NPV = \frac{FV}{(1+i)^n}$ (BECHTEL *et al.*, 1995) where *FV* is the future value of money, *i* is the interest or discount rate, and *n* is the number of years.

The *CBR* is the ratio obtained when the present worth of the benefit stream is divided by the present worth of the cost stream (GITTINGER, 1982) and can be obtained as follows (ERKUS and REHBER, 1998):

$$CBR = \frac{\sum_{t=0}^n R_t/q^t}{\sum_{t=0}^n C_t/q^t} \quad (1)$$

where *R* is the total revenue, *C* is the total cost, *i* is interest rate, and *n* is the number of years and $q^t = (1 + i)^t$. If *CBR* > 1, then the total revenue is greater than the total cost, If *CBR* = 1 then the total revenue is equal to the total cost, and if *CBR* < 1 then the revenue is less than the total cost.

The internal rate of return (*IRR*) is a useful measure of project worth (GITTINGER, 1982) and helps to determine the relative profitability of an investment (BECHTEL *et al.*, 1995). *IRR* is discounted rate, which makes Net Cash Flows of the economic life of project zero (TAUER, 2000). The *IRR* formula is as follows:

$$IRR = r_1 + \frac{ND_1}{ND_1 + ND_2}(r_1 - r_2) \quad (2)$$

where *r*₁ is the last discount rate which makes *NPV* positive, *r*₂ is the first discount rate which makes *NPV* negative, *ND*₁ is the last positive *NPV*, *ND*₂ is the first negative absolute value of *NPV*.

Sensitivity analysis is described as a technique for measuring the impact on project, while changing one or key input values about which there is uncertainty (MARSHALL, 1999).

Table 1: The investment cost of the farms (\$/da)

<i>Items</i>	<i>Peach – year of establishment of production</i>				
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
Soil preparing and planting	74.1	—	—	—	—
Maintenance	15.5	75.8	48.4	70.2	52.7
Harvesting-Transporting	—	—	2.8	10.0	13.0
Various inputs *	221.9	33.6	18.5	33.1	21.4
Other expenses (5%) †	15.6	5.4	3.5	5.7	4.3
Total variable costs	327.1	114.8	73.2	119.0	91.5
Capital interest (10%) ‡	32.7	11.5	7.3	11.9	9.2
Land Rent	82.5	82.5	82.5	82.5	82.5
Management cost (3%) §	9.8	3.5	2.2	3.6	2.7
Total fixed costs	125.0	97.5	92.0	98.0	94.3
Total	452.1	212.3	165.2	217.0	185.8

<i>Items</i>	<i>Apple – year of establishment of production</i>						
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>
Soil preparing and planting	25.5	1.1	1.1	1.1	1.1	1.1	1.3
Maintenance	9.4	22.6	27.4	20.5	37.5	38.1	45.0
Harvesting-Transporting	142.6	17.0	14.0	16.9	19.8	19.8	14.7
Various inputs *	—	—	—	—	—	—	22.7
Other expenses (5%) †	8.8	2.1	2.1	2.0	2.9	2.9	4.2
Total variable costs	186.3	42.8	44.6	40.5	61.3	61.9	88.0
Capital interest (10%) ‡	18.6	4.3	4.5	4.0	6.1	6.2	8.8
Land Rent	5.6	1.3	1.3	1.2	1.9	1.8	2.6
Management cost (3%) §	82.6	82.6	82.6	82.6	82.6	82.6	82.6
Total fixed costs	106.8	88.1	88.4	87.8	90.6	90.6	94.0
Total	293.1	130.9	133.0	128.3	151.9	152.5	182.0

* Cover pesticide, fertilizer, irrigation and labor costs
† The unexpected costs (transaction cost, transportation cost, labor and etc.), which occur during establishment period (ÇIÇEK *et al.*, 2001).
‡ The interest rate of capital is 10 percent of total fixed establishment (AKÇAY *et al.*, 2004).
§ Management cost is taken as 3 percent of total establishment cost (AKÇAY and UZUNÖZ, 1999).

3 Results and Discussion

Establishment cost is an investment that takes time to pay off (SHARP and COOLEY, 2004). The establishment costs of peach and apple production are given in Table 1.

As it can be seen from Table 2, the variable costs have a share of 65.0 percent for peach and 61.7 percent for apple in total production cost. With a 37.0 percent, maintenance

has the biggest share for peach and with a 23.0 percent, various inputs for apple in the variable costs.

As it can be seen from Table 3, the annual revenue of the producer is coming from the principal product and intermediary income.

Table 2: The production costs (\$/da).

<i>Items</i>	<i>Peach</i> <i>(year 6-20)</i>		<i>Apple</i> <i>(year 8-30)</i>	
	<i>(\$/da)</i>	<i>(%)</i>	<i>(\$/da)</i>	<i>(%)</i>
<i>Variable costs</i>				
Maintenance	133.4	37.0	45.1	15.0
Harvesting-Transporting	41.3	11.4	62.2	20.8
Various inputs	48.7	13.5	68.9	23.0
Other expenses (5%)	11.2	3.1	8.8	2.9
Total Variable Costs (1)	234.6	65.0	185.0	61.7
<i>Fixed costs</i>				
Capital interest (10%)	23.5	6.5	18.5	6.2
Management (3%) (*)	20.3	5.6	13.6	4.6
Land rent	82.5	22.9	82.5	27.5
Total Fixed Costs (2)	126.3	35.0	114.6	38.3
Total Production Costs (1+2)	360.9	100.0	299.6	100.0

* Management cost is 3% of gross production value.

Table 3: Income in the farms (\$/da)

<i>Income particulars</i>	<i>Peach – year of production</i>							
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>year 6-20</i>		
Principal product income	—	—	63.8	164.5	215.3	675.8		
Intermediary income	123.3	23.7	98.4	—	—	—		
Total	123.3	23.7	162.2	164.5	215.3	675.8		
<i>Income particulars</i>	<i>Apple – year of production</i>							
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>year 8-30</i>
Principal product income	—	—	—	—	—	—	86.2	452.1
Intermediary income	206.1	23.7	123.3	164.5	23.7	215.3	37.2	—
Total	206.1	23.7	123.3	164.5	23.7	215.3	223.4	452.1

The Net Cash Flows are given in Table 4.

Table 4: Cash flows in the farms (\$/da)

<i>Income particulars</i>	<i>Peach – year of production</i>					
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6-20</i>
<i>Annual Farm Income</i>						
- Principal product income	—	—	63.8	164.5	215.3	675.8
- Intermediary income	123.3	23.7	98.4	—	—	—
Total Farm Income	123.3	23.7	162.2	164.5	215.3	675.8
<i>Annual Costs</i>						
- Investment costs	452.1	212.3	165.2	217.0	185.8	—
- Production costs	—	—	—	—	—	360.9
Total Operation Costs	452.1	212.3	165.2	217.0	185.8	360.9
Cash Flows	-328.8	-188.6	-3.0	-52.5	29.5	314.9

<i>Income particulars</i>	<i>Apple – year of production</i>							
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8-30</i>
<i>Annual Farm Income</i>								
- Principal product income	—	—	—	164.5	—	—	86.2	452.1
- Intermediary income	206.1	23.7	215.3	37.2	—	—	—	—
Total Farm Income	206.1	23.7	123.3	164.5	23.7	215.3	223.4	452.1
<i>Annual Costs</i>								
- Investment costs	293.1	130.9	133.0	128.3	151.9	152.5	182.0	—
- Production costs	—	—	—	—	—	—	—	299.6
Total Operation Costs	452.1	212.3	165.2	217.0	151.9	152.5	182.0	299.6
Cash Flows	-87.0	-107.2	-9.7	36.2	-128.2	62.8	41.4	152.5

The annual profits (cash flows) were calculated by subtracting the annual costs from annual revenue for a period of 20 years for peach and 30 years for apple (Table 4).

The establishment year is taken as a base and from the following year to the end of economic life was taken as production period. The choice of discount rate is determined by the investor's assumptions about inflation, risk and earning potential of other investments. If a producer is financing the investment internally, then the loan rate would be replaced by the producer's opportunity cost in the computation. Therefore different discount rates (10, 8 and 5%) were used in the study. *NPV* of the period was calculated and given in Table 5.

The *NPV* achieved for each discount rates are 1113.6 \$/da; 1454.7 \$/da; and 2156.2 \$/da, for peach respectively. The *NPV* achieved for each discount rates are 574.2 \$/da; 805.4 \$/da; and 1342.9 \$/da, for apple respectively.

Table 5: Cost–Benefit Ratio according to 10, 8 and 5 % discount rates.

<i>Peach</i>											
Year	Incomes (\$/da)	Costs (\$/da)	Discount rate 10%			Discount rate 8%			Discount rate 5%		
			Discount	Disc.	Disc.	Discount	Disc.	Disc.	Discount	Disc.	Disc.
				Income	Costs		Income	Costs		Income	Costs
			(\$/da)	(\$/da)	(\$/da)	(\$/da)	(\$/da)	(\$/da)	(\$/da)	(\$/da)	(\$/da)
1	123.3	452.1	1	123.3	452.1	1	123.3	452.1	1	123.3	452.1
2	23.7	212.3	0.909	21.6	193.0	0.926	22.0	196.6	0.952	22.6	202.2
3	162.2	165.2	0.826	134.0	136.5	0.857	139.0	141.6	0.907	147.1	149.9
4	164.5	217.0	0.751	123.6	163.0	0.794	130.6	172.3	0.864	142.1	187.5
5	215.3	185.8	0.683	147.1	126.9	0.735	158.2	136.6	0.823	177.1	152.9
6-20	675.8	360.9	5.195	3510.7	1875.2	6.292	4251.7	2270.9	8.539	5770.8	3082.2
Total				4060.3	2946.7		4824.8	3370.1		6383.0	4226.8
NPV					1113.6			1454.7			2156.2
B/C					1.38			1.43			1.51
IRR											25.05

<i>Apple</i>											
Year	Incomes (\$/da)	Costs (\$/da)	Discount rate 10%			Discount rate 8%			Discount rate 5%		
			Discount	Disc.	Disc.	Discount	Disc.	Disc.	Discount	Disc.	Disc.
				Income	Costs		Income	Costs		Income	Costs
			(\$/da)	(\$/da)	(\$/da)	(\$/da)	(\$/da)	(\$/da)	(\$/da)	(\$/da)	(\$/da)
1	206.1	293.1	1	206.1	293.1	1	206.1	293.1	1	206.1	293.1
2	23.7	130.9	0.909	21.6	119.0	0.926	21.9	121.2	0.952	22.6	124.7
3	123.3	133.0	0.826	101.9	109.9	0.857	105.7	114.0	0.907	111.8	120.6
4	164.5	128.3	0.751	123.6	96.4	0.794	130.6	101.8	0.864	142.1	110.8
5	23.7	151.9	0.683	16.2	103.8	0.735	17.4	111.7	0.823	19.5	125.0
6	215.3	152.5	0.621	133.7	94.7	0.681	146.5	103.8	0.784	168.7	119.5
7	223.4	182	0.564	126.1	102.7	0.630	140.8	114.7	0.746	166.7	135.8
8-30	452.1	299.6	5.014	2266.9	1502.3	6.536	2954.7	1958.0	10.065	4550.5	3015.6
Total				2996.1	2421.9		3723.7	2918.3		5388.0	4045.1
NPV					574.2			805.4			1342.9
B/C					1.23			1.27			1.33
IRR											22.12

CBR is calculated by dividing the total discounted incomes by the total discounted costs. The *CBR* in all the three discount rates is greater than 1 for peach and apple (Table 5). This means that the producer has a positive return in the production of peach and apple.

Internal rates of return (*IRR*) are given in Table 5. *IRR* was found as 25.05 percent for peach and 22.12 percent for apple, which are greater than the interest rate of capital. This means that the farmers were making more than two times of capital interest in the peach and apple production. Also the *IRR* was more than two times *IRR* (10.78%) AKÇAY and UZUNÖZ (2005) found for peach in Amasya in Middle Blacksea Region.

In the sensitivity analysis, three different *NPV*, *CBR* and *IRR* were found under the three different assumptions. When a 10 percent total cost overrun and 10 percent reduction of product price were assumed (Table 6), the *IRR*'s for peach decreased from

25.05 percent to 22.70 and 20.21 percent, respectively and the *IRR*'s for apple decreased from 22.12 percent to 16.25 and 15.57 percent, respectively. The results showed that the *IRR*'s for peach and apple are greater than the interest rate of capital.

In the light of the findings determined from the present study, it can be concluded that peach and apple farming can be one of the most important income sources for the fruit farmers of rural provinces of Tokat-Turkey.

Table 6: Sensitivity Analysis

<i>Peach</i>			
Assuming 10 percent higher total cost			
Discounted Rate (%)	10	8	5
<i>NPV</i> (\$)	819.3	1118.2	1735.0
<i>CBR</i>	1.25	1.30	1.37
<i>IRR</i> (%)	20.70		
Assuming 10 percent lower price of product			
Discounted Rate (%)	10	8	5
<i>NPV</i> (\$)	707.9	972.7	1518.5
<i>CBR</i>	1.24	1.29	1.35
<i>IRR</i> (%)	20.21		
<i>Apple</i>			
Assuming 10 percent higher total cost			
Discounted Rate (%)	10	8	5
<i>NPV</i> (\$)	331.8	513.2	937.8
<i>CBR</i>	1.12	1.16	1.21
<i>IRR</i> (%)	16.25		
Assuming 10 percent lower price of product			
Discounted Rate (%)	10	8	5
<i>NPV</i> (\$)	274.4	432.7	803.6
<i>CBR</i>	1.11	1.15	1.19
<i>IRR</i> (%)	15.57		

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