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An Investment Analysis of Peach and Cherry Growing in Turkey

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Abstract: This study was conducted to determine profitability and feasibility of fruit farms by investment analysis in Amasya, 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 cherry. The NPV for peach were found to be positive (32.0, 131.7 and 340.5 \$/da). Also the NPV for cherry were found to be positive (3573.1, 4453.4 and 6327.5 \$/da). In addition to that, the CBR for peach were bigger than 1 (1.01, 1.03 and 1.07) and the CBR for cherry were bigger than 1 (1.89, 1.94 and 2.03). The IRR for peach was 10.78% and 47.13 for cherry. According to the results that 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 especially cherry of research region in Turkey.

Key words: Fruit, investment analysis, Net Present Value, Internal Rate of Return, sensitivity analysis

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 cherry can be grown in various region of Turkey^[1-3]. They are widely grown in Amasya province in Middle Blacksea Region and cover 48.93% 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^[4]. 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 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 was to analyze the feasibility and profitability of investment in fruit farms.

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 25 years for cherry. Establishment period for peach and cherry are 5 and 4 years, respectively. The profit was calculated and compared with real interest rate to find opportunity cost of enterprise.

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 Net Present Value (NPV) model is the appropriate procedure to evaluate investment decisions^[5]. The NPV is the total present value of future revenue and cost of an activity^[6]. The NPV was calculated by the formula $NPV = FV / (1 + i)^n$ ^[7] where, FV is the future value of money, *i* is the interest or discount rate and *n* is the number of years.

Among the measures of investment returns over time, NPV offers the better measure of project worth^[8].

The CBR is the ratio obtained when the present worth of the benefit stream is divided by the present worth of the cost stream^[9] and can be obtained as follows^[10]:

$$CBR = \frac{\sum R_t / q^t}{\sum C_t / q^t}, t = 0, \dots, n$$

where, R is the total revenue, C is the total cost, *i* is interest rate and *n* is the number of years and $q^t = (1+i)^t$.

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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 is a useful measure of project worth^[9] and helps to determine the relative profitability of an investment^[7]. IRR is discounted rate, which makes Net Cash Flows of the economic life of project zero^[11]. The IRR formula is as follows:

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

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^[12].

RESULTS AND DISCUSSION

Establishment cost is an investment that takes time to pay off^[13]. The establishment costs of peach and cherry production are given in Table 1.

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

Items	Peach (Years)				
	1st	2nd	3th	4th	5th
Soil preparing and planting	64.3	---	---	---	---
Maintenance	36.5	53.5	56.1	98.7	118.1
Harvesting-transporting	---	---	5.2	14.4	61.0
Various inputs (a)	229.2	42.1	31.2	21.4	25.5
Other expenses (5%) (b)	16.5	4.8	4.7	6.7	10.2
Total variable costs	346.5	100.4	97.2	141.3	214.8
Capital interest (10%) (c)	34.7	10.0	9.8	14.1	21.5
Land rent	79.8	79.8	79.8	79.8	79.8
Management cost (3%) (d)	10.3	3.0	2.9	4.5	6.5
Total fixed costs	124.8	92.9	92.5	98.4	107.8
Total	471.3	193.3	189.7	239.7	322.6
Items	Cherry (Years)				
	1st	2nd	3th	4th	5th
Soil preparing and planting	58.4	---	---	---	---
Maintenance	32.7	52.7	54.6	54.9	---
Harvesting-transporting	231.6	54.8	35.3	21.8	---
Various inputs (a)	---	---	---	59.2	---
Other expenses (5%) (b)	16.1	5.4	4.5	6.8	---
Total variable costs	338.8	112.9	94.4	142.7	---
Capital interest (10%) (c)	33.9	11.29	9.4	14.3	---
Land rent	79.6	79.5	79.6	79.5	---
Management cost (3%) (d)	10.2	3.39	2.8	4.3	---
Total fixed costs	123.6	94.3	91.8	98.1	---
Total	462.4	207.2	186.2	240.8	---

(a) Cover pesticide, fertilizer, irrigation and labor costs, (b) The unexpected costs (transaction cost, transportation cost, labor and etc.), which occur during establishment period^[4], (c) The interest rate of capital is 10% of total fixed establishment^[13], (d) Management cost is taken as 3% of total establishment cost^[16].

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

Items	(Peach) (6-20 Years)		(Cherry) (5-25 Years)	
	(\$/da)	%	(\$/da)	%
Variable costs				
Maintenance	182.1	40.7	85.2	17.9
Harvesting-transporting	86.5	19.3	224.8	47.2
Various inputs	35.7	8.0	32.2	6.8
Other expenses (5%)	15.2	3.4	17.1	3.6
Total variable costs (1)	319.5	71.4	359.3	75.5
Fixed costs				
Capital interest (10%)	31.9	7.1	35.9	7.6
Management (3%) (*)	16.4	3.7	1.1	0.2
Land rent	79.9	17.8	79.6	16.7
Total fixed costs (2)	128.2	28.6	116.6	24.5
Total production costs (1+2=3)	447.7	100.0	475.9	100.0

(*) Management cost is 3% of gross production value

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

Income particulars	Peach (Years)					
	1st	2nd	3th	4th	5th	6-20
Principal product income	---	---	22.3	122.9	312.6	548.6
Intermediary income	253.1	127.2	23.1	---	---	---
Total	253.1	127.2	45.4	122.9	312.6	548.6
Income particulars	Cherry (Years)					
	1st	2nd	3th	4th	5-20	
Principal product income	---	---	---	207.2	1109.2	
Intermediary income	127.2	146.3	111.2	---	---	
Total	127.2	146.3	111.2	207.2	1109.2	

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

	Peach (Years)					
	1st	2nd	3th	4th	5th	6-20
Annual farm income						
-Principal product income	---	---	22.3	122.9	312.6	548.6
-Intermediary income	253.1	127.2	23.1	---	---	---
Total farm income	253.1	127.2	45.4	122.9	312.6	548.6
Annual costs						
-Establishment costs	471.3	193.3	189.7	239.7	322.6	---
-Production costs	---	---	---	---	---	447.7
Total operation costs	471.3	193.3	189.7	239.7	322.6	447.7
Cash flows	-218.2	-66.1	-144.3	-116.8	-10.0	100.9
	Cherry (Years)					
	1st	2nd	3th	4th	5-20	
Annual farm income						
-Principal product income	1109.2	---	---	207.2	---	---
-Intermediary income	127.2	146.3	111.2	1109.2	---	---
Total farm income	127.2	146.3	111.2	207.2	1109.2	
Annual costs						
-Establishment costs	462.4	207.2	186.2	240.8	---	---
-Production costs	---	---	---	---	---	475.9
Total operation costs	462.4	207.2	186.2	240.8	---	475.9
Cash flows	-335.2	-60.9	-75.0	-33.6	---	633.3

As it can be seen from Table 2, the variable costs have a share of 71.4% for peach and 75.5% for cherry in total production cost. With a 40.7%, maintenance has the biggest share for peach and with a 47.2%, harvesting-transporting for cherry 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 5: Cost-benefit ratio according to 10, 8 and 5 discount rates

Peach											
Years	Incomes (\$/da)	Costs (\$/da)	Disc rate (10%)	Disc income (\$/da)	Discount costs (\$/da)	Disc rate (8%)	Disc income (\$/da)	Discount costs (\$/da)	Disc rate (5%)	Disc income (\$/da)	Discount costs (\$/da)
1	253.1	471.3	1.000	253.1	471.30	1.000	253.1	471.30	1.000	253.1	471.30
2	127.2	193.3	0.909	115.6	175.70	0.926	117.8	179.00	0.952	121.1	184.10
3	45.4	189.7	0.826	37.6	156.90	0.857	38.9	162.60	0.907	41.1	172.10
4	122.9	239.7	0.751	92.3	180.10	0.794	97.6	190.30	0.864	106.2	207.10
5	312.6	322.7	0.683	213.5	220.30	0.735	229.8	237.10	0.823	257.1	265.40
6-20	548.6	447.7	5.195	2850.0	2325.80	6.292	3451.5	2816.70	8.539	4684.9	3823.00
Total				3562.1	3530.10		4188.7	4057.00		5463.5	5123.00
NPV					32.00			131.70			340.50
B/C					1.01			1.03			1.07
IRR							10.780				

Cherry											
Years	Incomes (\$/da)	Costs (\$/da)	Disc rate (10%)	Disc income (\$/da)	Discount costs (\$/da)	Disc rate (8%)	Disc income (\$/da)	Discount costs (\$/da)	Disc rate (5%)	Disc income (\$/da)	Discount costs (\$/da)
1	127.2	462.4	1.000	127.20	462.40	1.000	127.2	462.40	1.000	127.2	462.40
2	146.3	207.2	0.909	133.00	188.40	0.926	135.5	191.90	0.952	139.3	197.30
3	111.2	186.2	0.826	91.90	153.90	0.857	95.3	159.60	0.907	100.9	168.90
4	207.2	240.8	0.751	155.70	180.90	0.794	164.5	191.20	0.864	179.0	208.00
5-25	1109.2	475.9	6.396	7094.90	3044.00	7.794	8645.1	3709.10	10.765	11940.9	5123.20
Total				7602.70	4029.60		9167.6	4714.20		12487.3	6159.80
NPV					3573.10			4453.40			6327.50
B/C					1.89			1.94			2.03
IRR							47.13				

Table 6: Sensitivity analysis

Peach			
Assuming 10% higher total cost			
Discounted rate (%)	10.00	8.00	5.00
NPV (\$)	-321.00	-274.10	-171.80
CBR	0.92	0.94	0.97
IRR (%)		1.84	
Assuming 10% lower price of product			
Discounted rate (%)	10.00	8.00	5.00
NPV (\$)	-324.20	-287.20	-205.90
CBR	0.91	0.93	0.96
IRR (%)		0.71	

Cherry			
Assuming 10% higher total cost			
Discounted rate (%)	10.00	8.00	5.00
NPV (\$)	3170.10	3981.90	5711.40
CBR	1.72	1.77	1.84
IRR (%)		44.50	
Assuming 10% lower price of product			
Discounted rate (%)	10.00	8.00	5.00
NPV (\$)	2812.80	3536.60	5078.70
CBR	1.70	1.75	1.82
IRR (%)		44.50	

The annual profits (cash flows) were calculated by subtracting the annual costs from annual revenue for a period of 20 years for peach and 25 years for cherry (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 32.0, 131.7 and 340.5 \$/da, for peach, respectively. The NPV achieved for each discount rates are 3573.1, 4453.4 and 6327.5 \$/da, for cherry, respectively.

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 cherry (Table 5). This means that the producer has a positive return in the production of peach and cherry.

IRR was found as 10.78% for peach and 47.13% for cherry, which are greater than the interest rate of capital. This means that the farmers were making more than four times of capital interest in the cherry production.

In the sensitivity analysis, tree different NPV, CBR and IRR were found under the three different assumptions. When a 10% total cost overrun and 10% reduction of product price were assumed (Table 6), the IRR's for peach decreased from 10.78% to 1.84 and 0.71%, respectively and the IRR's for cherry decreased from 47.13% to 44.5 and 44.5%, respectively. The results showed that the IRR's for cherry are greater than the interest rate of capital.

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

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