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ECONOMIC ANALYSIS OF ALMOND PRODUCTION: A CASE STUDY OF MUGLA PROVİNCE, TURKEY

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Abstract

The purpose of the study was to carry out an economic analysis of almond production in the province of Muğla which holds an important place in Turkey with regard to almond production. The primary material of the study was comprised of original data acquired from almond producers in the Muğla province via questionnaire method. Neyman Method from among the stratified sampling methods was used for determining the number of producers to take part in the questionnaire. The number of samples to represent the population was determined as 93 according to the Neyman method. The sample farms were classified into three groups and analyses were carried out. These groups were determined according to land size as; Group I (1-10 da; 41 farms), Group II (11-20 da; 24 farms) and Group III (>20 da; 28 farms). It was calculated according to the study results that the average almond land size varies between 3.93 da and 39.06 da subject to farm groups with an average of 17.05 da. The establishment costs for almond production was determined in total as 1,089.20 $/da. Of the establishment costs, variable costs made up 65.57 % and fixed costs made up 34.43 % of the total. It was determined that the total production costs per decare in farms decreases with increasing size. Production costs per decare were calculated as 301.98 $, 260.03 $ and 227.57 $ respectively for Groups I, II and III. It was also determined that the gross profit, net profit and relative return per decare in farm groups increase with increasing farm groups. Indeed, the gross profit values per decare were determined as 319.51 $, 404.33 $ and 455.28$ respectively for Groups I, II and III, whereas the net profit values per decare were determined respectively as 218.51 $/da, 304.55 $/da and 356.45 $/da and relative return values were determined respectively as 1.72, 2.17 and 2.57. It was determined based on these indicators that the producers in the larger group are more profitable in comparison with the producers in the smaller group.

Key words: *almond, production cost, profitability*

NTRODUCTION

Almond has first been produced in Iran, Turkey, Syria and Palestine from where it was taken over to Greece, Northern Africa, Italy and Spain followed later by Northern America where significant advancements in almond production took place especially in California after 1940 [9]. Almond is used in the nut, candy, chocolate and cake industry whereas almond oil is used in the cosmetic and pharmaceuticals industries [15]. Almond holds an important place in human nutrition due to its high nutrient value and can be produced in almost all parts of the world [11]. Almond production and consumption is increasing every day due to its fat and rich mineral and vitamin content which are beneficial for human health [1,5]. Almond is among the most important nuts which have adapted to the climate of Turkey. Since seeds are used for almond production in Turkey, there is a wide range of gene potential. The current gene potential has been enriched even more with the importing of standard varieties in recent years. Even though Turkey is among the gene centers of almond, it cannot be produced economically at regions with late spring frosts since it is a fruit with very little chilling requirement. Thus, studies on late flowering almond varieties have gained attention in Turkey as is the case all over the world [9]. Almond can be produced in all regions of Turkey except the coastal regions of Eastern Black Sea and plains at very high elevations. Almond production is centered mostly in the Aegean Region of Turkey followed by the Mediterranean, Central

Anatolian and Marmara Regions. The Aegean, Mediterranean and Marmara Regions cover two thirds of the whole almond production in Turkey [7].

Almond production in the world is 3,214,303 tons. USA is the leader in the world for almond production with a share of 62.31%. Turkey takes up a share of about 2.64 % in the worldwide almond production with a production of about 85,000 tons [4]. The province of Muğla where the study is carried out has a share of about 11 % ranking 3rd after Mersin and Antalya [13].

The purpose of this study was to carry out an economic analysis for almond production in the city of Muğla which has a significant potential for almond production. For this purpose, the general features of almond producers according to different farm groups such as population, education, age, experience, average land size as well as activity results such as inputs and costs for the establishment and production period, gross product value, gross profit, net profit and relative return will be determined and these results will be compared according to farm groups. Studies in Turkey have mostly focused on the technical aspect of almond production. The number of studies examining almond production economically has remained limited. It is hoped that the findings acquired from the present study will be beneficial for almond producers, researchers and related institutions.

MATERIALS AND METHODS

The main material of the study was comprised of original data collected via survey method from almond producer farms in the districts of Datça, Marmaris, Fethiye and Seydikemer located in the province of Muğla. In addition to primary data, similar studies carried out by related individuals and institutions, statistics and reports have also been used. The data cover the 2015 production season.

District centers of Datça, Marmaris, Fethiye and Seydikemer along with 22 villages in these districts were selected as the study area where almond production is carried out intensively based on information acquired from the technical staff of Muğla Provincial Directorate of Food, Agriculture and Livestock as well as related records. All farms in these districts and villages that are suited to the purpose of the present study make up the population of the study. The districts selected as the study area make up about 72% of the total almond production in the Muğla province [13]. Hence, it can be stated that the study region has the required features for representing the almond producer farms in the Muğla province.

Neyman Method from among the stratified sampling methods was used for determining the number of samples to be included in the questionnaire [16]. The number of samples was calculated using Equation 1.

$$n = \frac{(\sum Nh\ Sh)^2}{N^2\ D^2 + \sum Nh\ Sh^2} \quad (1)$$

Here:
n: Number of samples
N: Total number of units in the population ı
Nh : Number of units in group h
Sh: Standard deviation of group h
Sh^2: Variance of group h
D^2: d^2 / z^2
d^2: Allowed error from the population average (5 % deviation from the average)
z^2: The value in the distribution table for the allowed confidence interval (A confidence interval of 95 % was predicted in the study).

The number of samples to represent the main population was calculated as 93 using Equation 1 (Table 1). The farms to be included in the questionnaire will be selected randomly. Since the almond lands of the farms differ significantly, it was decided to examine the almond farms by classifying them into different groups in order to attain population homogeneity. The almond producers were thus classified into three groups according to frequency distribution taking into consideration their land sizes. Equation 2 was used for the classification of the farms into groups [16].

$$n_h = \frac{N_h S_h}{\sum N_h S_h} * n \quad (2)$$

where:
n_h: the number of samples selected for each group
n: total number of samples.

Accordingly; farms with a land size of 1-10 decares (41 farms) were classified as Group I, farms with a land size of 11-20 decares (24 farms) were classified as Group II and farms with a land size of >20 decares (28 farms) were classified as Group III. Questionnaire data were analyzed using package software such as Microsoft Excel and SPSS.
Foreign labor wages in the study area were taken as basis for calculating the family labor wage equivalent. Unit machinery rental fees were taken as basis for calculating the machinery expenses in the study. General administrative costs were calculated as 3% of the total variable costs. Revolving fund interest was calculated by applying half of the current interest rate applied by T.C. Ziraat Bank on plant production credits. Bare land value interest was calculated by taking 5% of the bare land value in the study area. Establishment costs annual depreciation share was calculated by dividing the total establishment costs made during the establishment period (4 years) to the economic life of the almond establishment (50 years). Whereas establishment capital interest was applied as 5% to half of the total establishment costs [8]. Gross profit, net profit and relative return calculations were made to put forth the profitability of almond production. Gross profit was calculated by subtracting the variable costs from the gross production value. Net profit was calculated by subtracting the production expenses from the gross production value. Whereas relative return was calculated by dividing the gross production value to the production costs [10].

RESULTS AND DISCUSSIONS

Table 2 shows the producer features. There were no significant differences between the average age, agricultural experience and experience in almond production of the producers. It was determined based on the average of all farmer groups that the average age of the producers is 57.70 years, agricultural experience average was 39.36 years and experience in almond production average was 37.63 years. Almond land size of the producers was calculated according to the farm groups as varying between 3.93 da and 39.06 da with an average value of 17.05 da. Family population was highest in Group I (3.43 person/family) and lowest in Group III (2.92 person/family). Cooperative membership ratio was highest in Group III (53.57 %) and lowest in Group I (43.90 %). Involvement in farmer registration system was observed to be highest in Group II (62.50 %) and lowest in Group I (39.02 %). It was determined that the producers generally have social security. The ratio of producers with social security was calculated based on the average of all farms as 96.42 %.
Table 3 shows the education levels of the producers. It was determined that majority of the producers are primary school graduates in all groups. The ratios of primary school graduate producers were determined for Groups I, II and III as 68.29 %, 62.50 % and 50 % respectively. The ratio of university graduate producers was determined to be low in all groups. The ratio of university graduate producers based on the average of all farm groups was calculated as 4.30 %.
Table 4 presents the ratio of producers that produce different almond varieties. It was determined that the producers in the study area produce 9 different almond varieties. However, the ratios of producers that produce these almond varieties are different. It was determined that almost all of the producers in especially Groups II and III are producing Nurlu and Ak almond varieties, whereas it was also determined that the producers in Group I have not focused on a certain variety.

Table 1. Distribution of farms by farm groups and number of sample farms for each group

Farm groups (da)	Number of farms (Nh)	Standard deviation (Sh)	Variance $(Sh)^2$	(Nh)*(Sh)	$(Nh)*(Sh)^2$	Number of sample farms (n)
1-10	379	2.32	5.40	880.45	2,045.38	41
11-20	167	3.03	9.19	506.28	1,534.85	24
21+	119	4.95	24.52	589.23	2,917.62	28
Total	665	10.3	39.11	1,975.96	6,497.85	93

Source: Own calculation.

Table 2. Producers' features

Features	Farm groups			Average
	I	II	III	
Age (year)	58.15	57.25	57.43	57.70
Agricultural experience (year)	40.07	37.63	39.79	39.36
Experience in almond production (year)	38.78	35.33	37.93	37.63
Almond land size (da)	3.93	13.77	39.06	17.05
Population (person/family)	3.43	4.14	2.92	3.46
Membership of cooperative (%)	43.90	37.50	53.57	45.16
Involvement in farmer registration system (%)	39.02	62.50	42.85	46.24
Ratio of producers with social security (%)	97.56	87.50	96.43	94.62

Source: Own calculation.

Table 3. Producers' education level

Education level	Farm groups (da)						Total	
	I		II		III			
	N	%	N	%	N	%	N	%
Primary school	28	68.29	15	62.50	14	50.00	57	61.29
Secondary school	8	19.51	4	16.67	5	17.86	17	18.27
High school	5	12.20	4	16.67	6	21.43	15	16.13
University	-	-	1	4.16	3	10.71	4	4.30
Total	41	100.00	24	100.00	28	100.00	93	100.00

Source: Own calculation.

Table 4. Different almond varieties and usage rates in farms (%) *

Almond varieties	Farm groups (da)			Average
	I	II	III	
Nurlu	34.15	100.00	96.43	69.89
Ak	39.02	100.00	100.00	73.12
Sıra	14.63	12.50	14.29	13.98
Diş bademi	7.32	4.17	7.14	6.45
Kababağ	14.63	29.17	32.14	23.66
Rüştü	17.07	45.83	39.29	31.18
Hacıeli	7.32	4.17	7.14	6.45
Haşmet	4.88	4.17	7.14	5.38
Carmel fıstık badem	12.20	4.17	7.14	8.60

*percentages are higher than 100 because of multiple choice
Source: Own calculation.

It was observed that the ratios of producers producing Nurlu and Ak almond varieties in Group I are 34.15 % and 39.02 % respectively.

Since almond is a perennial plant, costs were calculated for two different periods. These are the establishment and production periods. Costs were calculated first for the establishment period (4 years) after which the costs were calculated for the production period once yield is attained. Table 5 presents the costs and distributions for the expenses of

producers related with the establishment period. As can be seen in the Table, total almond establishment cost was determined as 1,089.20 $/da. It was determined that 65.57 % of the total establishment costs make up the variable costs and that 34.43 % make up the fixed costs. It can be observed upon examining the establishment period costs that the costs during the first year are higher in comparison with the other years. This is due to the higher costs involved in the sapling and planting costs during the first year.

Almond production costs were analyzed by classifying the costs as fixed and variable. Variable costs are those that increase or decrease subject to the production volume. These expenses emerge at the time of production and vary subject to the amount of production. Whereas fixed costs are those that do not vary with production volume which are always present regardless of whether production is made or not [6]. Almond production cost items and their ratios are presented in Table 6. As can be seen in the table, it was determined that total production cost per decare in the farms decrease with increasing group size. Production costs per decare were calculated for Groups I, II and III as 301.98 $, 260.03 $ and 227.57 $ respectively. It was determined that variable costs make up a significant portion of the total production costs in all farm groups. The shares of variable costs in total production costs were calculated for Groups I, II and III as 65.55 %, 61.63% and 56.57 % respectively. It was determined that the share of the variable costs in total production costs decrease with increasing farm groups and that the share of the fixed costs increase. Variable costs in almond production are comprised of fertilizers and fertilization, deep plowing, hoeing, pruning, harvest and fruit thinning and revolving fund interest while fixed costs are comprised of administrative costs, land rent, establishment depreciation and establishment capital interest. Beigi *et al.* (2016) [2] carried out a study in which it was reported that the total cost of production was \$4,547.54, \$5,799.26 and \$5,687.05 ha^{-1} in the three orchard groups (6–10 years old: Group I, 11–15 years old: Group II and 15–20 years old: Group III) respectively. It was revealed that variable expenditure share in Groups I and III was slightly higher than fixed expenditure share, where the fixed and variable expenditure shares for Group II are 49.85 % (\$2,890.86 ha^{-1}) and 50.15 % (\$2,924.36 ha^{-1}), respectively.

Table 7 shows the income of almond producers from almond production. The producers market a certain amount of the almond as green and the remainder as dried almond. It was determined that the gross product value increases with increasing farm size. Gross product value per decare was determined for Groups I, II and III as 520.49 $, 564.57 $ and 584.02 $ respectively. It was determined that the green almond and dried almond have similar shares in total gross product value in Group I, whereas it was also determined that the shares of dried almond in Groups II and III are higher.

Gross profit is a success indicator for determining the competitive power of production activities with regard to the use of scarce production factors in a farm. In other words, it is a significant criterion that puts forth the success of a farm organization [3]. Table 8 shows the gross, net profit and relative return per decare according to farm size groups in the study region. As can be seen in the table, gross profit increases with increasing farm size groups. Indeed, gross profit per decare was determined for Groups I, II and III as 319.51 $, 404.33 $ and 455.28$ respectively. Net profit is another success criteria used for comparing business activities. Gross profit includes fixed costs, however there is no expense element included in the net profit. As was the case for gross profit, net profit was also determined to increase with increasing farm size. Net profit values were calculated for Groups I, II and III as 218.51 $/da, 304.55 $/da and 356.45 $/da respectively. Tariq (2011) [12] carried out a study in which it was reported that the almond production was profitable and economically. It was reported that since, almond is proven to be economically profitable, new areas suitable may be brought into almond cultivation

orchards by providing bank loans at a cheaper rate of interest. Relative return corresponds to the profit from a unit cost. It was determined as a result of the calculations made that relative return increases with increasing farm group size as is the case for other profitability indicators. Relative return values were determined as 1.72 for Group I, 2.17 for Group II and 2.57 for Group III. Accordingly, it was determined that the producers in large groups are more advantageous with regard to economic criteria in comparison with producers in small groups. Ukav (2017) [14] carried out a study in which almond production relative return was determined as 2.54. In a study conducted by Beigi et al. (2016) [2] the average benefit to cost ratio from the almond production in the studied region was calculated to be 5.10, with a minimum value of 4.19 (for Group I) and a maximum value of 6.30 (for Group II), which means that almond production was a profitable operation in Iran.

Table 5. Almond establishment costs in farms

Years	Variable costs ($/da)	%	Fixed cost ($/da)	%	Total costs ($/da)	%
1. year	305.67	78.10	85.69	21.90	391.36	100.00
2.year	134.03	56.90	101.53	43.10	235.56	100.00
3.year	136.15	59.16	93.99	40.84	230.14	100.00
4.year	138.36	59.60	93.78	40.40	232.14	100.00
Total	714.22	65.57	374.98	34.43	1089.20	100.00

Source: Own calculation

Table 6. Production costs in farms

Cost items	Farm groups (da)						Average	
	I		II		III			
	$/da	%	$/da	%	$/da	%	$/da	%
Fertilizers and fertilization	31.57	10.45	30.43	11.70	25.51	11.21	29.45	10.96
Deep plowing	25.14	8.33	30.51	11.73	33.63	14.78	29.08	10.82
Hoeing	10.00	3.31	10.29	3.96	6.29	2.76	8.96	3.33
Pruning	30.65	10.15	20.87	8.02	13.14	5.77	22.85	8.50
Harvest	47.82	15.84	38.87	14.95	23.06	10.13	38.06	14.16
Fruit thinning	48.07	15.92	23.11	8.89	22.16	9.74	33.83	12.59
Revolving fund interest	7.73	2.56	6.16	2.37	4.95	2.18	6.49	2.41
A. Total variable costs (A)	200.98	66.55	160.25	61.63	128.74	56.57	168.72	62.78
Administrative costs (A*0.03)	6.03	2.00	4.81	1.85	3.86	1.70	5.06	1.88
Land rent	45.96	15.22	45.96	17.67	45.96	20.19	45.96	17.10
Establishment depreciation	21.78	7.21	21.78	8.38	21.78	9.57	21.78	8.11
Establishment capital interest	27.23	9.02	27.23	10.47	27.23	11.97	27.23	10.13
B. Total fixed costs (B)	101.00	33.45	99.78	38.37	98.83	43.43	100.03	37.22
C. Total production costs (A+B)	301.98	100.00	260.03	100.00	227.57	100.00	268.75	100.00

Source: Own calculation

Table 7. Gross product value in farms

Income items	Farm groups (da)						Average	
	I		II		III			
	$/da	%	$/da	%	$/da	%	$/da	%
Green almond	267.29	51.35	227.50	40.30	247.73	42.42	251.13	45.58
Dried almond	253.20	48.65	337.07	59.70	336.29	57.58	299.86	54.42
Gross product value	520.49	100.00	564.57	100.00	584.02	100.00	550.99	100.00

Source: Own calculation.

Table 8. Profitability indicators in farms

Profitability indicators	Farm groups (da)			Average
	I	II	III	
Gross product value ($/da)	520.49	564.57	584.02	550.99
Variable cost ($/da)	200.98	160.25	128.74	168.72
Production costs ($/da)	301.98	260.03	227.57	268.75
Gross profit ($/da)	319.51	404.33	455.28	382.28
Net profit ($/da)	218.51	304.55	356.45	282.24
Relative return	1.72	2.17	2.57	2.05

Source: Own calculation.

CONCLUSIONS

The average age of the producers was calculated as 57.70 years, whereas their almond production experience duration is 37.63 years and that the population is 3.46 people.

The cooperative membership ratio was determined to be higher in larger companies. It was determined that majority of the producers are primary school graduates. It was determined that production expenses per decare increases and that gross profit, net profit and relative return have increased. The share of the variable expenses in total production costs was determined as 32.78% whereas the share of the fixed costs was determined as 37.22 %.

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