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Full Length Research Paper

Calculation of peanut production cost and functional analysis in Osmaniye Province of Turkey

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The aim of this study is to determine the physical input quantity used in peanut production and unit cost, and to make the functional analysis of the aforementioned production in the farms of Osmaniye province. The data used in the study belongs to 2009 growing season and they are collected by finite population sampling method from 44 farms in the 27 villages of 6 counties in Osmaniye province. The inputs used per decare in peanut production are determined as follows respectively: 1 h male labor force, 0.54 h tractor traction, 8.60 kg seed, 21.40 fertilizer and 0.25 kg pesticide in averages. 1 kg peanut cost is 1.10 TL in 2009 prices. The $Y = 1.069X_1^{-0.315}X_2^{0.441}X_3^{0.701}X_4^{-0.441}X_5^{-0.947}X_6^{0.204}X_7^{-1.656}$ function is determined by using Cobb-Douglas production function analysis between production and inputs used. Multiple correlation coefficient (R^2) is 0.578. The sum of production elasticities for production function is $\sum b_i = -2.013$.

Key words: Turkey, peanut, cost, Cobb-Douglas production function.

INTRODUCTION

The peanut which is important for oil and food is the fourth oil seed crop mostly produced in the world after soybean, rape seed and cotton seed (FAS, 2010).

The peanut production for Osmaniye province is important because Osmaniye provides the most of the Turkey's peanut production. With regard to the agricultural structure in Turkey and so Osmaniye, production factors are not used in a proportional level because of small farms, their financial difficulties and their being not innovative due to their lacking in training, so production costs are high (Günaydin, 2006). Production and incomes of farmers will increase with using the most proper amount of inputs. Therefore, the studies which create models that show how to apply inputs in agriculture are required. The income and cost analyses are important in terms of producers and Turkish economy. Farmer has to know what the production activities he has to make will be if he continue to produce. The positive and satisfactory level of income as a result of cost analysis shed light on the decisions taken by the Government in addition to great benefits to producers (Erkuş et.al., 1996). The aim of this study is to determine the level of physical input quantity used in peanut production in Osmaniye province, the effects of several factors on production quantity and the unit cost of peanut production.

MATERIALS AND METHODS

The 44 surveys made with the peanut producers in Osmaniye province are the main material of the study. The information about promoting the study area in terms of its social and economical aspects and about peanut producing farms are collected from public institutions in the region.

Moreover, the publications and web pages of Turkey Statistics Institute (TUIK), The Ministry of Agriculture and Rural Affairs (MARA), Agricultural Economics Research Institute and General Directorate of Meteorology were used in the research. The books, journals, statistics and reports of national and international research institutions were the other sources of the research. Because there is no accounting records kept in Turkish farms, it was compulsory to make use of the data from farm surveys.

The data is collected from the peanut producing farms by using surveys. The data collected from the said farms are for 2009. The survey forms are filled by farmers face to face in August of 2009.

In sampling period, the agriculture provincial directorate data in study area are evaluated. The total for 935 farms from 27 villages in 6 counties are selected as the main population.

All farmers who grow peanuts were considered in the determination of the main population. A frequency distribution table was arranged according to the width of peanut planting area in the main framework table prepared for this purpose. Farmers frequency distribution graph showed a distribution close to normal distribution.

Table 1. The coefficients used in family labor transforming into the MLU (Erkuş et al., 1995).

Age Groups	Coefficients	
	Male	Female
7-14	0.50	0.50
15-64	1.00	0.75
65- +	0.75	0.50

Table 2. Land ownership of farm land.

Land Ownership	Land size (da)	The Land size ratio with farm land (%)
Own land	83.87	61.06
The Land Rented	28.23	20.55
The land Taken as a Sharecropper	25.26	18.39
The land given as rent or sharecropper	-	-
Farm Land [(1+2+3)-4]	137.36	100

The farm numbers to be sampled are determined by the finite population formula given below (Newbold, 1995).

$$n = \frac{N(1-p)}{(N-1)\sigma_{p_x}^{2} + p(1-p)}$$

n= sample size, p= the ratio of the characteristic of the sample on which is worked with population, $\sigma_{p_x}^{2}$ = Ratio variance, N= Population

In sampling the 90% confidence interval is used, margin of error 0.1 and p=0.5. Sample volume is found out as 44 farms. Just for the sake of considering the unavailable farmers in their farms, 25% farms are selected as the substitutes. The data collected by survey method are recorded on Microsoft Excel program. A part of these data later on are transferred into the SPSS package program for other analyses. The data were analysed and interpreted using different methods.

These methods are depicted below. As socio-economic aspects of labor is considered, for the sake of standardization, the potential of family labor is transformed into the “Male Labor Unit (MLU)”. In doing so, the coefficients that reflect the labor realization for gender and age groups of population are used (Table 1).

Labor costs is calculated by taking into account wages and the working hours for peanut production. The human labor and tractor traction given in cost table show in particular the quantity used in peanut production. Tractor driver labor is added to human labor. All the farms in study area have tractors.

When calculating farm land, the land amount that is rented or taken as sharecropper is added to and the land that is given to rent and is given as a sharecropper is extracted from farmer’s own land (Erkuş et.al., 1995). Tractor and other equipment are used in the production of peanuts. Therefore, requests to traction power of cost-table is given in hours.

Which process was made by which equipment and/or tractor is given in Table 4. based on the situation prevailing in the region. The quantities of the cost items in the peanut production are determined and they are evaluated by the farm prices.

Cobb-Douglas production function is used in functional analysis of peanut production. The reasons using this production function are its complying with the data that is obtained from the production activity, its providing the ease of calculation, the statistical evaluation of the records obtained and its providing enough degree of freedom even if data is less (Heady and Dillon, 1966). The equation of this function for population is:

$$Y = aX_1^{b1} X_2^{b2} X_3^{b3} \ldots\ldots\ldots X_n^{bn}.$$

As logarithms are taken on both sides, the equation of:

$\log Y = \log a + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + \ldots\ldots\ldots\ldots + b_k \log X_k$ is derived.

The b symbols expressed in the equation refer to the production elasticities. Coefficient of determination (R2) was calculated that is the statistical method which explains how much of the variability of a factor can be caused or explained by its relationship to another factor.

“Returns to scale” is also calculated. The sum of b coefficients make “returns to scale” (Karkacier, 2001).

RESULTS

Land ownership and land use

The situation of land ownership is one of the factors that affect the way of working of farms. Land is the main requirement to establish a farm to produce. Land ownership has a significant influence on the productivity of state enterprises. The issues of owned land, rented land or the land that is taken as a sharecropper or the land that is given to rent or given as a sharecropper were examined.

The average operational land is 137.36 acres. 61.06% of the total land is owned land, 20.55% the rented land, 18.39% the land taken as a sharecropper. The surveyed farms did not give land as rent or sharecropper (Table 2). The average land size per farm is 60.9 da in Turkey (TUIK, 2010). The average land size in Osmaniye

Table 3. The population in sample farms.

Age groups	Male	Female	Total	%
0–6	0.17	0.15	0.32	8.06
7–14	0.17	0.19	0.36	9.07
15–49	1.14	1.30	2.44	61.46
50–+	0.48	0.37	0.85	21.41
Total	1.96	2,01	3.97	100,00

province is 2.25 times of Turkey average.

Population and labor

The population in farms forms family labor of relevant farms. Labor is directly relevant to human and a production factor which has social and economical aspects.

The average total population in sample farms is 3.97 people. 49.37% of this population is male and the 50.63% is female. Active population (15 to 49 age) which is the main source of labor force is 61.46% of the total population. 21.41% of the total population is 50 years old or over (Table 3). The average labor force in sample farms is 3.28 male labor unit. The rented labor is used in peanut production besides family labor.

Input supply level and unit cost in peanut production

Sweep, cultivator, harrow in tillage, drill in sowing, fertilizer distributor in fertilizing, pulverizator in sparying, pan machine in irrigation, hoeing machine in hoeing, harvest machine in harvesting and tractor trailer in transportation are widely used in peanut production at sample farms. Soil is tilled 4 times before sowing. Soil is fertilized only one time in the region. Control is made for red spider and green worm. Harvesting machine is used for harvesting and crop is transported by trailer. Average 8.60 kg seed, 21.4 kg fertilizer and 0.25 kg pesticide per decare are used (Budak and Budak, 2001).

1 h male labor force per decare and 0.53 h tractor traction force are demanded in peanut production in sample farms. In a study carried out in the region for cotton production it is determined that 59.65 h labor force and 1.9 h machine force per cotton production area are used (Budak and Budak, 2001). The 61.19% of total labor force in harvesting and the 28.28% of it in hoeing are used. The 6.6 h labor force and 1.45 h machine traction per corn production area are used (Budak and Budak, 2001).

29% of the labor force is used in soil prepearation and 26% in maintenance and 44.74% in harvesting. 34.48% of the labor force in soil prepearation is used in first ploughing, the 17.24% in second ploughing, 20.69% in third ploughing and 10.35% in sowing. 23.08% of 0.26 h labor force demanded for maintenance is used in fertilizing, 38.46% in middle ploughing, 19.23% in spraying. 93.18% of the labor force in harvesting is used in collecting peanuts, 6.82% in transportation. Harvesting and the first ploughing are the labor forces which are most demanded in production process.

The 54.72% of traction power per decare is used in land preperation, the 39.62% in maintenance, the 5.66% in harvesting. The most traction need is for first ploughing and sowing and second ploughing follow that (Table 4). The costs of labor force, tractor traction and material used are seperately calculated for each production process and the interest amount of general administration costs are calculated on total costs (Kiral and Kasnakoğlu, 1999). Production costs are divided into the peanut production quantity and then peanut unit cost is found. Total cost of peanut production per decare is 420.7 TL. Operation costs which are 94.51of the total costs is the highest of all costs. The yield of peanut in sample farms was 383.8 kg/da. As a result, 1 kg peanuts production cost was 1.10 TL (Table 4).

The functional analysis of production of the sample farms

Total output (Y) is chosen as dependent variable in determining the relationship between the inputs used in peanut production and production amount (Zoral 1973, 1984; Gündoğmuş, 1998; Edwin and Lehman,1970). Total output is depicted as kilogram(kg). The independent variables in model are as follow:

X_1= Labor used(Igs)
Human labor is depicted as male labor force
X_2= Tractor Traction force(Tcs)
The traction force in production is presented in tractor hours in sample farms.
X_3= Nitrogenous fertilizer quantity used (kg)
Goldenmix and goldenzinc foliar fertilizers are used in all the sample farms. The data to be included to the model is given by depicting them in active ingredient
X_4= Potash fertilizer quantity used (Kg)
When plants reach fruit height, golden potash fertilizer is given.
X_5= The pesticide amount used(Kg)
Pesticides that reduce Ph, insecticdes and herbicides in

Table 4. Physical input Use and Unit Costs per decare in peanut production (Turkish Liras/Kg)(Farms average).

Cost Items	Labor and Traction force used				Equipment used	Material used			Total cost amount
	Labor		Traction						
I.Soil prepearation	**Hour**	**Value**	**Hour**	**Value**		**Kind**	**(kg/each)**	**Value**	**TurkishLiras**
a.First Ploughing	0.10	13.2	0.10	21.2	Plough				34.4
b.Second Ploughing	0.05	13.2	0.05	16.5	Plough				29.7
c.Second Ploughing	0.05	12.3	0.05	15.0	Disc Harrow				27.3
d.Fourth Ploughing	0.06	11.5	0.06	15.7	Sweep+dredge				27.2
e.Sowing or Planting	0.03	14.6	0.03	18.3	Drill	Seed	8.60	32.3	65.2
II.**Maintenance**									0.0
a.Fertilizing	0.06	4.2	0.06	7.8	Fert.distrib.	Che.fert.	21.40	17.0	29.0
b.Middle Ploughing	0.10	13.2	0.10	13.8	Hoeing mach.				27.0
c.Irrigation	0.05	10.8	0.03	12.8	Dynamo				23.6
d.Spraying	0.05	11.8	0.03	13.5	Pulverizator	Pesticide	0.25	6.3	31.6
III.**Harvesting**									0.0
a.Harvest(reap)	0.41	11.5							11.5
b.Transportation	0.03	11.6	0.03	0.1	Trailer				11.7
IV.**Revolving funds interest**									79.5
A-Total operation costs	1.00	127.9	0.53	134.7				55.5	397.6
a.General Administration cost (A x 3%) *									11.9
b.Land Rent									11.2
B-Total overall costs									23.1
C-total production costs (A+B)									420.7
D-Peanut Production (kg/da)									383.8
E-1 kg peanut cost (TL)									1.10

*General administrative costs of 3% was calculated as total operating costs.

peanut production are used in production period. The quantities used are included in kg to the equation

X_6= Seed quantity used (kg)

The virginia group peanut varieties as seed are sowed and they added to the equation as kg.

X_7= Peanut sowing area (da)

The changes in planted area as independent variable are added to the equation in decare in respect of examining the impact of the changes in planted area on production.

The $Y = 1.069X_1^{-0.315}X_2^{0.441}X_3^{0.701}X_4^{-0.441}X_5^{-0.947}X_6^{0.204}X_7^{-1.656}$ equation between the dependent variable (Y) and independent variables(Xi) is found. The relationships among the factors are found significant for 5% possibility level. When the production elasticities are examined, human labor(X_1), potash fertilizer amount(X_4), the pesticide quantity used(X_5) and peanut sowing area(X_7) have negative production elasticities. Economic optimum calculation is not possible since there are negative elasticities in the derived function. On the other hand the results about which input use must be increased or decreased can be drawn (Zoral, 1973).

As the other inputs are fixed human labor (X1), potash fertilizer quantity (X4), the pesticide guantity used(X5) and peanut sowing area (X7) are increased by 1% the production quantities (Y) are decreased by respectively 0.31, 0.44, 0.094 and 1.65%. On the other hand, tractor traction (X2), nitrogenuous fertilizer quantity (X4) and the seed quantity used are increased by 1%, the production quantities (Y) are increased by respectively 0.44, 0.7 and 0.2%. It can be said that the inputs which have negative production elasticities are excessively used. Total elasticities with relation to the inputs is $\sum b_i = -2.013$.

DISCUSSION

With respect to the results from 44 sample farms in the region, the inputs used per decare are determined as follows respectively: 1 h male labor, 0.54 h tractor traction, 8.60 kg seed, 21.40 fertilizer and 0.25 kg

pesticide are used in peanut production. 1 kg peanut cost is 1.10 TL in 2009 prices used in the determination of the relationship between the amount of production inputs, the amount of peanut production dependent variable (Y), human labor, tractor traction, nitrogenous fertilizers, potassium fertilizers, the amount of drug, the amount of seed planting area with an independent variable (Xi) were examined.

Production quantity is dependent variable (Y) and human labor, nitrogenuous fertilizer, potash fertilizer, pesticides used, seed quantity used and sowing area are indepenedent variables (Xi) in determining the relationship between production quantity and the inputs used.

When derived production function is considered, it is concluded that human labor, potash fertilizer quantity, pesticide quantity and peanut sowing area are excessively used. When the diminishing returns law is considered farmers must obtain information from agriculture province directorates about production information with relation to the excessive input use and must produce in a more effective way in the light of this law. Peanut production in the region has big potential. Because the organization in the region is insufficient, pricing in the market does not work in an effective way.

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