Carrot production-structure and profitability-cost analysis: the case of Konya Province, Turkey

Musa Acar

MSc in Agriculture Economics
Instituição: Şırnak University
Endereço: Cizre Vocational School, Şırnak University, Cizre, Şırnak, Turkey.
E-mail: **musa.acar@outlook.com**

Mevlüt Gül

PhD in Agriculture Economics
Instituição: Süleyman Demirel University
Endereço: Faculty of Agriculture, Department of Agricultural Economics, Süleyman Demirel University, 32260, Isparta, Turkey.
E-mail: **mevlutgul@sdu.edu.tr**

Abstract

Carrot (*Daucus carrota* L.) is produced in Turkey not only for fresh consumption but also used as candy and juice industries. It is valued as food mainly because it is rich in alpha and beta carotene. There are a few studies on the economics of carrot production. Konya is the most important carrot production area and takes the first position in ranking in Turkey. Therefore, the aim of this study is to determine production cost and profitability of carrot production in Konya province, Turkey. The data was obtained from 73 carrot farm enterprises with the help of a well-structured questionnaire. The survey applied to selected enterprises randomly. Data covered the 2011 production season. The average production cost of carrot was US$ 0.150 per kg, the sales price was US$0.201 per kg and profit margin was US$ 0.051 per kg in carrot producer enterprises. Relative profit was calculated as 1.34. Gross profit and absolute profit for enterprises were determined US$7838.62 and US$4249.46 per hectare respectively. According to the Tobit model results; such variables as groups of carrots cultivated area, yield, taking precautions in pesticide used, pesticide dose, marketing, household size were found to have a significant effect on profitability of carrot farms.

Keywords: Carrot. Production cost. Profit. Konya. Turkey.

1. Introduction

The carrot as a kind of vegetable, whose root is edible is produced and consumed in large quantities in Turkey. All over the world 126 countries take part in carrot production. The world carrot production was 34.7 million tons in 2012 (FAO, 2013). The most important carrot producer is China with its 46% share. The other important carrot producers in the world are Russia, USA, Uzbekistan, Poland, Ukraine, United Kingdom, Japan and Turkey.

In Turkey, 55 provinces take part in carrot production. The top ten producers in 2012 were reported by the Turkish Statistical Institute, Konya is the first producer reaching 353020 tons, 68.8% of the total Turkish carrot production (TUIK, 2013).

The way to sustain economic activities of the agricultural enterprises is through observing the constantly changing technological and economic events and taking the required precautions. The income from the production activities, production cost and the ratio of expense elements in total cost should be known in order for the producers to make rational innovation and adaptations (Özkan *et al.,* 2002).

Production costs and the income should be known in order for the producers to make mid and long-term planning for what and how to produce. It has great benefits to make calculations regularly according to the methods. Moreover, a healthy data base may be created through cost studies, the commonly used production techniques and physical amounts of inputs used in production (Özkan and Kuzgun, 1997).

Therefore, the production cost is the most important factor in deciding what to cultivate. Usually, to know how much of which products, for whom and how to produce are important for producers working with limited capital to maintain their production activities. In order for these decisions to be taken in a healthy and effective way, the production costs and the net profit of the cultivated agricultural crops should be known by the enterprises (Özkan *et al.*, 2002).

Determining the input usage amounts, cost and incomes is very important for the producers at the micro level and those who manages the economic policies. The results of the studies on agricultural production costs become an important tool for governments to determine the price policy. Moreover, the costs of agricultural products, determining the usage levels of physical production inputs, labour force planning, preparing financing programs, preparation of product budgets, investment projects, etc. are highly used in planning activities (Özkan and Yılmaz, 1999; Anonymous, 2001).

The relevant studies are limited. Velioğlu (1999) stated in his study on carrots that 76.63% of production cost was variable cost and 23.37% was fixed cost. Therefore, we aim to make an analysis of cost structure and profitability of the enterprises involved in carrot production in Konya.

2. Materials and Methods

Konya is the case-study province. Therefore, the data of the study was from the enterprises involved in carrot production in Konya. The obtained data represents the 2011 production season.

It was determined that Konya province was represented by Meram and Çumra areas in terms of carrot production, as it stated some technical staff points of view held by people who are currently working for Konya Food, Agriculture and Livestock Directorate. In this framework, the Farmer Register System of the Food, Agriculture and Livestock Directorate constitute the main mass. The interviews were conducted with the enterprises involved in the carrot production in the İçeri Çumra district of Kaşınhanı Town in Meram County with the help of well-designed questionnaire.

All the enterprises involved in the carrot production in the chosen counties were included in the population. Thereafter, the frequency polygon was drawn by allocating the frequency of the carrot cultivated fields. The population (carrot cultivated fields) was divided into four layers ranking the frequency polygon. These layers were: 1st layer carrot cultivated fields of 0.10-2.49 hectare (ha), 2nd layer fields of 2.50-4.99 ha, 3rd layer, 5.00-9.99 ha; and 4th layer 10.0ha or bigger, respectively. Survey included 73 enterprises as the population by applying the random stratified sampling method with 95% confidence interval and 5% margin of error. The "Neyman Method" was used in the distribution of sample enterprises in the layers. The enterprises were chosen randomly from the main mass in accordance with the calculated sample size.

Budget analysis method of single products was used for the detection of operating costs. Accordingly, revenues and expenses were calculated only for the carrot, which was the research subject, not for all products.

In this study, the average wage of the region was taken for the calculation of family labour force expenses. General administrative expenses were calculated by taking the 3% of the variable cost. The land tenure of the research field was taken as a base in the calculation of land rent. In the calculation of the total costs for the provision of interest, the half of the 10% interest rate applied to agricultural loans by TC Ziraat Bank in 2011 was taken into account. As carrot production in the region generally takes place within six months of the production process. Therefore, the half of the interest rate applied by Ziraat Bank was taken into account. The product sales price, which was obtained by the farmers, was considered in the calculation of sales price and gross production values of the surveyed enterprises.

In the evaluation of the level of success of carrot production activities; profitability levels were demonstrated. The following formulas were used in the calculation of the relative, gross and absolute (net) profits (Açıl and Demirci, 1984; Kıral *et al.,* 1999; Tanrıvermiş, 2000):

Gross Profit = The Gross Production Value - Variable costs,

Relative Profit = The Gross Production Value/Production costs, and

Net Profit = The Gross Production Value - Production costs.

The data was interpreted by creating crosstabs between the enterprises width groups (carrot cultivated fields groups) and variables mentioned above.

The factors affecting the profitability of carrot enterprises were determined by using the Tobit model. The regression analysis was conducted among descriptive variables inherent to the enterprises by using the limited Tobit model. The aim was to find out the factors affecting the farm enterprises decision and preferred institution.

Tobit model is an econometric method proposed by James Tobin in order to define the relationship between a non-negative dependent variable y_i and an independent variable or vector x_i (Green, 2003).

The model supposes the existence of a latent (unobservable) variable like y_i^*. This variable is connected to the x_i variable with the β parameter or vector.β parameter or vector defines the relationship between x_i and y_i^* as in the linear model. Additionally, there is an error term u_i which has normal distribution to cover the random effects. The observable y_i equals to the y_i^* if the unobservable y_i^* is bigger than the zero and equals to the zero if the unobservable y_i^* is smaller than or equal to the zero (Green, 2003).

$y_i = y_i^*$ if $y_i^* > 0$

$y_i = 0$ if $y_i^* \leq 0$

Here, y_i^* is unobservable variable.

$y_i^* = \beta x_i + U_i, U_i \sim N(0, \sigma^2)$

If the relationship parameter β is obtained from the regression of observable y_i's over the x_i's, the regression of the smallest squares is inconsistent. This curve gives the downward-sloping predictions of coefficients and upward-sloping predictions of the fixed term (Green, 2003).

The Tobit regression model, which is used to explain the effective factors over profitability, can be written as given below;

$$y = \delta_0 + \delta_1 GROUP + \delta_2 YIELD + \delta_3 MARKET + \delta_4 PROTEC + \delta_5 DOSAGE + \delta_6 FHOLD + \delta_7 EDU + \delta_8 AGE + \delta_9 EXPER$$

where, terms on the model in this study are defined by:

y = Relative profit;

δ = function predictor parameters;

GROUP : Carrot harvesting areas groups (categorical) (I. group 0-2.49 ha-1, II. group 2.50-4.99 ha-2, III. group 5.00-9.99 ha-3, IV. group 10.0-+ ha-4)

YIELD : Yield of carrot per hectare (kg ha^{-1})

MARKET : Marketing structure of farms (dummy) (0= use marketing channels, 1= direct marketing)

PROTEC : Take precaution on spraying of carrot growing (dummy) (1= Definitely, 2=Yes, 3= Sometimes, 4= Scarcely)

DOSAGE : pesticide dosage on carrot production (dummy) (0= use more than recommended dosage, 1= use recommended dosage)

FHOLD : number farmer's household (person)

EDU : farmer's education level (year)

AGE : farmer's age (year)

EXPER : farmer's experience on carrot growing (year)

3. Findings and Discussion

3.1. Information about the enterprise

The enterprise land width was taken into consideration in order to determine the width of enterprise assets in the study. In the surveyed enterprises; the rented land, private property land of the enterprise and shared land constitute together the lands of the enterprise.

Enterprises were divided into four groups based on the width of carrot cultivated lands. In the average enterprises width total land were 5.57 ha, 8.40 ha, 14.95 ha and 27.03 ha by groups respectively.

Considering the number of plots, it was found that an enterprise averaged was 5.75 plots of land a piece.

In the surveyed enterprises; 5.03 ha of the enterprise land was private property land, 7.46 ha was the rented land, and 0.13 ha was the shared land. The ownership structure of the

land of the enterprises poses a difference in the width groups. However, there was only statistical significance for private land ownership (P<0.00; P= 0.009).

Çelik and Direk (2008) stated in their study that the ratio of rented lands changes among the economic size groups and it increased directly with the economic size group. Additionally, they stated that the average share of rented lands in the total lands of the enterprise was 49.41%. The reason why the land size and the rented land ratio per each carrot producing enterprise was high in the research region was caused by the characteristics of the carrot production. In any given plot, intense fertilizer and pesticide use in carrot production and soil erosion in remarkable amounts, due to the long harvest process driven by market demands, requires cultivating other products for the following two years, or in other words alternation. Therefore, the carrot producing enterprises have to take for rent other lands to produce carrot.

In surveyed farm, 39.83% of the average (12.62 ha per enterprise) land was private land, 59.15% was the rented lands and 1.02% was the shared lands.

The share of the irrigated land in the enterprise lands was 88.01% and non-irrigated land share was 11.99%.

The cultivated land consists of the cultivated fields of the enterprise land during one year. In the surveyed enterprises; 8.61% of their average land extent were cereals cultivation fields, 10.58% were industrial plant cultivation fields, 69.67% were vegetable fields, and 11.14% were fallow fields.

From 26.13 to 61.90% of the total agricultural land was allocated for carrot production in the enterprise size classes. The average ratio was 50.71%. Thus, results indicated that the surveyed enterprises were mostly focused on the carrot production.

The average amount of population and its allocation to the age groups were important for the distribution of the enterprise's income and for determining the workable population and labour force (Kızıloğlu, 1994). The average number of women was 3.04 and was 3.05 for men. The average household number was 6.09 in the enterprises. It has been found in the studies conducted at the same region (Çelik and Direk, 2008; Arısoy and Oğuz, 2005; Gündoğmuş, 2000), the structure of the population has close figures.

Çelik and Direk (2008) detected in their study that the average amount of population in the enterprise size groups' changes between 5 to 7 and the average of the enterprises was 6.37. While the number of population was more than the average of Turkey which was 5, it was less than the average of agriculture enterprises in the East and South East Regions.

According to Çelik and Direk (2008), 14.13% of the population surveyed in the study area was in the 0-6 age group, 22.45% was in the 7-14 age group, 51.81% was in 15-49 age group, 11.61% was in the 50 and above age group. As in all over the Turkey, most of the population in the research fields was situated in the active population group. On the other hand, 49.13% of the population was woman and 50.87% was man as the average of the enterprises.

If the population of the enterprises was evaluated according to the gender; it was seen that the ratios were very close. In the enterprise width groups; the women ratio was the highest with 58.75% in fourth enterprise group and the men ratio was the highest with 53.75% in the first enterprise group.

The average population of above age 6 was 5.22 and 0.78% of these population was illiterate, 4.16% was literate, 75.58% was studying at the primary school or graduate, 15.06% was studying at the secondary school or graduate, 3.90% was studying at the high school or graduate. Additionally, 0.52% of the average population was studying at the vocational school or graduate.

Oğuz and Mülayim (1997) stated in their study conducted in Konya province that 3.96% of the average enterprise population above age 6 was illiterate, 72.87% was studying at the primary school or graduate, 20.53% was studying at the secondary and high school or graduate, 2.64% was studying at the vocational school or graduate.

When the studies were compared, it was seen that there was a decrease in the illiterate population and a similarity in the ratios of those studying at the vocational school or graduate. The education level of the farmer families was generally low in the agricultural enterprises situated in the rural areas. Considering the studies conducted in different regions, the education level of the agricultural population changes from region to region (Oğuz and Mülayim, 1997).

3.2. Gross production value

Gross production value (GPV) was obtained by multiplying the production amount of crops and animal products during one year in agricultural enterprises with the prices acquired by the farmer and adding annual productive value increases in the crops and animal production (Açıl and Demirci, 1984; Erkuş and Demirci, 1985).

The value of crops and animal products, produced as a result of agricultural activities in one year by the surveyed enterprises and productive fixture value increases of the same year constitutes the gross production value (Erkuş, 1979).

As seen in the Table 1, the average GPV of the enterprises was US$170635. The highest GPV of the enterprise width groups was found at the fourth group with US$371657.

Carrot was the highest share with 62.66% in total GPV and followed by other vegetables with 25.88%, industrial plants with 9.65%, cereals with 1.48% and livestock with 0.33%. Within the enterprise groups, the highest GPV was found at fourth group as 81.38% and followed by second enterprise group as 68.89% share. Other vegetables had the highest share with 46.00% in the third enterprise group and followed by carrot with 45.66% share. Similar findings were found for the first enterprise group (Table 1).

Velioğlu (1999) found that 95.15% of GPV was crop production and 4.85% was animal production and 79.47% of GPV was vegetable production in the enterprises average. In our results, 88.54% of total GPV was vegetable production.

Table 1: Structure of gross production value in investigated farms

Farm groups (ha)	Carrots	Grains	Industrial	Other vegetable	Livestock	Total
	Average of surveyed enterprises (US$)					
I	21553	166	11164	28227	798	61909
II	60692	1521	5334	20240	319	88105
III	110957	973	19301	111789	0	243021
IV	302471	9446	34092	24651	998	371657
Average	106914	2528	16461	44166	566	170635
	Share in total gross production value (%)					
I	34.81	0.27	18.03	45.59	1.29	100.00
II	68.89	1.73	6.05	22.97	0.36	100.00
III	45.66	0.40	7.94	46.00	0.00	100.00
IV	81.38	2.54	9.17	6.63	0.27	100.00
Average	62.66	1.48	9.65	25.88	0.33	100.00

3.3. Costs of carrot production

A specific amount of inputs and service are required in order for a good or service production. Cost can be defined as the amount and value of the altruistic behaviours in order to produce goods and services. In another reading, cost is the total amount of monetary values of inputs associated with the production factors used in the goods or services production (Erkuş *et al.,* 2005).

Carrot production is an agricultural production activity which provides a high level income in the unit field. Concordantly, the amount of capital invested by the producers is also high. Compared to the other agricultural activities, more labour force is used. At the same time, it is an activity consisting of intense input and capital. Therefore, both the changes at the prices of carrot and the changes at the prices of inputs affect this activity a lot.

The cost items were examined under variable and fixed cost items. The variable cost items in the carrot production were seed, fertilizer, pesticide, irrigation, the cost of renting machinery, marketing costs (packaging, categorization, washing, commission, etc.).

The variable costs are those which increase or decrease depending on the production size. These costs emerge during the production and change depending on the amount of production (İnan, 1998).

Marketing cost was the highest ratio with 36.94% in the variable cost items of the surveyed enterprises. Seed cost was followed with 19.87%, temporary labour force with 14.47%, irrigation cost with 9.54%, fertilizer cost 8.33%, machinery rent expenses with 7.08% and pesticide expenses with 3.77%.

The fixed cost items in the carrot production were administrative expenses, land renting cost, the interest of the total expenses and permanent labour force expenses.

Land renting costs were the highest ratio with 66.71% in the fixed cost items of these carrot producing enterprises. The interest of the total expenses followed with 13.36%, permanent-family labour force with 12.52% and administrative expenses with 7.41% in the fixed cost.

Production costs can be defined as the monetary value of the inputs required for the carrot production. Accordingly, the production cost per hectare for carrot was given in Table 2. The production costs per hectare in carrot were detected to be changing between US$12018.38 and US$13150.60. It was US$12459.34 per hectare in the enterprises average.

In the surveyed enterprises, variable costs were the highest share with 71.19% (US$8870.18 per hectare) in the carrot production costs. The share of the variable costs change between 69.77-73.20% in the enterprise groups. While, third group was the highest share, fourth enterprise group was the lowest share.

In the carrot production, the share of the fixed costs in the production costs was 28.81% (US$3589.16 per ha). The share of the fixed costs in the production costs changed between 26.80-30.23%.

The marketing expense which is one of the items of the variable costs, was the highest share with 26.30% in the production costs. In the enterprise groups, the marketing expense was the highest value with 29.91% in the third group enterprises and the lowest value with 24.31% in the fourth group enterprises.

Land rent, which is one of the items of the fixed costs, was the secondary important cost item in the carrot production costs. Land rent was constituted 19.22% of the carrot production costs. It changed between 17.35% and 20.69% at the enterprise width groups.

The third important item constituting the carrot production cost was the seed cost. The share of the seed cost was 14.15% in the average of enterprises.

Other items constituting the carrot production costs in the study area were labour force with 10.30%, irrigation costs with 6.79%, the fertilizer costs with 5.93%, machinery rent costs with 5.04%, the interest of the total expenses with 3.84%, permanent-family labour force costs 3.61%, pesticide costs with 2.68%, and administrative costs 2.14%, respectively (Table 2).

Velioğlu (1999) stated in his study in Ankara that 76.63% of production costs was variable costs and 23.37% was fixed costs. In our findings fixed cost was more high because of land tenure cost was higher in surveyed areas.

Table 2: Production cost of carrot production

Production cost items	Farms groups (ha)				Total/average
	I	II	III	IV	
	Production cost per hectare of carrot production ($)				
Seed	2023.11	1911.92	1808.86	1663.89	1762.63
Fertilizer	893.83	616.11	765.03	732.63	738.68
Pesticide	312.81	285.21	340.30	347.01	334.31
Irrigation	850.90	830.90	853.11	846.23	846.29
Renting cost of machinery	633.89	630.66	617.43	631.86	628.32
Temporary labour	1362.22	1353.59	1309.04	1242.16	1283.47
Marketing	3092.51	3616.05	3932.40	2921.32	3276.47
Variable cost	9169.22	9244.49	9626.11	8385.09	8870.18
General administration expenses	275.09	277.31	288.80	251.56	266.11
Land tenure	2225.69	2340.72	2283.17	2484.91	2394.37
Permanent/family labour	471.44	488.26	435.03	442.87	449.40
Interest of production cost	495.81	500.48	517.49	453.95	479.28
Fixed cost	3468.02	3606.89	3524.49	3633.29	3589.16
Production cost	12637.19	12851.32	13150.60	12018.38	12459.34
	Their share in production cost (%)				
Seed	16.01	14.88	13.75	13.84	14.15
Fertilizer	7.07	4.79	5.82	6.10	5.93
Pesticide	2.48	2.22	2.59	2.88	2.68
Irrigation	6.73	6.47	6.49	7.04	6.79
Renting cost of machinery	5.02	4.91	4.69	5.26	5.04

Temporary labour	10.78	10.53	9.95	10.34	10.30
Marketing	24.47	28.14	29.91	24.31	26.30
Variable cost	72.56	71.94	73.20	69.77	71.19
General administration expenses	2.18	2.16	2.20	2.09	2.14
Land tenure	17.61	18.21	17.35	20.69	19.22
Permanent/family labour	3.73	3.80	3.31	3.68	3.61
Interest of production cost	3.92	3.89	3.94	3.77	3.84
Fixed cost	27.44	28.06	26.80	30.23	28.81
Production cost	100.00	100.00	100.00	100.00	100.00

The cost of carrot (1 kg) range between US$0.140- US$0.164 in the surveyed enterprises. It was found out that the carrot cost was US$0.150 in the average of the enterprises (Table 3). The carrot selling price was found to be US$0.201 in the average of the enterprises.

The profit margin of carrot was found to be US$0.051 in the average of the enterprises. It was calculated that the profit margin changes between US$0.023- US$0.070 in the enterprise groups (Table 3).

Table 3: Unit cost and profit margin in carrot production

Farms groups (ha)	Per kilogram sales price of carrot($)	Per kilogram cost of carrots ($)	Per kilogram of profit margin ($)
I	0.189	0.162	0.028
II	0.184	0.160	0.023
III	0.192	0.164	0.029
IV	0.210	0.140	0.070
Average	0.201	0.150	0.051

3.4. Gross, absolute and relative profit in the carrot production

The gross, net (absolute) profit and the relative profit values of the enterprises involved in the carrot production were given in Table 4.

The gross profit had a negative value in one of the surveyed enterprises. In other words, 1.4% of the enterprises could not even meet the variable expenses.

The absolute profit had negative values in 18 of the investigated enterprises. In other words, 24.7% of the enterprises did not meet the carrot production cost.

The relative profit was 1.34 in the average of the enterprises. It means that the surveyed enterprises obtained 134 units GPV for the 100 unit production expense. In other words, the enterprises involved in the carrot production obtained US$1.34 GPV for their US$1 expense and therefore achieved US$0.34 profit. The relative profit changes between 1.14-1.50 in the enterprise groups.

The gross profit per hectare was US$7838.62 in the average of the enterprises. The highest gross profit value in the unit field was US$9690.90 in the fourth group enterprises. The lowest value was US$5462.75 $ in the second group enterprises (Table 4).

Also, the highest absolute profit value in the unit field was US$6057.54 in the fourth group enterprises. The lowest absolute profit was US$1855.93 in the second group enterprises.

Table 4: Gross profit and absolute profit in per hectare for carrot producers

Farms groups (ha)	Gross profit ($)	Absolute profit($)	Relative profit
I	5638.26	2170.24	1.17
II	5462.75	1855.93	1.14
III	5824.91	2300.42	1.17
IV	9690.90	6057.54	1.50
Average	7838.62	4249.46	1.34

The average and standard deviation values of the variables taken into the Tobit model were given at the Table 5.

Table 5: Variable descriptive statistics

Variable	Mean	Std Dev.
Dependent variable		
y	1.34	0.278
Independent variables		
GROUP	2.26	1.17
YIELD	79178.08	17258.93
MARKET	0.15	0.36
PROTEC	0.82	0.56
DOSAGE	0.74	0.44
FHOLD	6.29	2.34
EDU	6.90	3.11
AGE	40.78	12.10
EXPER	18.88	9.35

Results of the Tobit regression analysis were given in Table 6. In the Tobit model estimated for the effect of socio-economic variables on the profitability of enterprises in carrot production; it was detected that such variables like enterprise group, yield, taking precautions

for pesticide use, dosage of pesticide, marketing structure, and household size had an important effect on profitability. The model's R^2 was 0.647.

Carrot harvested area groups and yields were statistically significant even at 1% level and these parameters had a positive sign. So, it could also be said that carrot production area size and yield has a positive effect on carrot profitability. Farmer's carrot marketing channels level was found to have a positive effect on profit. This parameter was statistically significant at 1% level. It could be said that, direct marketing has increased effect on profit of carrot farms. Taking precaution level on spraying of carrot growing of the farmer was also found to have a negative effect on profit. This parameter was statistically significant at 5% level. Farmers who no take precaution on spraying decreased their profit. Farmers' pesticide dosage on carrot production was statistically significant at 6% level and this parameter had a positive sign. In other word farmers who use recommended dosage increased their profit. Number of household has an adverse effect on profit.

Table 6: Tobit Estimation

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.255234	0.118772	2.148935	0.0316
GROUP	0.081240	0.016534	4.913576	0.0000
YIELD	0.000011	0.000001	9.806883	0.0000
MARKET	0.146728	0.053173	2.759441	0.0058
PROTEC	-0.080629	0.035559	-2.267438	0.0234
DOSAGE	0.089834	0.046697	1.923752	0.0544
FHOLD	-0.013250	0.007820	-1.694351	0.0902
EDU	-0.001622	0.006255	-0.259295	0.7954
AGE	-0.000594	0.001696	-0.350096	0.7263
EXPER	0.000007	0.002176	0.003103	0.9975

4. Results

In conclusion, the land width of the enterprises involved in the carrot production was 12.62 hectare and the ownership structure of land of the enterprises posed a difference in the width groups in the study area. Because of carrot production system, the ratio of the rented land was the highest in the enterprises surveyed.

The household size was 6.09 people in the enterprises and it was above the Turkey average. The average GPV of the enterprises was US$170635, 62.66% of this value was provided by the carrot. Therefore, the surveyed enterprises showed good potential for carrot and vegetable production and more of their income came from vegetable production. The results showed that carrot production is profitable in the study area.

In the surveyed enterprises, variable costs had the highest share with 71.19% in the carrot production costs. The share of the fixed cost in the production costs was 28.81%. The marketing expense was the highest share with 26.30% and land rent was the secondary important cost item in the carrot production costs. The third important item was the seed cost.

The cost of carrot (1 kg) ranges between US$0.140-US$0.164 in the surveyed enterprises and the profit margin of carrot was found US$0.051 per kg. 1.4% of the enterprises could not even meet the variable costs. The absolute profit had negative values in 18 producers of the region. Therefore, 24.7% of the enterprises involved in carrot production made losses in the economic cycles analysed. Also these findings showed that some farmers use improper management of resources. Therefore farmers should be trained and advised on proper and efficient utilization of resources in order to improve their profit.

The results of the Tobit model indicated that such variables like groups of carrot cultivated fields, yield, precautions for pesticide use, pesticide dosages, marketing structure, size of the household affected profitability remarkably.

Within the extent of the findings, the excessive use of diesel oil in the carrot production, increases the costs; and makes it necessary to provide a diesel oil incentive for carrot production, along with the search for better ways to use cost-efficiently the diesel oil.

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