Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 18, Issue 2, 2018
PRINT ISSN 2284-7995, E-ISSN 2285-3952

FACTORS AFFECTING COTTON PRODUCTION DECISIONS OF FARMERS: EASTERN MEDITERRANEAN REGION, TURKEY

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Abstract

This study aimed to determine the factors affecting cotton production decisions of producers in the Eastern Mediterranean Region of Turkey. The main research material was the data obtained from the questionnaires conducted with farmers in this region. We identified six factors influencing the decision-making in cotton production, which included economic, technical, political, environmental, personal, and product-related factors. The logistic regression model attempted to explain the factors convincing farmers to cultivate cotton. The variable related to the cotton experience of farmers was found significant. Besides, the variables of the number of individuals per household, total agricultural area, cotton plantation area in 2013, 2011, 2000, and 1990 were statistically significant. Cotton cultivation areas in the Eastern Mediterranean region tended to shrink rapidly after 2000s. In addition to increasing the cost of cotton production, factors like competitor product costs, productivity, changes in technology and price fluctuations also played a role in such a decline. Therefore, the decision to cultivate cotton is affected by not only the price of cotton but also the government supports in place, changes in foreign trade practices, technology, human resources, competitor product prices, and yield.

Key words**:** *cotton, Eastern Mediterranean Region, production decision, factors*

INTRODUCTION

Cotton has a profound economic importance for the producer countries, as it is an indispensable product in many sectors that brings a substantial added value and employment opportunities. It is a raw material for many industries, including cotton-ginning industry, textile industry using its fiber, oil and feed industry using its seeds, and paper industry using cotton linter. An alternative to petroleum, the oil obtained from cottonseeds has been increasingly used as a raw material in biodiesel production. In addition, the recent rise in the population and standard of living increase the demand for cotton plants [3]. As in the world, Turkey also has limited area suitable for cotton cultivation. Cotton production in Turkey is confined to certain irrigable areas in the Aegean and Mediterranean regions, as well as South-eastern Anatolia. In this context, the decisions of cotton producers to choose, discontinue, or continue cotton cultivation become crucial for the future of cotton production in our country.
In general, the decision to determine product design is analysed by considering economic, technical, sociocultural, and environmental criteria. The economic criteria in determining what agricultural product to cultivate might include income prospects, income stability during the period, production costs, risks, institutional supports, dependency on foreign agricultural inputs and marketing opportunities. The technical criteria are productivity, production techniques, product quality, and healthy working conditions. The sociocultural criteria consist of family labour and employment, social justice in the rural area, availability of cultivation in problematic and disadvantaged areas, and adaptation to local sociocultural values. The environmental criteria usually include soil erosion, soil fertility, regional water use, water pollution, air pollution, and biodiversity [16].

Accurate insight into the structure and nature of the farmer's production objectives should precede any analysis of resource distribution and production behaviour [4]. In this context, determining farmer goals could prove extremely beneficial. Determining the long or short-term goals of farmers can be quite useful in predicting economic behaviour. Goals are included in business models, thus helping farmers in decision-making. The identification of farmer's goals and targets contributes to the development of agricultural extension and relevant policies.

The cotton production in the research area was 462,678 tons in 1991, but this figure declined to 421,971 tons in 2016. The total area used for cotton cultivation accounted for 183,772 hectares in 1991, but this area decreased to 77,054 hectares in 2016. The region's share in Turkey's overall cotton production showed a significant drop from 30-35% in the 1990s to 18-27% in the 2000s. The region's share in cotton cultivation area in Turkey also declined from 17-34% in the 1990s to 16-24% in the 2000s (Fig. 1). Indeed, the region suffered considerable downturn in cotton production and cultivation area. However, while the cotton yield was 2,518 kg per hectare in early 1990s, this figure more than doubled (2.38 times), rising to 6,005 kg in 2016. This increase in cotton yield appears to have compensated the deficit in overall production activity.

The analysis of the changes in cotton production in the region reveals that cotton production in the region fluctuated between -18% and +64% in the 1990s. In the 2000s, the change in cotton production in the region ranged between 19% and 27%, which means that 1990s showed much more fluctuation. The change in cotton plantations in the region ranged from -34.5% to +38.3% in 1990s, but 2000s witnessed a sharper fluctuation between 17.9% and 51.2%. The change in cotton production showed even more variation. However, in the 2000s cotton cultivation areas remained below the numbers in 1991. Cotton yield in the region was always above the yield achieved in 1991, except for 1992, 1995, and 1996 (Figure 2).

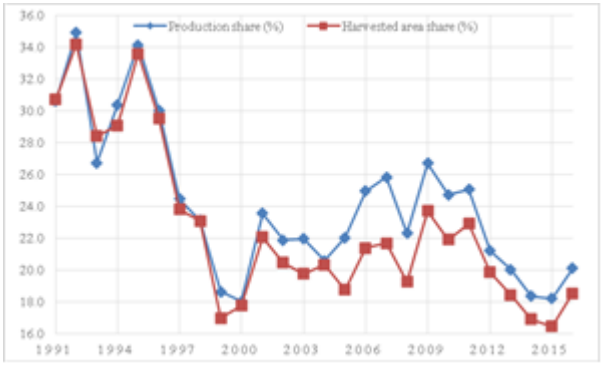

Fig. 1. Changes in cotton production, planting area and yield in the study area as compared to 1991
Source: TUIK [19]

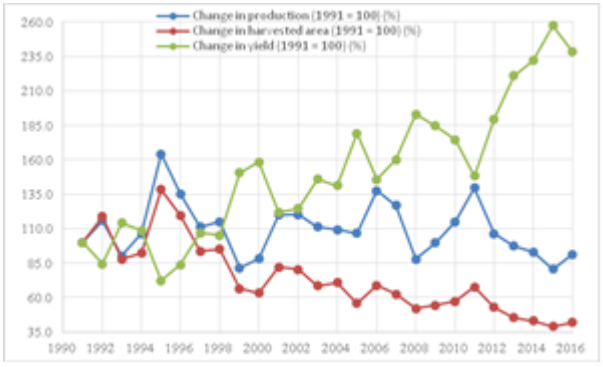

Fig. 2. Changes in cotton production, planting area and yield in the study area as compared to 1991
Source: TUIK, [19]

Policy decisions for agricultural production are assessed taking into account social, environmental, and economic objectives. The protection of family businesses, improving the quality of life in rural areas and the protection of traditional agricultural products are among the social objectives. For environmental purposes, it is possible to consider promoting agricultural practices for environmental protection, contributing to the maintenance and conservation of natural areas. Criteria such as the provision of reasonable prices to consumers, the production of safe and healthy products, the promotion of competition between enterprises, the provision of adequate income for farmers, the guarantee of self-sufficiency at the national level can be given as examples of economic objectives of policies [7], [18].

Economists assume that limited resources are distributed to maximize profits. In addition to making the most profit, other goals can also be important. Moreover, it is no longer possible to run operations easily based on the assumption that profit maximization can

adequately account for all observed operation behaviours. Although many farmers desire to achieve the highest profit, they may also want to carry out the least risky production. Determination of purpose structure provides ease of distribution of resources [20], [5]. A sufficient understanding of the structure and nature of the farmers' production objectives should precede the analysis of any resource allocation and production behaviour [4]. In this context, there are many benefits to determining farmer goals. Determining the goals of farmers can be useful in predicting economic behaviour. Goals are included in business models, helping farmers in decision-making. The introduction of farmer goals and objectives contributes to the development of agriculture policy and publishing programs [20].

Over the past 20 years, cotton cultivation areas have tended to show a steady decline across Turkey and in the Eastern Mediterranean region. In recent years, shrinking of cotton cultivation lands has been more pronounced. It is of vital importance in this context that we analyse the mechanisms of farmer's decision about what to cultivate, which is one of the fundamental issues to address. There has been no research looking into the reasons why the farmers in the Eastern Mediterranean region have been abandoning cotton production and looking to grow other crops. This study therefore seeks answers to this problem in the region.

This study aimed to determine the factors affecting cotton production decisions among the farmers in the Eastern Mediterranean Region of Turkey.

MATERIALS AND METHODS

The main research material was the data from the surveys conducted with cotton producers in the Eastern Mediterranean Region. There are five provinces in the region: Adana, Mersin, Kahramanmaraş, Osmaniye and Hatay. The questionnaires were administered in the cities of Adana, Mersin, and Hatay. We used the proportionate stratified random sampling in determining the number of samples to represent the main population in studying the factors influencing the farmer's decision to cultivate cotton in the Eastern Mediterranean Region. Using the proportional sampling formula, the sample volume was determined as 194 farmers with 95% confidence interval and 5% error margin. In the region, the cotton cultivation areas showed declines and expansions over the years. Determining the measures that could be taken to prevent the increase or decrease of cotton production in the region was another goal of the study. For this purpose, taking into consideration the year 1995, when the cotton cultivation areas reached the highest level in the Eastern Mediterranean Region, the number of the survey was determined according to the cultivation areas in the provinces and districts. Accordingly, data obtained at face-to-face interviews with a total 194farmers, including 100 farmers from Adana, 60 from Hatay, and 34 from Mersin.

Factor analysis was used to determine the factors influencing the decision to cultivate cotton among farmers. Factor analysis refers to a class of multivariate statistical methods aiming for data reduction and summarization. In general, it mainly analyses the relationships between large numbers of variables and then explains these variables by main dimensions (factors). In addition, in this method, each factor can be seen as a dependent variable, which is a function of the original observation values [10].

The general factor model has many forms. The most commonly used are "common factor analysis" and "component factor analysis". The choice of factor model depends on the purpose of the study. The mathematical model of factor analysis is similar to multiple regression equations. Each variable is expressed as a linear combination of actually unobservable factors.

The Logistic Regression model was used to explain the influence of various factors on farmer's decision to cultivate cotton. Logistic regression is a nonlinear regression model specially designed for binary dependent variables. If the dependent variable in the model is expressed by two categories, the model is called "Binary Logistic Regression Model", and if it is expressed in more than

two categories of the dependent variable, it is called "Multinomial Logistic Regression Model" [13]. In the binary logistic regression model, the observed dependent variable can take only two values: "0" and "1". If the event occurs, it will take the value 1 and if it does not it takes the value 0 [24].

RESULTS AND DISCUSSIONS

The individual and household characteristics of the farmers were found to be important factors in decision-making in agricultural activities. The mean age of the farmers interviewed was 57 years, ranging from 38 to 68 years. The education level of the farmers was 6 years on average. Although they were predominantly elementary school graduates, there was a wide range of educational differentiation from primary school to university. Agricultural experience was 27 years on average, showing a variation between 5-45 years.

The household size of the farmers ranged from 2 to 38 persons, with an average of 4 people per household. Two persons from every household were involved in agricultural activities. Membership to agricultural cooperatives was an important factor influencing their decision-making. About 79% of the producers in the study were members of an agricultural cooperative, with 83% of them actively participating in cooperative activities.

The farmer's land assets, ownership status and characteristics of land were important elements in agricultural activities. The land assets of interviewed producers accounted for 56 decares on average, ranging from 1 to 392 decares. The mean land owned by the farmers was 45 decares, and the average rented and sharecropping land was 24 decares. There was a wide variation in the size of the owned, rented and sharecropping land.

Cotton cultivation areas in the Eastern Mediterranean region began to shrink rapidly after 2000s. Cotton cultivation histories of the farmers in the region were examined to determine the reasons why they gave up cotton production.

Cotton cultivation areas covered by the study were 18 decares on average in 1990. In 2013, the average cotton plantation area increased to 26 decares, which was associated with the incentive policies and cotton prices.

The change in the cotton cultivation areas in the Eastern Mediterranean region was largely attributed to the changes in the cost and price of competitive products. The producers turned to alternative products. The alternative product's growing conditions, profitability, prevalence in the region were important factors in decision-making. It was found that 77% of the farmers who gave up cotton production began to cultivate corn and 23% began to produce soybean. The main reason for preferring corn over cotton was lower cost, lower labour force and its ease of cultivation as compared to cotton.

The cotton plantation area of the farmers interviewed in the Eastern Mediterranean region was 172 decares on average. In 2013, farmers who produced cotton were found to have cultivated cotton in minimum 20 decares and maximum 400 decares of land. Average yield of cotton in the region was 541 kg. It was determined that the minimum cotton yield was 450 kg and the maximum yield was 600 kg. In the research area, the average income from cotton was TRY794 per decare, ranging from TRY428 to TRY1020. The average cost of cotton production was TRY596, and the lowest production cost for farmers was TRY551 and the highest was TRY637.

The average absolute profit from the cotton production in the region was calculated as TRY197. The lowest absolute profit of the farmers was -TRY160, while the highest profit was TRY445. Absolute profits differed widely in the region. The main reasons for this variation could be factors such as yield, price and different production techniques. In particular, the producers with a yield above the regional average had higher absolute profit values. The relative profit in cotton production was calculated as 1.33. Previous studies performed in different regions also found a low relative profit value in the production of cotton. For example, Yılmaz and Gül [22] calculated the relative profit in cotton production in Antalya as 1.02. Similarly, Kuzgun et al. [12] found that

relative profits in cotton production varied between 0.93 and 1.36 in 1992 and 1998. Yılmaz [21] reported that the absolute profit in all farmer groups was negative and the relative profit was 0.85 in Antalya. Sağlam [17] found that the relative profit in cotton production was 0.83 in Adana. Karlı et al. [11] estimated that the relative profit in cotton production in Şanlıurfa varied from 0.52 to 2.10, reporting significant variation in relative profit over the years.

The average land allocated to corn cultivation was 102 decares in the research area, which ranged from a minimum of 106 decares to a maximum of 700 decares. In the research area, the average corn yield per decare was 1,252 kg, ranging from 1,057 kg to 1,400 kg. The average revenue from the corn cultivation was calculated as TRY761 per decare (range: TRY764-896). Average production cost per decare was TRY364, with the lowest being TRY365 TL and the highest TRY403.

The absolute profit from the corn production in the region was TRY397 per decare. The lowest absolute profit was TRY399, and the highest absolute profit in corn production was TRY525. The absolute profit values in corn production also showed a significant variation.

The average area for soybean cultivation in the research area was 74 decares on average (range: 81-230 decares). The mean soybean yield was 350 kg per decare (range: 355-425 kg). The average gross production value obtained from the soybean cultivation was TRY 543 per decare, ranging between TRY562 to TRY806. The average production cost for soybean was TRY241 per decare. The lowest production cost was calculated as TRY244, while the highest production cost for soybean production was TRY354.

The average absolute profit from the soybean production in the region was TRY302 per decare (range: TRY318-451). Variations in yield, price, and cultivation techniques seem to cause a signification variation in absolute profit values.

Absolute profit and relative profit values obtained from cotton production were lower than profits derived from corn and soybean production. Yurdakul and Ören [23] investigated the relationship between cotton production cost, selling price and plantation area in Çukurova Region between 1971-1988, and they reported that the correlation coefficient between the changes in the net profit and the plantation area in the following year was 0.645. Özkan [14] reported that the greatest uncertainty in cotton production in Antalya between 1981 and 1995 was in absolute profit. Özkan [15] determined that cropping decisions of farmers were mainly based on net returns of cotton production and farmers in the past were influenced by a wide variety of factors in choosing farm enterprises. Akpınar and Gül [1] found that there was seasonal fluctuation in cotton prices in Cukurova region between 1981-1996and also there were severe fluctuations in real prices.

Table 1. Income, Cost and Profitability of Cotton, Corn and Soybean Production

Indicators	Cotton	Corn	Soybean	Corn/ Cotton	Soybean/ Cotton
Plantation Area (decare)	172	102	74	0.59	0.43
Yield (kg/decare)	541	1,252	350	2.31	0.65
Gross Production Value per decare (TRY)	794	761	543	0.96	0.68
Production Cots per decare (TRY)	596	364	241	0.61	0.40
Absolute profit per decare (TRY)	198	397	302	2.02	1.53
Relative Profit	1.33	2.09	2.25		

Source: Own calculation.

In their technical efficiency study in cotton production, Günden [9] calculated the technical efficiency in cotton production in Menemen as 0.677, suggesting that the current yield could be increased by 32.3% under the same conditions. Aktürk [2] calculated the technical efficiency of cotton production in Söke as 0.839.

Binici et al. [6] reported that 72% of the enterprises in the Harran Plain were running inefficient operations. Gül et al. [8] reported that cotton-growing enterprises in the

Çukurova region could reduce their current input by 20% and still get the same output.

Results of Factor Analysis

A factor analysis was performed to reveal the factors that influenced the decision to cultivate cotton among the producers in the Eastern Mediterranean region. A total of 37 variables thought to be effective in farmer's decision-making were included in the analysis. The data on these variables were collected through a questionnaire using 5-point Likert scale and the responses given by the participants were analysed.

The hypothesis that the correlation matrix obtained from the factors evaluated in the study is the identity matrix was rejected (Bartlett's Test of Sphericity 6574.294). In addition, the value of Kaiser-Meyer-Olkin (KMO) statistics was greater than 0.5 (KMO 0.670). Therefore, it is safe to say that a factor analysis was appropriate for these data.

Table 2. Logistic Regression Model (Y = Cotton Production Dummy)

Variables	1	2	3	4	5	6
Production cost is high						0.557
The profitability of alternative products is higher than the cotton						0.520
It sells for a low price						0.466
Harvesting cotton is easy						-0.422
In a short time I can convert cotton into cash	0.856					
It is a traditional product	0.843					
Alternative product's marketing is easier than cotton	-0.840					
There is storage possibilities	0.823					
There are marketing issues	-0.821					
Irrigation facilities are suitable for cotton farming	0.818					
I cultivate cotton out of habit	0.655					
I get the opinion of other farmers when I decide to cultivate cotton		0.730				
I get the opinion of other family members in deciding to cultivate cotton		0.715				
Cotton production gives me free time		0.593				
This product is easy to grow		0.491				
It needs little hoeing and care		0.665				
Pesticide costs are low		0.615				
Production cost of alternative product is lower than cotton		-0.570				
Climate conditions are suitable for cotton farming			0.858			
The structure of our land is suitable for cotton farming			0.856			
Cotton cultivation involves many risks			0.627			
I produce cotton as it is eligible for insurance			-0.565			
It requires a lot of manual labour			0.492			
It is widely cultivated in the region			0.452			
It is suitable for machine use				0.721		
I do not have the necessary tools-equipment				0.667		
I produce cotton as there are reliable buyers				-0.581		
I am a member/officer of a cooperative or union related to the product				0.573		
It is suitable for the use of family labour				0.555		
There is availability of unionization (cooperative etc.)				0.530		
I enjoy cultivating this product				0.472		
I produce cotton due to the government subsidies					-0.550	
I suffer financial troubles for production inputs					-0.696	
I have experience in cotton cultivation					-0.493	
It is difficult to find workers					-0.411	
Alternative product requires less labour					0.384	
Soil conditions are not suitable for any crops other than cotton					0.370	

Kaiser-Meyer-Olkin Measure of Sampling Adequacy: 0.670
Bartlett's Test of Sphericity: 6574.294 (sig: 0.000).
Source: Own calculation.

An appropriate method should be selected after the factor analysis has been found to be suitable in the analysis of the available data. In the factor analysis, there are two basic approaches: principal component analysis and common factor analysis.

The principal components analysis was used in this study and eigenvalues were used to determine the number of factors.

A rotation can be applied in order to assign the data to more appropriate factor groups. In cases where the number of factors is high, more commonly used orthogonal rotation applications include "varimax, equamax and quartimax" and nonorthogonal ones include "direct oblimin, and promax" rotations. Various rotations were tried and the most favourable results were obtained from the varimax method. The results of the factor analysis performed are presented in Table 2.

As a result of factor analysis, 37 variables were reduced to 6 factor groups. Accordingly, Factor 1 was the product, Factor 2 personal, Factor 3 environmental, Factor 4 technical, Factor 5 politic, and Factor 6 economic factor.

Logistic Regression Model

The dependent variable of the Logistic Regression model was the values 0 and 1, representing the events of cotton production and absence of production. The value 0 represents 98 farmers who cultivated an alternative product and the value 1 represents 96 farmers who cultivated cotton. In other words, 51% of the farmers produced a product alternative to cotton in 2013, while the remaining 49% produced cotton. Using this model, we attempted to explain the factors influencing the farmer's decision-making in the agricultural product to cultivate. The explanatory variables included the age of the producers (years), the education level (years), farming experience (years), the number of individuals in the household (persons), the number of individuals working in the agricultural activities in the household (persons), membership to an agricultural organization (member: 1, not member:0), cotton plantation area (decares) in 1990, 2000, 2011, 2012 and 2013, and the factors identified in the factor analysis were used in the model designation.

Table 3.Logistic Regression Model (Y = Cotton Production Dummy)

Variable	Coefficient		Standard Error	Wald Statistics	Probability ratio
Constant	-9.989		9.908	1.017	0.000
Education	-0.044		0.092	0.228	0.957
Experience	0.039	*	0.023	2.737	1.040
Number of family members	0.320	*	0.176	3.319	1.378
Number of families engaged in agricultural activities	-0.011		0.268	0.002	0.989
Membership to a cooperative	-0.480		0.419	1.310	0.619
Cultivation Area	0.006	***	0.002	7.101	1.006
Personal factors	-0.191		0.188	1.036	0.826
Environmental factors	1.717		1.880	0.834	5.566
Political factors	-0.243		0.178	1.861	0.785
Cotton 2013	0.091	*	0.049	3.411	1.095
Cotton 2011	0.177	***	0.058	9.327	1.194
Cotton 2000	0.011	**	0.005	4.284	1.011
Cotton 1990	-0.009	*	0.005	2.760	0.991
R Square	0.57				
-2 Log likelihood	205.57				
Model Accuracy of Prediction %	87.70				

Significance levels: * represents 0.10, ** 0.05 and *** 0.01.
Source: Own calculation.

The model was generally meaningful and independent variables had a high explanatory power over the dependent variable in terms of horizontal cross-sectional data (R^2 = 0.57). The model function's ability to produce

predictions close to the real values was calculated as 88%.

The analysis showed that the independent variables including the farming experience, number of family members, total cultivation area, and cotton plantation areas in 2013, 2011, 2000, 1990 were statistically significant. On the other hand, factor variables obtained from factor analysis were not statistically significant.

The variable of the farming experience was found significant. Its positive coefficient indicates the existence of a synergistic relationship between experience and the probability of producing cotton. The increase in farming experience by one year increases the probability of producing cotton by about 4%. As the farming experience was a variable related to the farmer's age, the age variable was excluded from the model in order to avoid multicollinearity problems. It was found that the number of individuals per household positively correlated with the farmer's probability of producing cotton – when the household population increases, the probability of the farmer producing cotton increases by about 38%.

There was also a positive and statistically significant relationship between the total agricultural area, which was another independent variable, and the cotton cultivation. According to the model results, the increase of the total cultivation area by 10% would increase the farmer's probability of producing cotton by 6%.

The analysis of intermittent cotton production from 1990 to 2013 and the dependent variable of cotton production revealed a significant relationship between the probability of farmers producing cotton and cultivation areas in 2013, 2011, 2000 and 1990. A 1% increase in the number of farmers producing cotton in 2013, would increase the probability of cotton production by about 9%. In 1990, it was estimated that 1% increase in cotton plantation area would reduce the likelihood of producing cotton by about 9%.

CONCLUSIONS

The study revealed that the main factors influencing cotton production decisions in the Eastern Mediterranean Region included the product factor, personal, environmental, technical, political, and economic factors. The logistic regression model estimated that the individual and household characteristics of the farmers were also important determinants of agricultural activities. The most important factors were variables of experience and family population. The independent variables of the total cultivated area and cotton plantation areas in 2013, 2011, 2000 and 1990 were also statistically significant.

The cotton plantation areas in the Eastern Mediterranean region began to shrink in size rapidly after 2000s. This decline could be attributed to the rise in the cost of cotton production, alternative product costs, yield, changes in technical applications, and changes in prices. Indeed, the corn production was 2 times more profitable and soybean production was 1.5 times more profitable than cotton production in the year studied. Therefore, the decision to cultivate cotton was not only affected by the price of cotton but the incentive policies, foreign trade practices and the changes in alternative product prices and yields.

ACKNOWLEDGEMENTS

This study was funded by the Republic of Turkey Ministry of Food, Agriculture and Livestock TAGEM/GDARP (General Directorate of Agricultural Research and Policies) (Project No: TAGEM/TEAD/13/A15/P01/003-003). We would like to thank TAGEM/GDARP.

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