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# Effects of the economic performance of farmers of the risks encountered in the production of organic cotton, and risk management strategies

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This study has importance in terms of determination of risks and risk management strategies that affect the economic performance of farmers who produce organic cotton. With this aim, Turkey, a major organic cotton producer, was investigated as a case study. In the study, the most important sources of risk affecting economic performance of farmers were determined as variability in yield, high production costs and low price premiums. These were followed by the difficulties in production, climate conditions, and institutional uncertainty. Management of production, marketing and capital, conformity to regulations, sharing of information, and crop variety are the strategies developed for management of these risk sources, respectively. The strategies developed by the farmers towards risk sources will not be enough alone. The strategies developed by the farmers must be supported both by the government and NGOs.

**Key words:** Organic cotton, organic farming, risk, risk management, risk strategies.

## INTRODUCTION

Risk is uncertainty that affects an individual's welfare, and is often associated with adversity and loss (Harwood et al., 1999). The agricultural sector is exposed to a variety of risks which occur with high frequency. These include climate and weather risks, natural catastrophes pest and diseases, which cause highly variable production outcomes. Production risks are exacerbated by price risks, credit risks, technological risks and institutional risks. (Anonymous, 2006). These risks affect the incomes and thus the welfare of farm households. (Moreddu, 2000).

Organic farming, which is distinguished from conventional farming by its reliance on the natural processes of ecosystems, may present particular risks and ways of managing risks. Organic farming systems virtually exclude what are often thought of as important risk management tools in conventional farming, such as

the use of synthetic chemicals and antibiotics. Instead, organic farmers rely on their understanding and management of cultural practices such as crop rotation, timing of planting and harvesting, mechanical cultivation, and development of beneficial insect populations (Hanson et al., 2004). However, it was seen that specific work on this topic was inadequate, and this study was intended to take a step towards making up this deficiency. In pursuit of this aim, the risks and risk management in the organic farming were investigated on organic cotton. The fact that cotton is a strategic crop, that it is grown in many countries, that the practices involved in its culture are difficult compared to other crops, that it is a crop which is sensitive to climate and weather conditions, that it has an unstable marketing structure, and that it is subject to frequent intervention by governments affect the choice of growing this crop. The factors affecting the choice of growing cotton in this study were as follows: cotton is a strategic crop and its cultivation is done in many countries, its cultivation practices are difficult when compared to other crops, it is sensitive to climate and weather conditions, it has an unstable marketing structure, and it

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is subject to frequent intervention by governments. Cotton is a crop with a great number of risk sources and it has been seen that risk sources are increased when it is organically grown. This increase in risk sources has caused conventional cotton farmers have apprehension and they show indecisive attitude about organic cotton production. When they consider the current sources of risk in organic cotton production, they display little enthusiasm in taking it up, and frequently abandon the idea of growing organic cotton.

For example, although Turkey has for a long time been in the forefront of world organic cotton production, the number of producers, which was 500 in 2003, fell to 71 in 2007, a drop of about 86% (MARA, 2008), and for this reason Turkey's organic cotton fibre production has not shown a great increase in recent years. Indeed, according to a report by Organic Exchange on organic cotton in the production year of 2007/08, world leadership in the production of organic cotton fibre has passed from Turkey to India (Condit and Marquardt, 2008). The example of Turkey shows that although the world demand for organic textile products is rising, the reasons why the supply of organic cotton remains insufficient are still very real.

In this context, it is important to determine the sources of risk which affect the economic performance of producers and to set out the strategies for coping with this risk in organic cotton, the production of which entails such great economic expectations. This will help to ensure the spread of the production of organic cotton, and to achieve an increase in supply. In addition, it is thought that the support of this study by means of the survey which was carried out in Turkey, an important producer of organic cotton, will be of great significance.

## MATERIALS AND METHODS

The basic material for this study comprised primary data obtained in a survey carried out in 2006. In addition, materials such as articles, research and statistics from a number of relevant sources have been made use of. The research work carried out for this study was conducted in the Aegean Region of Turkey, a region which is important for the production of organic cotton. Three provinces in the Aegean Region - Aydin, Izmir and Manisa - were chosen for their importance in terms of number of producers, crop area and quantity of production. These three provinces, according to data from 2007, had 53.52% of the producers in Turkey, 25.02% of the crop area and 27.01% of total production (MARA, 2008). There were 330 producers of organic cotton in these three provinces. Sample volume was determined by the proportional sampling method (Newbold, 1995):

$$n = \frac{Np(1-p)}{(N-1)\hat{\sigma}_x^2 + p(1-p)}$$

In determination of the sample volume, the error level was taken as 10%, the confidence interval as 90%, and the sample volume was

calculated as 57. However, of the 57 producers of organic cotton who were selected for interview on the basis of sample volume, interviews were secured with only the 46 who consented to be interviewed. The reason for this lies in the intensive competition that exists in the organic cotton sector. Thirty-nine of the organic cotton producers interviewed were located in Aydin Province, 5 in Izmir, and 2 in Manisa.

Prior to carrying out the survey to determine the risks encountered by those farmers engaged in the production of organic cotton and the strategies to counter the risks observed, a questionnaire form was prepared. This form searched for information on many variables concerning the sources of risk for organic cotton and the strategies to counter them. In order to put these variables in order of importance, a 5-point Likert scale was used, which enabled the farmers to assign a score to each risk source and strategy in its order of importance.

Factor analysis was used in order to reduce the sources of risk and the strategies which had been put in order of importance by the Likert scale to a small number of significant independent factors. Thus, the factors which explained the maximum variance between the variables were calculated in order of importance, and the variables were ranked.

Factor analysis is a technique for summarizing a generally large number of variables by means of a small number of factors, which are obtained by adding the weighted scores of variables which are seen to be relevant. For each factor which is defined a score is obtained for each subject of the sampling. The factors are generally not calculated from the observed raw scores of the variables: in this calculation, the standardized forms of the variables are used. For this reason, the standard score known as the z score is used. According to the definition, the average score of a standardized variable on all topics is 0, and the standard error is 1. The use of a standardized variable enables the variables to be equivalent to one another.

In the factor analysis, the factor score for the  $i^{\text{th}}$  subject on the  $q^{\text{th}}$  factor was calculated according to the formula given below (Timmerman, 2005):

$$f_{iq} = b_{1q}z_{i1} + b_{2q}z_{i2} + b_{3q}z_{i3} + \dots + b_{jq}z_{ij}$$

where  $b_{jq}$  shows the weighting of the  $j^{\text{th}}$  variable ( $j=1, \dots, J$ ) used in the determination of the  $q^{\text{th}}$  factor, and  $z_{ij}$  shows the score of subject  $i$  ( $i=1, \dots, n$ ) on the  $j^{\text{th}}$  standardized variable.

## RESULTS AND DISCUSSION

### Perceived sources of risk in organic cotton farming and their effect on the economic performance of farmers

Previous studies on farmers using conventional production techniques showed that farmers' perception of risk is variable. Several studies have examined the relative importance of different risks and management strategies for different farms. A 1996 USDA survey of U.S. farmers noted that concerns varied by farm enterprises and geographic regions (Harwood et al., 1999). For example, cotton and grain farmers were more concerned about risk from yield loss and price variability while livestock and specialty crop producers were more concerned about risks from institutional changes in policies and regulations (Hanson et al., 2004). It can be said that a similar situation is encountered in relation to

organic farming, and these variations become apparent when the perceived sources of risk of producers of organic cotton in various other countries are examined.

For example, in the USA, three major sources of risk have been identified with regard to producers of organic cotton (Swezey and Goldman., 1999). First, the need to ensure sufficient plant desiccation and leaf drop can lead to slower harvests, multiple harvest runs through each field, decreased yields, and reduced overall cotton grades. A second, equally important production risk is that of securing a production loan on a year-to-year basis, which is crucial to managing finances and bringing the crop to harvest. Market instability and the absence of established production practices can cause lenders to be hesitant about year-to-year production loans to organic growers.

The third significant risk concerns the marketing and sale of the product after ginning had been completed. Supply, market competition and consumer demand affect returns to the growers, or in other words, profit. Sales agreements and price premiums are not guaranteed, nor is all cotton fibre sold compulsorily at a single fixed price. Growers are sometimes forced to sell their goods on the conventional market when there is no market for organic cotton.

The degree of importance of the sources of risk perceived by producers of organic cotton in Turkey is somewhat different from that of producers of organic cotton in the United States. The degree of importance of risk perceived by producers generally comes from the effect on economic performance. For this reason, the main sources of risk encountered in growing organic cotton in Turkey were found to include the potential effects on the economic performance of the farms examined. The effects of these sources of risk were determined in accordance with the answers given by farmers concerning each source of risk.

The Kaiser-Meyer-Olkin (KMO) value obtained as a result of factor analysis carried out on the sources of risk was found to be 0.50, which showed that the data set was suitable for factor analysis. The KMO ratio needs to be preferably above 0.50. According to the results of the analysis, 60.86% of the risk factors which were seen to affect the economic performance of farms producing organic cotton can be explained by three factors (Table 1).

Factor 1 may be called 'productivity and economy'. In this group, variability in product yield (0.688), product cost (0.679) and the price premium for organic cotton (0.650) have the highest factor for weighting.

As can be understood from these results, variation in cotton yield is seen as a significant source of risk for growers. Certain losses in yield are to be expected, and are mostly related to such factors as choice of variety, soil fertility, disease and pest pressure, and management skills in the production of organic cotton. When compared with conventional cotton production, the most important

role in minimizing yield losses in organic cotton growing is played by variety and management skill. Loss in yield is at the same time related to the location in which the cotton is grown. The size of the loss in yield which a producer can accept is related to the price which he can get for organic cotton (Chaudhry, 1993). In a previous study, it was shown while creating the conditions necessary for organic growing that there was no great difference between the yields of organic and conventional cotton, and that the yield in organic cotton varied in a positive direction (Adanacioglu, 2009).

Another important source of risk for farms engaged in organic cotton production is production cost. The cost of organic cotton production can show variation between the regions of a single country as it does between different countries. For example, in a study carried out in India in 2005, it was found that the cost of production of organic cotton was 13-15% less than that of conventionally-produced cotton (Thomas, 2006). In a study carried out in Turkey, however, the cost of production of organic cotton was determined to be 18.24% higher than that of conventional production (Adanacioglu, 2009). While in some countries the necessary materials for organic cotton production are handed out free of charge to producers as part of organic cotton production projects, in others no support is given to help the move to organic production. For example, in the West African country of Mali, a foundation connected to the government, CMDT, provides cotton seed and bio-pesticides free of charge to farms producing organic cotton (Lakhali et al., 2008). In Turkey on the other hand, the entire cost of materials used in production is borne by the producer, and there is no support for moving over to organic agriculture. One of the important points to note when comparing the costs of organic and conventional cotton production is the status of other crops produced in rotation with organic cotton. If the organic cotton producer cannot sell the crops grown in rotation with organic cotton at a premium price, the extra costs involved in the organic system will be borne by the cotton (Elzakker, 1999). In an investigation in Turkey, it was revealed that crops such as wheat, maize and fodder plants produced in rotation with cotton could not be marketed as organic. The fact that companies with whom the organic cotton producers had made contracts bought the cotton as organic but were unwilling to buy the crops produced in rotation and could not find a market for these crops for the producers can be seen as one of the main reasons for this (Adanacioglu, 2009).

The fact that the world price for cotton is low and that the price premiums paid for organic cotton are insufficient are seen as important barriers to continued production (Thomas, 2006). Producers of organic cotton generally get a premium of 20%. In Turkey however, the premium obtained for organic cotton production is very low in comparison with that of other countries where organic cotton is produced. Thus, in a study carried out in the Aegean Region of Turkey, the average premium paid for

**Table 1.** Mean score for organic cotton farmers, and joint varimax rotated factor loadings for sources of risk.

Sources of risk	Mean score	Rank	Most important factors		
			1	2	3
Variations in product yield	2.43	6	0.688	0.330	-0.028
Production cost	4.65	1	-0.679	0.064	0.175
Organic cotton price premium	4.22	2	0.650	0.016	0.481
Difficulty of production making work more intensive	1.52	8	-0.087	0.778	0.103
Variations caused by climatic conditions	2.37	7	0.375	0.765	0.117
Inadequacy of technical support	2.67	5	-0.019	-0.480	0.691
Market stability	3.74	4	-0.388	0.280	0.682
Changes in policies regarding cotton and organic products	3.91	3	0.073	0.180	0.576

Mean score (1 = no impact, 5 = very high impact for organic cotton farmers). KaiseMeyer-Olkin : 0.529, Barlett's Test of Sphericity : 50,491, sig.0.006, correlations between the variables is significant at the 0.05 level. Factors: F1, Yield and Economy; F2 – Difficulties of production and climate conditions; F3 – Institutional uncertainty.

the production of organic cotton between 2001 and 2005 was between 6.92 and 9.13% (Adanacioglu, 2009).

Factor 2 has been called 'production difficulty' and 'climate conditions' because the greater difficulty of production of organic cotton over conventional methods means that the weighting of the factors of more intensive work (0.778) and possible variations in the climate (0.765) is high.

Organic cotton production must be carefully planned in order to obtain optimum yield. This planning must include many factors such as the choice of land and variety of cotton, crop rotation, weed control, the determination of non-chemical methods of pest control, and skill in the management of organic production (Chaudhry, 1993). The planning and practice of organic cotton production requires an intensification of work and an increased labour force. In a study carried out in Turkey it was found that weed control and especially harvest required a greater input of labour time (Adanacioglu, 2009). The fact that organic cotton must be harvested by hand and that this requires a large labour force is an important factor here. In a study carried out in India, it was found that more time was spent on the application of organic fertilizer and on weeding (Thomas, 2006).

Variations which occur in climatic conditions have been recognized as a source of risk which has an effect on economic performance. From time to time, production losses may occur as a result of climatic conditions. It has been found that excessively hot weather, which causes the cotton to dry out or excessive rain can cause serious damage to product quality. However, it should be pointed out that these problems do not occur over extended periods, and vary from area to area.

Factor 3 concerns the uncertainty arising from the companies with whom organic cotton producers sign contracts, and from governments. Therefore, this factor has been called 'institutional uncertainty'. In this factor group it was found that inadequacy of technical support (0.691), instability of markets (0.682) and changes in policy on cotton and organic products (0.576) had the

greatest factor weightings.

There are a large number of technical difficulties involved in ensuring an adequate yield in organic farming. In addition, the changeover to organic farming takes time and requires knowledge and expertise (Ton, 2007). In the case of organic cotton production in Turkey however, neither the companies with whom the farmers sign contracts nor government institutions provide direction to farmers.

Demand for organic cotton is greater than supply, and this gives rise to fierce competition among companies in the sector. However, this competition does not reflect down to the producers in the way that it should. For example, one of the important points which producers of organic cotton in the United States see as a problem in the marketing of organic cotton is the necessity of finding a market to meet the extra costs engendered by organic production (Pick, 2006). In a study carried out in Turkey, it was found that cotton prices were variable and tended to fall, and a reliable market for organic cotton could not be found (Olgun et al., 2008), and the lack of a reliable market is the reason why the contracting companies pay such low premiums to producers.

Changes in government policy towards cotton and organic products can seriously affect producers' economic performance. Producers state that the lack of a determined and effective policy toward agriculture and especially organic farming creates an element of risk for them, which has a negative effect on their income. Other problems are the downward trend of cotton prices in recent years, the inadequacy of support premiums paid by the government, the fact that a system for the marketing of organic products has not been established, and deficiencies in the management of organic farming.

### **Risk management strategies by farmers in farms producing organic cotton**

Methods of removing or at least reducing the effect of

**Table 2.** Mean score for organic cotton farmers, and joint varimax rotated factor loadings for risk management strategies.

Risk management strategies	Mean score	Rank	Most important factors			
			1	2	3	4
Keeping records	1.98	9	0.788	0.121	0.103	0.081
Obtaining technical information support	2.50	8	0.755	0.010	0.106	0.270
Increasing yield	2.76	7	0.745	0.136	-0.357	-0.294
Controlling diseases and pests	3.09	6	0.627	0.472	-0.072	-0.302
Using marketing information services	4.28	2	0.078	0.806	-0.033	0.156
Off-farm activities	3.57	5	0.515	0.615	0.138	-0.078
Conforming to rules and regulations regarding organic cotton	3.87	4	-0.215	-0.020	0.859	-0.107
Quality control	3.41	5	0.358	0.008	0.687	0.143
Establishing communication with other farmers producing organic cotton	4.20	3	0.011	0.235	-0.090	0.852
Crop variety	4.59	1	-0.051	0.432	-0.173	-0.560

Mean score (1 = not important, 5 = very important for organic cotton farmers). Kaiser-Meyer-Olkin: 0.631, Bartlett's Test of Sphericity: 121,012, sig.0.000, correlations between the variables is significant at the 0.05 level. Factors: F1 – Crop management; F2 – Marketing and capital (cash-flow) management; F3 – Institutional conformity; F4 – Information sharing and variety.

factors which create risk in agricultural production are known as risk management strategies (Akcaoz et al., 2006). Risk management is formed from a series of complex and interrelated decisions. Successful risk management strategies vary widely according to the specific characteristics of farms. Risk management is important in identifying opportunities to prevent problems, and good risk management strategies can help to guide producers in critical situations (Ray, 2000).

The risk strategies of producers practicing organic agriculture are very different from those of conventional producers, because the production systems they use are different. Along with this, the means whereby organic farmers manage risk are also very different (Medina and Iglesias, 2008). In a study carried out in Greece, factor analysis was performed in order to determine risk strategies in organic agriculture. From the results obtained, three significant risk strategy factors were identified, namely exploiting the superiority of organic farming (better prices, strong demand, perspectives for market expansion), protecting income (insurance, crop diversification, off-farm activities), and health protection (workforce health) (Tzouramani et al., 2008).

In order to determine the strategies to be followed by farmers producing organic cotton to counter the risks which they face, use was again made of a Likert scale. Thus, farmers' views were taken on various important risk management strategies. The level of importance which they perceived for each strategy (from 1 = not important to 5 = very important) was identified. Factor analysis was once again used to reduce risk strategy variables to significant factors. In this way a Kaiser-Meyer-Olkin (KMO) value of 0.631 was obtained, and this was shown to be suitable for factor analysis of the data set. According to the results of the analysis, 4 factors were identified for risk strategies of farmers engaged in organic cotton production (Table 2). These 4 factors

explain 68.99% of variance.

In Factor 1, keeping records (0.788), receiving technical information support (0.755), increasing productivity (0.745), and disease and pest control (0.627) had the highest factor weightings. For this reason, Factor 1 was called 'production management'. As can be seen from this result, farmers mainly developed strategies to bring under control risks arising from within the farms. The reason for this stems from their concerns about productivity in organic cotton. Their purpose was to keep records of all the stages of organic cotton production, to gain technical support regarding production methods, to control diseases and pests, and to increase and preserve productivity.

The farmers' second most important risk strategies were grouped under Factor 2. The factor weightings of variables in this group – the use of information services in marketing (0.806) and off-farm activities (0.615) – were high. Therefore, Factor 2 was called 'marketing and capital management'. As previously stated, even though the demand for their product is high, the organic cotton produced on these farms is sold to the companies with which they have contracts at a very low premium. The reason for this arises from the fact that farmers producing organic cotton have little or no knowledge of markets and marketing. These farmers plan to reduce the risk of a low premium and thus price by making use of information services with regard to marketing. Another important risk strategy under Factor 2 is off-farm activities. Off-farm activities are thought of as compensating for cash-flow problems arising from organic cotton. By means of this strategy, farmers and their family members aim to maintain a constant cash flow by working off the farm, in this way protecting the farm working capital.

The farmers' third most important risk strategies are given under Factor 3. In this group, the weightings of two variables are seen to be high. These are, in order of

importance, conformity to rules and regulations relating to organic cotton (0.859) and quality control (0.687). Because these variables are an indicator of conformity to institutional regulations, it was seen as suitable to name Factor 3 'institutional conformity'. It is of great importance in the production of organic cotton to conform to national rules concerning organic products. It was found that if farmers perform effectively the management of culture practices of organic cotton farming, they will show conformity to national organic regulations and also avoid problems with regard to quality. Along with this, farmers stated that at each stage in the process of the production of organic cotton, they would keep under control factors which would adversely affect quality, with the aim of avoiding the risk of problems of marketing arising from product standards and quality.

The other risk management strategies of farmers in organic cotton are grouped under Factor 4. The variables with important weighting in this factor are, in order of importance, establishing communications with other farms producing organic cotton (0.852) and crop variety (0.560). Farmers think that important benefits could be obtained by establishing communications with other producers of organic cotton and so achieving an exchange of information on culture practices and especially marketing. The aim of this strategy is to prevent the risk of yield loss and low premium, and thus price. Another important strategy of farmers is crop variety. Significant losses of cotton yield can occur because, for example, climate conditions are not suitable, culture practices are not performed, or planting and harvesting are carried out at the wrong time, and it was found that for this reason farmers were planning to reduce this risk by practicing polyculture farming. In a study carried out in the Aegean Region of Turkey, it was seen that the farms of organic cotton producers showed a great variety of crop patterning (Adanacioglu, 2009). According to this study, alongside cotton in their fields, space was given to other field crops, vegetables, olives and grapes and other fruits.

## Conclusions

The global market for organic cotton has expanded greatly in recent years. In 2007 it was worth \$1.9bn and this rose to \$3.5bn in 2008. This market is expected to be \$5bn in 2009, and to reach \$6.8bn by the end of 2010. The growth of the market in organic cotton has increased the demand for the product. However, the supply of organic cotton has not kept pace with this demand. This problem with the supply of organic cotton arises from the fact that risks perceived by farmers relating to organic cotton production and strategies relating to those risks cannot be determined on the basis of producing countries.

In this study, which gives Turkey as an example, it was determined that the greatest sources of risk in organic

cotton production are variations in yield, high production costs, and low price premiums. This can be observed in difficulty of production, climate conditions and institutional uncertainty. Apart from these sources of risk, such negative factors as the inability to market as organic the crops produced in rotation with cotton, the lack of support for farmers at the changeover stage to organic farming, and the lack of technical information support to farmers are also present. Strategies which farmers have developed to cope with these sources of risk will not be sufficient on their own to solve the problems, and government support is also needed for this. In order to keep prices and premiums high, the market in organic cotton should not be allowed to be controlled by only a small number of companies, and with this aim, NGOs should be involved in the planning of organic cotton production in Turkey. In fact, in many countries outside Turkey, NGOs have taken a prominent role in organic cotton projects. Also, in the case of organic cotton projects in Turkey, participation in fair-trade schemes is an important opportunity to obtain a higher price. Fair-trade cotton producers throughout the world are seen to have a greater profit margin.

If crops produced in rotation with cotton could be marketed as organic products by the companies involved, producers' views of organic cotton production could change significantly. In addition, financial support for producers at the stage of changeover to organic cotton production, the provision of technical information support and long-term contracts for producers are all of great importance. It is felt that one solution could be for the government to introduce compulsory regulation.

As stated above, in order for organic cotton production to be sustainable in the long term, the sources of risk must be properly identified and the methods used to manage these risks must be properly chosen. This is particularly important for a product in which supply is insufficient in relation to demand. With risk management planning in organic cotton production, the economic benefits to producers will increase, and this will help the spread of organic cotton growing. This in turn will help the ecological balance, protect human health, solve commercial supply problems, prevent an oligopoly market structure, and prevent the prices of organic textile products from rising too high. This study examined Turkey, which is an important producer of organic cotton, and it is hoped that it can provide guidance for other producing countries.

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