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Farmers' Preferences for Organic Milk Production in Iznir, Turkey

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Abstract: This study was conducted to determine farmers' preference for organic milk production and the factors influencing the degree of farmer preferences in Turkey. The data were obtained from a survey of 96 farmers in Izmir, Turkey. The study was conducted using a two-stage methodology. First, fuzzy pair-wise comparison was applied to calculate the degree of preference. Five important factors were hypothesized to affect the transition to organic milk production; the producers were asked to make pair-wise comparisons among these factors. The reasons for farmers' preferences were then determined using a seemingly unrelated regression. The results showed that the most important factors for producers are health of consumer and guarantee of sale. Preferences for these factors are mainly influenced by producers' level of education and farm size.

Key words: Organic milk, farmers' preferences, fuzzy pair-wise comparison, SUR model

INTRODUCTION

Society's growing awareness of the health of people and the environment in developed countries has sparked new interest in an organic approach to agriculture (Tekeli *et al*., 2003). Organic agriculture is agriculture that is controlled and certified at every stage (from production to consumption) as not using chemical inputs. The aim of organic production is to protect the environment, plants, animals and people without polluting the soil, water, or air. Organic agriculture primarily began for the purpose of producing organic vegetables. However, countries such as the United States, Canada, Austria, Denmark and Germany have recently started to transition to organic animal production (Saner and Engindeniz, 2001). Available economic conditions and the increased income level of consumers have increased the production and demand for organic products (Cicek and Tandogan, 2009). Production of milk and milk products in the United States increased 37% from 1998 to 2003. Production of organic milk and milk products in the United States comprised 2% of total milk production (USDA, 2004). There are approximately 70 certified dairy farms and 7000 organic milked cows in Canada (Macey, 2007; Saner and Engindeniz, 2001). In Austria, the largest organic milk producer in Europe, the market share of organic milk and products represents 3.5% of the total milk market (Cavdar, 2004). Organic milk production in Denmark is a symbol of the development in organic production. In Denmark, where there is a remarkably high level of government support for organic production, organic milk is produced in 550 farms (Norfelt, 2005) and the share of organic milk production in total milk production has reached

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20% (Schmaedick, 2003). The market share of organic milk in Germany is approximately 2.8%. The market share of organic milk products in France is approximately 3% for milk and 4% for milk products (Saner and Engindeniz, 2001).

In Turkey, organic agriculture activities in vegetable production were started in response to the demands of import firms. However, organic animal production started first with apiculture (Saner and Engindeniz, 2001). Organic breeding projects have been undertaken by the Ministry of Agriculture and Rural Affairs (Aksoy *et al*., 2005) and there is a comprehensive organic milk production project in the private sector in Kelkit, Gumushane (Koyubenbe *et al*., 2006). In Turkey, organic milk production represented 2,875 tons, while total milk production was 11.3 million tons in 2007 (MARA, 2009). Consequently, organic milk production comprises only 0.025% of total milk production. The price of organic milk is 30% higher than the price of conventional milk (Koyubenbe *et al*., 2006).

In Turkey, 35% of total conventional milk production occurs in the Ege Region. Izmir Province is one of the provinces with the highest milk production, with 22% of the production in the Ege Region (MARA, 2009). This region has extensive production potential and was therefore chosen as the study area for determining producer preferences in organic milk production.

There are many studies about organic animal production in Turkey (Cukur and Saner, 2005; Saner and Engindeniz, 2001; Sayan and Polat, 2001; Tekeli *et al*., 2003; Unal, 2003; Yesilbag, 2004), but studies on organic dairies are quite limited, especially in Turkey (Atasever and Erdem, 2007; Butler, 2002; Cicek and Tandogan, 2009; Koyubenbe *et al*., 2006; McBride and Greene, 2007). Moreover, studies on this topic that have been carried out in Turkey are reviews, not original research.

The aim of this study is to determine farmer preferences regarding factors that can ease the transition to organic milk production in dairy farms in Izmir. As far as we know, this is the first study investigating farmer preferences regarding organic milk production in Turkey and should be of interest to producers considering an organic production approach.

MATERIALS AND METHODS

Data obtained from a 2008 survey of farmers formed the main source of material for this study. The Odemis, Tire, Bayindir, Bergama and Kiraz districts, which are responsible for 71.6% of the total milk in the Izmir Province, were included in this study. There are 5,824 dairy farms registered to the Izmir Cattle Breeding Association in these districts. The sample volume was determined through the proportional sampling method (Newbold, 1995):

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

n = Sample volume
N = Population (5,824)
p = Proportion of dairy farms (0.50)
σ_{px}^2 = Variance (0.05102)

The proportion of dairy farms was taken as 0.50 to reach maximum sample volume and was calculated as 96. When the data were being analyzed, farms were evaluated in five groups depending on their size (Table 1). The number of farmers in each group was calculated to be proportional.

Table 1: Farm groups according to number of cows and farms including in the sample

Farm size	No. of cows	No. of farms included in the sample
1.Group	5-14	47
2.Group	15-29	25
3.Group	30-49	16
4.Group	50-99	4
5.Group	100+	4
Total		96

The Kolmogorov-Smirnov test was conducted to determine whether the variables of the plantations are normally distributed. To identify the difference between groups of plantations, one-way ANOVA for parametric variables and Kruskal-Wallis analysis (Miran, 2002) for non-parametric variables were used. In this study, the Fuzzy Pair-Wise Comparison (FPC) method was used to determine farmers' preferences regarding organic milk production.

Fuzzy theory began with a study on fuzzy sets (Zadeh, 1965). Fuzzy set theory is an extension of crisp set theory (Tanaka, 1997). Fuzzy sets are sets with boundaries that are not precise. Thus, fuzzy sets describe ranges of vague and soft boundaries by degree of membership (Lai and Hwang, 1994). Membership in a fuzzy set is a matter of a degree (Klir and Yuan, 1995) and a fuzzy set is characterized by a membership function that can choose an arbitrary real value between zero and one.

FPC was first used by Van Kooten *et al.* (1986) to study farmers' goal hierarchies for use in multiple-objective decision making. The first step of the FPC approach is data collection using a unit line segment as shown in Fig. 1. Two options, A and B, are located at opposite ends of the unit line. Producers are asked to place a mark on the line to indicate the degree of their preferred option. A measure of the degree of preference for option A over B, rAB, is obtained by measuring the distance from the producer's mark to the A endpoint. The total distance from A to B equals 1. If rAB<0.5, option B is preferred to A; if rAB = 0.5, the producer is indifferent between A and B; and if rAB>0.5, then A is preferred to B. rAB = 1 or rAB = 0 indicate an absolute preference for option A or B. For example, if rAB=1, then option A is absolutely preferred to B (Van Kooten *et al.*, 1986).

Fig. 1: Fuzzy method for making pair-wise comparison between options (A) and (B)

The number of pair-wise comparisons, λ, can be calculated as follows:

$$\lambda = n^* (n-1)/2$$

where, n = the number of the factors.

In the second step of FPC, rij (i≠j) is obtained for each paired comparison (i,j). rij = s values are collected directly from the producer. rij (i≠j) is also a measure of the degree by which the producer prefers factor i to factor j and rji = 1 - rij represents the degree by which j is preferred to i. Following Van Kooten *et al.* (1986), the consumer's fuzzy preference matrix R with elements can be constructed as follows:

$$R_{ij} = \begin{cases} 0 & \text{if } i = j \forall i, j = 1,...,n \\ r_{ij} & \text{if } i \neq j \forall i, j = 1,...,n \end{cases}$$

Finally, a measure of preference, i, can be calculated for each factor using the producer's preference matrix R. The intensity of each preference is measured separately with the following equation:

$$I_j = 1 - \left(\sum_{i=1}^{n} R_{ij}^2 / (n-1) \right)^{1/2}$$

I_j has a range in the closed interval [0,1]. A larger value of I_j indicates a greater intensity of preference for factor j. As a result, the producer's preferences are ranked from most to least preferable by evaluating the μ values.

To analyze the producers' preferences derived from FPC, nonparametric statistical tests are used (Basarir and Gillespie, 2003). The Friedman test, which establishes whether the factors are equally important and the Kendall's W test, which tests for agreement among more than two sets of rankings, were used (Bowen and Starr, 1982).

In agricultural research in Turkey, fuzzy pair-wise comparison was first used by Gunden and Miran (2007) to determine farmers' objective hierarchy. In their study, the quantified preferences obtained from FPC were analyzed by the seemingly unrelated regression (SUR) investigated by Zellner (1962). An SUR system involves n observations on each of g dependent variables. In principle, this could be any set of variables measured at the same points in time or for the same cross-section. However, in practice, the dependent variables are often quite similar to one another. SUR is an extension of the linear regression model, which allows correlated errors between equations. The seemingly unrelated regressions model is as follows:

$$y_i = X_i\beta_i + \varepsilon i,\ i=1...., M$$

Where

$$\varepsilon = [\varepsilon_1', \varepsilon_2', ... \varepsilon_M']'$$

and

$$E[\varepsilon | X_1, X_2...., X_M] = 0$$
$$E[\varepsilon\varepsilon' | X_1, X_2...., X_M] = \Omega$$

It is assumed that a total of T observations were used in estimating the parameters of the M equations. Each equation involves Km repressors, for a total of $K = \sum_{i=1}^{n} K_i$. The data are assumed to be well behaved. It is also assumed that disturbances are uncorrelated across observations. Therefore,

$$E[\varepsilon_{it}\varepsilon_{js} | X_1, X_2...., X_M] = \sigma_{ij},\ \text{if } t = s \text{ and } 0 \text{ otherwise}$$

The disturbance formulation is therefore

$$E[\varepsilon_i\varepsilon_j' | X_1, X_2...., X_M] = \sigma_{ij} I_T$$

or

$$E[\varepsilon\varepsilon'|X_1, X_2 ..., X_M] = \Omega = \begin{bmatrix} \sigma_{11}I & \sigma_{12}I & \cdots & \sigma_{1M}I \\ \sigma_{21}I & \sigma_{22}I & \cdots & \sigma_{2M}I \\ & \vdots & & \\ \sigma_{M1}I & \sigma_{M2}I & \cdots & \sigma_{MM}I \end{bmatrix}$$

The data matrices are group-specific observations on the same variables. The covariance structures model is, therefore, a testable special case (Greene, 2008).

RESULTS

General Characteristics of Studied Dairy Farms and Farmers

Within the studied farms, the average age of the farmers was 40.1 years, the average education level was 7.5 years, the average agricultural experience was 21.5 years and the average dairy experience was 15.7 years.

In the dairy farms that participated in the study, 54.2% of the farmers were members of an agricultural cooperative. When examined according to farm size, the rate of cooperative membership was highest for Group 4 and the lowest in Groups 1 and 5, the smallest and largest farms, respectively.

Within the studied farms, 54.2% of the farmers were members and shareholders in Agricultural Cooperatives. Thirty one percent of these farmers were shareholders of Milk Collection Cooperatives. The proportion of the farmers that were members of the Chamber of Agriculture was 93.8%.

The average land size of the farms studied was 11.5 hectares and the average number of parcels per farm was 4.89. Therefore the farms involved in our study were multipartite.

The average daily milk yield in the farms studied was 21 kg, the lactation milk yield was 6.7 tons and the average milk sale price was 0.53* TL kg^{-1} [* 1$ = 1.313 TL]. The yield of daily milk per cow did not change according to farm size ($p = 0.133$), but the average milk sale price increased as the farms size increased ($p = 0.000$).

The farms in the study produce mostly corn for silage as the feed crop (6.96 ha), followed by *Vicia sativa* sp. (4.11 ha) and *Avena* sp. (3.78 ha). The average feed crop cultivation area per farm was 13.68 ha.

Thirty-seven percent of farmers buy concentrated feed from a dealership. The others prefer local milk collectors and local cowsheds (32.3%), milk collection cooperatives (15.6%) and feed factories (14.6%).

Awareness for Organic Milk Production of Studied Dairy Farms

Of the farmers, 27.1% stated that they had no idea about organic crops, but 72.9% said they had heard of organic cropping. Nearly 93% of the farmers who had heard of organic crops knew the correct definition of organic. The percentage of farmers who thought organic crops had a higher yield was 5.7%; 1.4% of the farmers thought that organic production was a method of production that used chemical fertilizers and pesticides intensely.

In the examined farms, the rate of farmers who had heard of organic milk was 59.4%. Among these farmers, the rate of knowing the correct definition of organic milk was 79.3%. The other farmers' statements with regard to the definition of organic milk were that it was obtained from cows that were fed in a pasture (15.5%) and it is milk that does not contain water or added ingredients (5.2%). It may be said that awareness of both organic crops and organic milk increases as farm size increases.

Table 2: Descriptive statistics for farmers' preferences regarding factors that can affect the transition to organic milk production in izmir

Factors	Mean	Minimum	Maximum	SD
Health of consumer	0.64	0.12	0.90	0.18
Guarantee of sale	0.53	0.20	0.80	0.13
High price	0.39	0.12	0.81	0.15
Technical information	0.38	0.12	0.70	0.12
Premium	0.34	0.10	0.77	0.13

Friedman test (χ^2 = 129.259), Kendall's W = 0.337

In this sample, 92.7% of the farmers used chemical fertilizer and pesticides in the production of feed crops, while only 7.3% of the farmers did not use them. The number of farmers using fertilizer and pesticides increases proportionately with farm size (p = 0.043).

Preferences for Organic Milk Production among the Studied Dairy Farms

This study used FPC to determine the priority of farmers' preferences for factors that might have an effect on the transition to organic milk production. The reasons for those preferences were then put forward using Seemingly Unrelated Regression (SUR).

Measures of Producer Preference

Here, degree of farmer preference for factors that might affect the transition to organic milk production was determined. Five alternatives that might affect organic milk production were offered to the farmers; the farmers were then asked to make pair-wise comparisons among these alternatives. These factors are as 1. High price; 2. Premium; 3. Guarantee of sale; 4. Technical information and 5. Health of consumer

The basic descriptive statistics for the results obtained from the FPC model are shown in Table 2. The factors were ranked from most to least preferable using degree of farmer preference. The results showed that the most preferred factor for farmers was health of consumer with a fuzzy pair-wise degree of 0.64. The second most significant factor was guarantee of sale; the other factors in order of significance were high price, technical information and premium.

The Friedman test was used to see if there was a difference in the rankings of the factors. The results were statistically significant. In other words, some factors were preferred more than others. A Kendall's W test was used to measure the degree of agreement. In this study, the value of Kendall's W was 0.337. This indicates that agreement among the farmers in the ranking of the factors is weak.

Factors Influencing Farmer Preference

The SUR model was used to determine the factors influencing farmer preference. The degree of farmers' preference for organic milk production was regressed on farmer-specific characteristics in order to identify the reasons for the preferences. The summarized estimation results of the model are shown in Table 3. There was a positive relationship between education and guarantee of sale, premium, high price and technical information. Experience with dairy had a negative impact on premium and high price. A negative relationship was observed between farm size and all examined criteria; guarantee of sale, high price, premium, technical information and health of consumer are important for small farms. The use of credit had a positive impact on all the factors examined. In the current study, age of farmer, membership in a cooperative and land size did not affect the farmers' preferences regarding the adoption of organic milk production.

Table 3: SUR model for producer preferences

Variables	High price	Premium	Guarantee of sale	Technical knowledge	Health of consumer
Constant	-0.57755**	-0.70142***	-0.44582	-0.56263**	-0.2127
	0.271418	0.281173	0.27771549	0.28680517	0.27996863
Education	0.03902**	0.03207*	0.02916*	0.03461**	0.02543
	0.01643	0.01702	0.01681095	0.01736117	0.01694734
Age	0.00153	0.00455	0.00543	0.00294	0.00261
	0.005982	0.006197	0.006121	0.00632134	0.00617066
Membership of cooperative	-8.19E-05	-0.00012	-9.56E-06	-5.51E-05	4.41E-05
	9.68E-05	0.0001	9.90E-06	0.00010229	9.99E-05
Experience of dairy	-0.01443**	-0.01105*	-0.00806	-0.01012	-0.00876
	0.006044	0.006261	0.00618388	0.00638628	0.00623405
Herd size (number of cows)	-0.00421**	-0.00414**	-0.00338*	-0.00479**	-0.00518***
	0.001793	0.001858	0.00183485	0.00189491	0.00184974
Farm size (ha)	-0.00023	-5.82E-05	-0.0001	-0.0001	-8.22E-05
	0.000313	0.000325	0.00032055	0.00033104	0.00032315
Credit usage	0.96519***	0.96596***	0.97241***	0.96942***	0.97771***
	0.019959	0.020676	0.02042157	0.02108997	0.02058725

*Significant at 1% level, **Significant at 5% level, ***Significant at 10% level

Table 4: Milk prices and farmers' intentions to switch to organic milk production in the farms investigated

	Group					
Farm size	1	2	3	4	5	Mean
Farmers not thinking of producing organic milk (%)	6.4	4	25	25	-	9.4
Farmers thinking of producing organic milk (%)	83	88	68.8	75	100	82.3
Farmers undecided regarding whether to produce organic milk (%)	10.6	8	6.3	-	-	8.3
Conventional milk price* (TL kg^{-1})	0.5	0.52	0.56	0.68	0.74	0.53
Expectation of organic milk price* (TL kg^{-1})	0.96	1.04	1.46	1.38	1.46	1.09

*1$: 1.313 TL

The percentage of farmers who had thought about switching to producing organic milk was 82.3%, while the percentage of the farmers who had not thought about producing organic milk was 9.4%. The percentage of farmers who could not decide was 8.3%. When farm size is taken into account, large farms are more positive about organic milk production (Table 4). While the average price of conventional milk was 0.53* TL kg^{-1} [* 1$ = 1.313 TL] in the farms examined, the average price the farmers expected for organic milk was 1.09 TL kg^{-1}. As farms grow, both conventional milk price and expected organic milk price increase (Table 4).

DISCUSSION

The youngest farmers, the most educated farmers and the most inexperienced farmers in terms of both agriculture and dairy were placed in Group 5. Also, there was no statistically significant difference between the farmers that were thinking of producing organic milk and those that were not in terms of age, education level and experience ($p = 0.844$; $p = 0.114$; $p = 0.230$, respectively). This is consistent with the results of a study conducted in the United States in which no difference was found between farmers producing organic milk and farmers producing conventional milk in terms of age and education level (McBride and Greene, 2007).

The rate of become a cooperative was quite low compared with that of developed countries, although it includes more than half of the farms studied. Investigated farmers are

organized by occupation much more than by economic level. This arises from direct Income Support Paying (ISP) per unit of land; the farmers must be members of the Chamber of Agriculture in order to receive this payment. Therefore, the number of Chamber of Agriculture members increased after the practice of ISP was introduced. The fact that the farmers who were not members of the Chamber of Agriculture in Group 1 do not have private-registered land supports this argument.

The average feed crop cultivation area per farm is higher than the average land size; this is a result of growing feed crops twice a year, especially corn for silage.

The percentage of farmers who had heard of organic crops was higher than that of farmers who had heard of organic milk, indicating that organic animal production is a newer concept for farmers than organic crop production.

According to their degree of preference regarding the factors that might affect the transition to organic milk production, the producers thought that organic milk production was most necessary for the health of consumer. This was a very difficult choice for the farmers because they had to choose between economic factors such as high price, guarantee of sale and premium and an emotional factor such as the health of consumer. Present results showed that farmers were acting emotionally in this matter. Guarantee of sale ranked second. This finding shows that farmers can produce organic milk but are anxious about being able to sell it. Akgungor *et al*. (2007) found that consumers in Turkey were willing to pay as much as 36% more for organic products. High price was ranked third and is of great importance since price directly affects the farmer's income. On the other hand, farmers think that switching to organic milk production will decrease their milk yield. In fact, two previous studies found that the milk yield in organic milk production was lower than that of conventional milk production, by 15 and 30%, respectively (Butler, 2002; McBride and Greene, 2007). The farmers ranked technical information fourth. This means farmers need technical support for organic milk production. In fact, this study found that 40.6% of the farmers did not know about organic milk production and 20.7% of the farmers who were aware of organic milk production did not know the correct definition of organic milk. Thus, the farmers must be given more information on organic milk production. The premium was ranked last within the farmers' preferences, indicating that the premium is not of great importance for the farmers in the transition to organic milk production.

As education level increases, the expectation of guarantee of sale, premium, high price and technical information increases. This result was not predicted. As education level increases, one would expect the preferences regarding health of consumer to increase. No relationship was found between education and health of consumer. As experience with dairy increases, the expectations for premium and high price decrease. As farms grow, these expectations decrease during the transition to organic milk production. As the use of credit increases, all of the factors in the study gain importance for the farmers.

The price expectation for organic milk is quite high. The reason of this is the decrease the farmers expect to see in organic milk yield.

The results indicate that the most preferred factors for producers are health of consumer, guarantee of sale and high price. The least preferred factors for producers are technical information and premium. Well-educated producers prefer premium, guarantee of sale, high price and technical information. Preferences for the factors are not influenced significantly by age of producer or cooperative membership in any model. Farmers with more experience in dairy do not expect premium or high price. Guarantee of sale was very important for small farms.

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