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Araştırma Makalesi

Determination of Factors Affecting Farmers' Preference for Corn Seed by Conjoint Analysis[¥]

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ABSTRACT

Modeling consumer preferences among multi-attribute alternatives has been one of the main activities in consumer research. Conjoint analysis is a multivariate statistical analysis technique that reveals the acceptance of criteria such as yield, price and adaptability that are important in consumers' usage habits and preferences. In this study, it was aimed to determine the degree of importance given by grain corn growers to seed traits in corn seed purchase. For this purpose, conjoint analysis was applied and preferences in seed purchase were determined according to the data obtained from the survey conducted among farmers. The survey questions used in the research were applied to 123 farmers. Kendall's Tau value, which is the representativeness of the model, was 0.935 ($p<0.05$) and the coefficient of determination was 0.98. As a result, the qualities emphasized during corn seed purchase were firstly yield (60.41%), secondly drought resistance (11.96%), thirdly disease resistance (11.85%), fourthly price (8.81%) and finally grain size (6.98%).

Key words: Conjoint analysis, corn seed, orthogonal plan, preference model.

Çiftçilerin Mısır Tohumu Tercihini Etkileyen Faktörlerin Konjoint Analizi ile Belirlenmesi

ÖZ

Tüketici tercihlerinin çok özellikli alternatifler arasında modellenmesi, tüketici araştırmalarında ana faaliyetlerden biri olmuştur. Konjoint analizi çok değişkenli istatistiksel analiz tekniği olup, tüketicilerin kullanım alışkanlıkları ve tercihlerinde önemli olan verim, fiyat ve adaptasyon gibi kriterlerin kabulünü ortaya çıkarmaktadır. Bu çalışmada, danelik mısır yetiştiricilerinin mısır tohumu alımında tohum özelliklerine verdikleri önem derecelerinin belirlenmesi amaçlanmıştır. Bunun için konjoint analizi uygulanmış ve çiftçiler arasında yapılan anket çalışmasından elde edilen verilere göre tohum alımında tercihler belirlenmiştir. Araştırmada kullanılan anket soruları 123 çiftçiye uygulanmıştır. Modelin temsil gücü olan Kendall's Tau değeri 0.935 ($p<0.05$), belirleme katsayısı ise 0.98 olarak bulunmuştur. Sonuç olarak, mısır tohumu alımı esnasında üzerinde durulan nitelikler, ilk olarak verim (%60.41), ikinci olarak kuraklığa dayanıklılık (%11.96), üçüncü olarak hastalığa dayanıklılık (%11.85), dördüncü olarak fiyat (%8.81) ve son olarak da dane büyüklüğü (%6.98) olarak tespit edilmiştir.

Anahtar kelimeler: Konjoint analizi, mısır tohumu, ortogonal plan, tercih modeli.

INTRODUCTION

Corn is a cereal plant that has been cultivated for thousands of years. It is known that corn, whose homeland is America, spread all over the world from here. Corn is a plant that can be cultivated in temperate climate zones and can be cultivated in many countries around the world. Today, corn can be cultivated in many parts of the world, except for the northern and cold climatic zones (Geçit et al., 1988). Corn is the most important cereal crop cultivated after wheat and rice. Millions of farmers in the world make a living from corn cultivation and about 80% of them are in developing countries (Dowswell et al., 1996; Çekmez, 2014). World corn production

is estimated to be 1.198 million tons in 2021-2022 (Nogay and Azabağaoğlu, 2024). In our country, corn production was realized only in the Black Sea and Marmara Regions in the 1950s, but after the 1980s, corn production increased significantly in the Mediterranean and Aegean Regions and in the last 10 years, in the Southeastern Anatolia Region and Central Anatolia Region. Following wheat and barley, corn is one of the cereal crops with the highest cultivation area with the development of industrial crop production. The government's encouragement of corn production, the development of modern corn production techniques by producers, and the widespread use of hybrid seeds have enabled producers to cultivate corn (Anonymous, 2017). There has been an increase in corn production in Türkiye in recent years, especially in the Southeastern Anatolia region with the Southeastern Anatolia Project, and the increase in yield due to all these factors. Grain corn production in Türkiye was 5.95 million tons in 2014 and 6.40 million tons in 2016 (TÜİK, 2018). Conjoint analysis literally means “collective participation”. The word conjoint is formed by combining the words CONsidered and JOINTly (Orme, 2010). Conjoint analysis is related to experimental design and was developed out of the need to analyze the effects of predictable factors (the characteristics we have identified) that can be measured frequently and whose properties can be based on precise judgments (Green and Srinivasan, 1978). In real life, people express their preferences through choices. The sum of choices creates demand for goods and services, voting for political candidates and other interests. It is important to understand how changes in the characteristics of choice affect preferences and to predict human choice. The fields of interest include psychology, economics, environmental science, geography, management, marketing, political science, recreation and transportation. Conjoint analysis is a multivariate market research technique that reveals the level of importance of criteria such as efficiency, price and adaptability that are essential to consumers' usage habits and preferences (Raghavarao et al., 2011).

In this study, conjoint analysis was applied to determine the utility of preferences in corn seed purchase and the data obtained from the survey conducted among farmers were analyzed. Yield, drought resistance, disease resistance, price and grain size were used as corn seed characteristics.

MATERIAL and METHOD

Material

The study material consists of the survey data conducted with the grain corn producers in 7 districts in Diyarbakır province (Fig. 1).

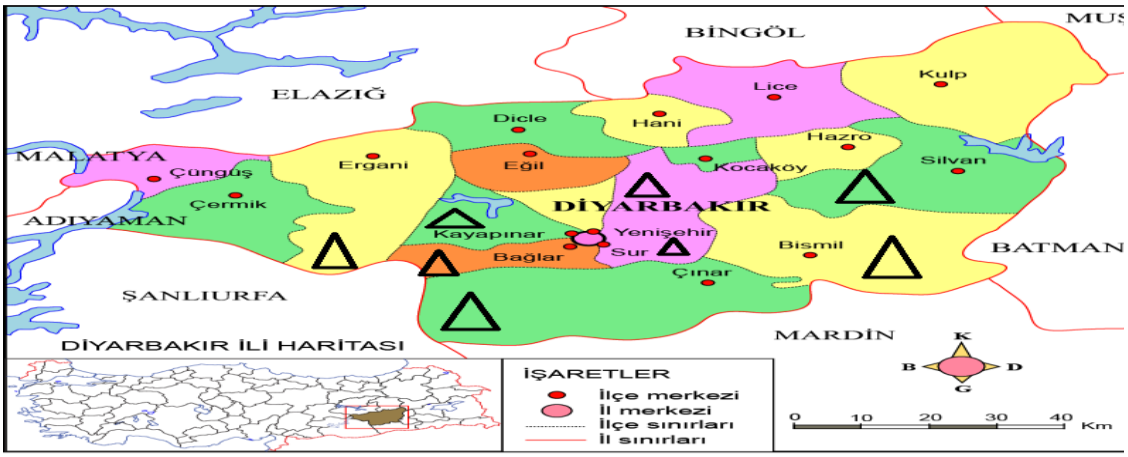

Figure 1. Map of Diyarbakır province (Saygılı, 2015)

Data were collected from grain corn farms registered in Diyarbakır province during April - May 2019. The questionnaire forms prepared in accordance with the purpose of the research were filled in face-to-face by the farmers in the farm.

Method

Sampling method

Considering the corn cultivation area of the farms, the number of sample farms to be surveyed by simple random sampling method was calculated as 96 (Güneş and Arıkan, 1988). For this purpose, equation (1) was used.

$$n = \frac{Nz^2pq}{Nd^2+z^2pq} \quad (1)$$

Where;
n: Sample size,
N: Population size,
d: Allowable error from the population mean,
p: The proportion of the wanted event in the main population (p=0.5),
q: The proportion of the unwanted event in the main population (q=0.5),
z: The z table value at 95% confidence limit used in the study (z=1.96).

Proportional distribution method (2) was used to distribute the determined sample size to the districts.

$$n_i = \frac{N_i}{N} * n, \quad (2)$$

Where;
n: sample size,
n_i: i. sample size in a district,
N_i: population size in i. district,
N: is the population size.

Although the sample size was determined as 96 farms, this number was planned as 150 considering that the questionnaires could be filled in incomplete. After the questionnaire application 123 questionnaires remained. Since this number was more than the minimum sample size, it was considered sufficient for the reliability of the research. The corn cultivation areas in the districts in Diyarbakır province are given in Table 1.

Table 1. Corn cultivation areas in the districts in Diyarbakır province

Districts	Cultivated area (decare)	Number of questionaries (theoretical)	Number of questionaries (practical)
BAĞLAR	13000	5	5
BİSMİL	143000	52	59
ÇINAR	18320	7	8
KAYAPINAR	6000	2	4
SİLVAN	49340	18	18
SUR	13686	5	7
YENİŞEHİR	21500	8	22
Total	**264846**	**96**	**123**

*Diyarbakır Provincial Directorate of Agriculture and Forestry, 2018

The sampled villages and sample numbers were determined to best represent Diyarbakır province and its districts. After the questionnaires filled in the farms were reviewed separately, the data obtained were recorded. The questionnaires were analyzed using the SPSS Version 20.0 package program (IBM, 2011).

Conjoint Analysis

Conjoint analysis is a suitable analysis for evaluating predefined combinations of attributes that offer potential products or services and for understanding consumer responses. It also allows the analyst to understand the composition of customer preferences with a very realistic approach (Sönmez, 2006).

In the late 1960s and 1970s, psychologists working on a variety of seemingly unrelated problems developed a paradigm from which the policies of decision makers could be inferred (Luce and Tukey, 1964; Krantz, 1964; Tversky, 1967; Hoffman et al., 1968; Anderson, 1981). These researchers were primarily interested in identifying the “composition rules” that decision makers use to combine information into overall evaluations. The application to economics and the evaluation of objects was suggested by Lancaster (1966), who suggested that a consumer's utility for a good can be understood as a function of the utility for the components of the good. While psychologists presented the idea that the problem of understanding how people choose could be understood in terms of how they combine information about the object of choice, Lancaster presented the view that the relevant information to be combined is information about the components or attributes of the object.

Preference models can be divided into three according to individuals' preference estimates. These are linear model, quadratic model and partial utility model.
Linear preference model

$$S_j = \sum_{p=1}^{n} W_p Y_{jp} \quad (3)$$

(j=1, ...,m) (p=1, ...,n) was given by Srinivasan and Shocker (1973) and Parker and Srinivasan (1976). Here, j: the profile number indicating a combination of product attributes and levels, p: the number of levels of product attributes selected for the preference model, W_p: the weights of individuals for attribute p, and Y_{jp}: the level of attribute p for the jth profile. The weights $\{W_p\}$ are in general different for different individuals in the sample. Geometrically, the preference S_j can be represented as a projection of the stimulus $\{Y_{jp}\}$ on the vector $\{W_p\}$ in the n-dimensional feature space.

The quadratic model states that the preference S_j is negatively related to square of the distance (d_j^2) between the actual location of the jth profile Y_{jp} and its ideal point X_p. This model can be expressed as follows:

$$d_j^2 = \sum_{p=1}^{n} W_p \left(Y_{jp} - X_p\right)^2 \qquad \text{(j=1, ...,m) (p=1, ...,n)} \quad (4)$$

(Green and Srinivasan, 1978).

To draw conclusions from partial utilities, the researchers proposed an analysis of variance (ANOVA) model with main effects and interactions. ANOVA models have not previously been used to represent the judgment process, despite the fact that many judgment situations seem intuitively descriptive. The inferential qualities of the ANOVA technique can be applied to the study of judgment if judgment stimuli are treated as categorical process factors rather than random variables, and if the decisions to the stimuli are treated as dependent variables. The application is simple and straightforward: It is only necessary to prepare multidimensional decision stimuli by creating all possible combinations (patterns) of levels of stimuli in a full factorial design. Here orthogonality in stimulus dimensions is a must (Hoffman et al., 1968).

Let $y_{x_1 x_2 \ldots x_n}$ be the response or transformed response of the opinion profile (x_1,x_2,…,x_n) of any choice S_l. With a full factorial design, the, $y_{x_1 x_2 \ldots x_n}$ model is as follows::

$$y_{x_1 x_2 \ldots x_n} = \mu + \sum_{i=1}^{n} \alpha_{x_i}^{A_i} + \sum_{\substack{i,j=1 \\ i \neq j}}^{n} \alpha_{x_i x_j}^{A_i A_j} + \sum_{\substack{i,j,k=1 \\ i \neq j \neq k \neq i}}^{n} \alpha_{x_i x_j x_k}^{A_i A_j A_k} + \cdots + \alpha_{x_1 x_2 \ldots x_n}^{A_1 A_2 \ldots A_n} + e_{x_1 x_2 \ldots x_n} \quad (5)$$

Where, μ – overall mean, $\alpha_{x_i}^{A_i}$ – the effect of the factor A_i at level x_i, $\alpha_{x_i x_j}^{A_i A_j}$ – the effect of the factors A_i and A_j at levels x_i and x_j and $e_{x_1 x_2 \ldots x_n}$ is the random error.

The relative importance (RI) of each attribute was computed from the utilities (U_i). RI was defined as the percentage of the range assigned to each attribute to the variation of total ranges (Bernabeu and Tendero, 2005; Orme, 2010; Kibar and Mikail, 2018):

$$\mathrm{RI} = \frac{\max U_i - \min U_i}{\sum(\max U_i - \min U_i)} \times \%100.$$

RESULTS AND DISCUSSION

Information about the farmer

In the survey questions, information about the farmer includes the farmer's age, education level, marital status, number of individuals in the household and average monthly income. When the educational level of the farmers was analyzed, it was seen that 96.7% of the farmers were literate, 32 of them were graduates of primary school, 26 of them were graduates of secondary school, 44 of them were graduates of high school and 17 of them were graduates of university (Table 2).

Table 2. Demographic information about the farmers

Features	Levels	n	%
Education level	Illiterate	4	3.3
	First school	32	26.0
	Middle school	26	21.1
	High School	44	35.8
	University	17	13.8
Marital status	Married	106	86.2
	Single	17	13.8
Average monthly income	Less than 1400 Tl	4	3.3
	Between 1401-3000 Tl	50	40.7
	More than 3001 Tl	69	56.1

It is seen that 86.2% of the farmers who participated in the survey were married, 13.8% were single, 3.3% had a monthly income of less than 1400 TL, 40.7% had a monthly income between 1400-3000 TL and 56.1% had a monthly income of more than 3000 TL (Table 2). Descriptive statistics on the age of the farmers and the number of individuals in the household are given in Table 3.

Table 3. Descriptive statistics on age of farmers and number of household members

Features	N	Mean	Std. D.	Minimum	Maximum	Median
Age	123	40.49	8.960	21	68	40
Number of household members	123	6.47	2.299	2	13	6

It is seen that the youngest of the 123 farmers participating in the survey is 21 years old and the oldest is 68 years old, and the average age is 41 years old. When the number of individuals in the household is analyzed, it is seen that the number of individuals in the household consists of at least 2 and at most 13 people and the median value is 6 (Table 3). In the study conducted by Adalıoğlu et al. (2017), while the average age was approximately 51 years, the average age of the farmer was younger in our study, and while the number of individuals in the household was 4, the average number of individuals in the household was 6 in our study. In the study conducted by Ayçiçek and Karakaya (2022) in Bingöl, the ages of the surveyed farmers ranged from 28 to 80, with an average age of approximately 48.5 years. The percentage of farmers who graduated from primary and high school was 30.6%, those who graduated from middle school made up 37.1%, and the percentage of farmers with a university degree was determined to be 1.6%.

Information about the farm

In the survey we conducted, 19.5% of the farmers stated that the ploughed land is rented, 25.2% of the farmers stated that the land is shared, and 35.8% of the farmers stated that the land belongs to them. In the answers given to the same questions, 2.4% of the farmers stated that some of the ploughed land is shared and some of it is rented, 13.8% stated that some of it is owned and the rest is rented, and 3.3% stated that they cultivate both on shared land and on the land they own (Table 4).

Table 4. Information about the farm

Questions	Answers	n	%
Ownership status of the ploughed land	For rent	24	19.5
	Shareholder	31	25.2
	Property owner	44	35.8
	For rent and shareholding	3	2.4
	Rent and ownership	17	13.8
	Share and property owner	4	3.3
Type of crop cultivated	Corn	43	35.0
	Corn and cotton	51	41.5
	Corn and wheat	10	8.0
	Corn, cotton and wheat	19	15.5
Origin of the cultivated product	Local	30	24.4
	Foreigner	31	25.2
	Doesn't matter	62	50.4

In the answers to the question on the type of crops grown, 35% of the farmers stated that they planted only corn, 41.5% planted corn and cotton, 8% planted corn and wheat together, and 15.5% planted all three crops, corn, wheat and cotton, in the same season (Table 4). These percentages vary each season according to crop prices and field rotations. When the farmers were asked about the origin of the crops they grow, 24.4% of the farmers stated that they prefer local seeds, 25.2% of the farmers prefer foreign seeds, and 50.4% of the farmers stated that it does not matter whether the seeds are of local or foreign origin (Table 4).

When the statistical data on the land holding of the farmers participating in the survey are analyzed, it is seen that the minimum land holding is 100 da and the maximum is 2000 da and the median value is 340 da. When the number of generations in agriculture is examined, it is seen that the minimum is 1 and the maximum is 5 and the median value is 2. Likewise, the number of generations growing corn is at least 1, at most 3 and the median value is 2 (Table 5).

Table 5. Some descriptive statistics about the farm

Features	N	Mean	Std. D.	Minimum	Maximum	Median
Land holdings (da)	123	481.38	416.742	100	2000	340
Number of generations in agriculture	123	2.80	.478	1	5	3
Number of generations growing corn	123	1.56	.560	1	3	2
The year you started farming	123	-	-	1970	2014	2000
The year you started growing corn	123	-	-	1996	2016	2010
Distance of the land you farm from home	123	6.16	6.111	1	30	5
Yield (kg/da)	123	1481.83	129.795	1150	1800	1500
Amount of product sold (tons)	123	415.58	345.639	100	2550	300

When the statistical values related to the year of starting farming are analyzed, it is seen that the earliest year of starting farming was 1970, the latest year was 2014 and the median value was 2000. Likewise, when asked about the year of corn cultivation, it is seen that the earliest year of corn cultivation was 1996, the latest year was 2016 and the median value was 2010. When we look at the statistical data of the question about the distance of the farming land from home, it is seen that the closest distance of the land is 1 km, the farthest distance is 30 km and the average is 6.16 km. According to the statistical data of the answers given to the farmers about corn yield, it is seen that the lowest yield is 1150 kg/da, the highest yield is 1800 kg/da and the average yield is 1482 kg/da. According to the statistical data on the amount of products sold, it is seen that the farmers sold a minimum of 100 tons and a maximum of 2550 tons of products after harvest, and the average of the products sold was 416 tons.

Information about farming

When asked whether the farmers did soil analysis or not, it was stated that 39.8% did and 60.2% did not (Table 6).

When the respondents were asked about the soil quality of their fields, 75.6% of the farmers evaluated the soil quality between 7-8 points out of 10 (Table 6). 90.2% of the farmers reported that their land was irrigated, 9.8% of the farmers reported that they also practiced dry farming. In response to the question about the information received by the farmers, 83.7% of the respondents stated that they received support from firm representatives, while 5.7% of the other respondents stated that they received information from family members. 4.9% of the participants stated that they received information from Provincial and District Directorates of Agriculture, 1.6% from universities and 4.1% from private consultancy services. When asked if they try new products, 61% of the participants answered yes, 29.2% were undecided and 9.8% said no. To the question of company reliability of the products, 39.1% of the farmers answered very reliable, 52% answered medium and 8.9% answered less reliable. When the participants were asked about the marketing status of the harvested products, 83.3% answered easy and 16.7% answered difficult. Among the agricultural implements and equipment, 9.8% had only a tractor, 0.8% had only planting implements, and 89.4% had both a tractor and planting implements. 66.6% of the participants stated that their land was irrigated with flood irrigation, 11.4% with sprinkler irrigation, 22% with sprinkler and flood irrigation. When asked which of the variety characteristics were taken into consideration when cultivating corn, 51% of the respondents stated that the hectoliter should be high, 39.8% stated that the variety should not have soil selectivity, 24.4% stated that the variety should have early dehumidification, 23% stated that the variety should not lie down and 4.1% stated that the variety should remain green until the harvest period (Table 6).

Table 6. Information about farming

Questions	Answers	n	%
Do you have soil analysis?	Yes	49	39.8
	No	74	60.2
How do you rate soil quality out of 10?	3	2	1.6
	4	1	0.8
	5	3	2.4
	6	7	5.7
	7	46	37.5
	8	47	38.2
	9	9	7.3
	10	8	6.5
Type of cultivated farming	Irrigated farming	111	90.2
	Irrigated and dry farming	12	9.8
Knowledge received about cultivation	Provincial and District Directorate of Agriculture	6	4.9
	University	2	1.6
	Private consultancy	5	4.1
	Family members	7	5.7
	Company representatives	103	83.7
Willingness to try a newly developed product	Yes	75	61.0
	Unsure	36	29.2
	No	12	9.8
Company reliability of the purchased product	Very reliable	48	39.1
	Moderately reliable	64	52.0
	Less reliable	11	8.9
Marketing of the harvested product	Easy to sell	100	83.3
	Hard to sell	20	16.7
Agricultural tools and equipment	Tractor	12	9.8
	Sowing equipment	1	0.8
	All	110	89.4
Field irrigation type	Flood irrigation	82	66.6
	Sprinkler irrigation	14	11.4
	Flood and sprinkler irrigation	27	22.0
Variety features desired in the cultivated product*	Hectoliter	63	51.0
	Lack of soil selectivity	49	39.8
	Early demotion	30	24.4
	Lying down	25	20.3
	Staying green	5	4.1

*: It was offered the option to choose more than one answer in the question

Application results of conjoint analysis

Selection of Attributes and Attribute Levels

Since the number of corn grain traits and levels of these traits is too much, previous studies and the researcher's own experience were used to select the traits and levels to be used in the research. When the number of combinations is very high, it is very difficult to do this in practice. For this reason, 5 traits that best describe the corn seed were selected for the study (Fig. 2).

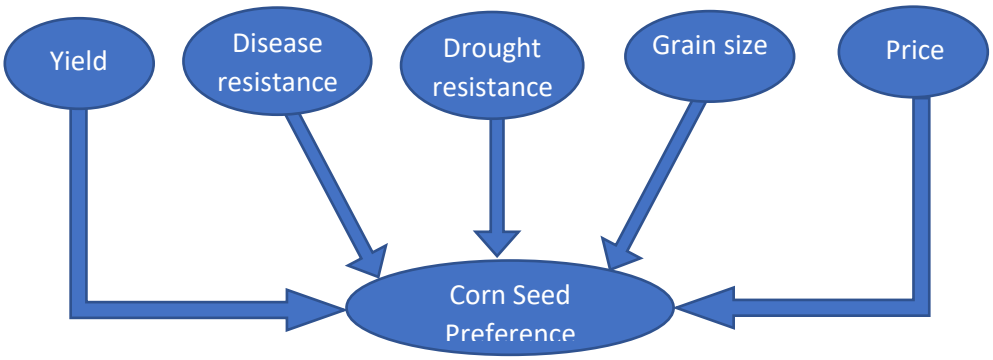

Figure 2. Factors affecting farmers' preference for corn seed

The number of levels for the attributes was determined in a way that would not excessively increase the number of choice cards to be presented to the respondents. The selected features and their levels are given in Table 7.

Table 7. Selected attributes and their levels

Attribute	Level
Price	Low
	Medium
	High
Yield	Low
	Medium
	High
Disease resistance	Low
	Medium
	High
Drought resistance	Low
	Medium
	High
Grain size	Small
	Medium
	Large

Creation of the orthogonal plan

A reduced design model was used for the conjoint analysis. In a full factorial design, if 5 attributes and their levels are calculated, there are 3x3x3x3x3=243 choice cards. It is not possible to present 243 choice cards to respondents and have them answer and analyze them. Therefore, a reduced design was chosen. For this, an orthogonal design was used. With this method, 243 selection cards can be reduced to 22. In this part of the application, the orthogonal design was obtained with the help of SPSS package program. The 22 selection cards obtained with the orthogonal design to be used in the study are shown in Table 8.

Table 8. Cards created for corn seed preference

	Card No	Price	Yield	Disease resistance	Drought resistance	Grain size
1	1	Low	Medium	High	High	Small
2	2	Medium	High	Medium	Medium	Small
3	3	Medium	High	High	Low	Medium
4	4	High	High	Low	Low	Small
5	5	High	Medium	High	Medium	Small
6	6	Low	Medium	Medium	Low	Large
7	7	High	Medium	Medium	Low	Medium
8	8	Medium	Medium	Low	Medium	Medium
9	9	Low	Low	Low	Medium	Medium
10	10	Medium	Low	High	Low	Large
11	11	High	Low	Medium	High	Medium
12	12	High	Low	High	Medium	Large
13	13	Low	Low	Low	Low	Small
14	14	Low	High	Medium	Medium	Large
15	15	Medium	Medium	Low	High	Large
16	16	Low	High	High	High	Medium
17	17	Medium	Low	Medium	High	Small
18	18	High	High	Low	High	Large
19[a]	19	Low	Low	Medium	Medium	Large
20[a]	20	High	Low	Medium	High	Small
21[a]	21	Low	Medium	Low	Low	Medium
22[a]	22	Low	Low	Medium	High	Large

a.Holdout

The cards were then designed as follows for presentation to the producer (Fig. 3).

Card 4		Card 5		Card 6	
Price	High	Price	High	Price	Low
Yield	High	Yield	Medium	Yield	Medium
Disease resistance	Low	Disease resistance	High	Disease resistance	Medium
Drought resistance	Low	Drought resistance	Medium	Drought resistance	Low
Grain sze	Small	Grain sze	Small	Grain sze	Large

Figure 3. Examples of cards used in the research

Results of conjoint analysis

As a result of the conjoint analysis, the attributes emphasized during corn seed purchase are listed as follows: firstly, yield (60.41%), secondly, drought resistance (11.96%), thirdly, disease resistance (11.85%), fourthly, price (8.81%) and lastly, grain size (6.98%) (Figure 4). The Kendall's Tau value of 0.935 (sig.=0.000), which is the representative power of the model, was found to be at an acceptable level.

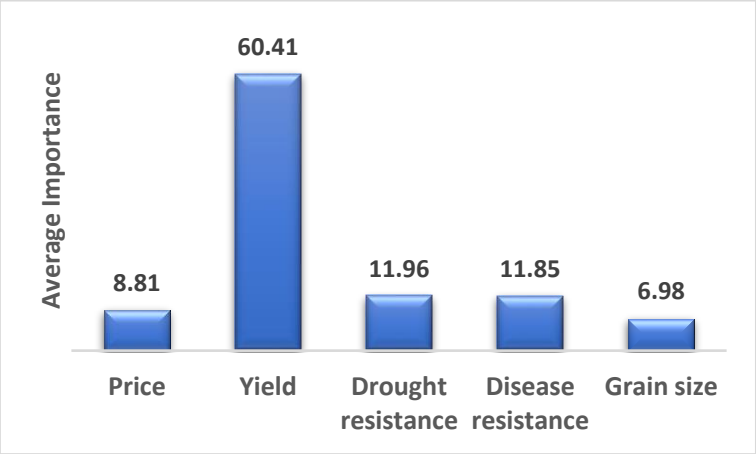

Figure 4. Relative importance of factors

According to the research results of the similar study conducted by Adalıoğlu et al. (2017) in Aydın province and Söke district, seed price ranked second with a rate of 18.69% in cotton seed variety preference. In our study, seed price is at the last place with 8.81% importance level. The degree of importance found for the price trait was lower than the study of Adalıoğlu et al. (2017). According to the results of the study conducted by Sánchez-Toledano et al. (2017), new crop seed varieties are preferred more than traditional varieties, so that the importance levels of higher yield, disease resistant variety preferences are high, which is similar to our study. In the study conducted by Örmeci Kart et al. (2017), it was determined that the most important factor in potato seed preference was industrial type and disease resistance came after yield performance when buying seeds. In this aspect, in our study, yield is high and disease resistance comes later. For this reason, there is a similarity with our study. In a similar study conducted by Ayhan and Armağan (2018) in Söke, Germencik and Koçarlı districts of Aydın province, they examined the importance levels of yield, quality, durability and price criteria affecting the variety selection of cotton producers. It was determined that quality was 28%, yield 25%, price 24% and resistance 23% important. In our study, it is seen that yield and disease resistance have a similar importance ranking, while price has a low level of importance in our study. In the study conducted by Baki et al. (2017) through face-to-face interviews in Izmir in 2014, according to the results of conjoint analysis, it was determined that the most important factor determining consumers' preference for strained pine honey was the place where honey was purchased (38.48%), followed by the region where honey was produced (30.65%), label (11.60%), price (10.88%) and color (8.39%). Although price seems to be important in market research at first glance (Nelson et al., 2005; Patıl et al., 2006; Özel and Ceylan, 2016; Toklu, 2017), it is not in the first place in terms of importance in our study and in a few other studies (Claret et al, 2012; Annunziata and Vecchio, 2013; Adalıoğlu et al., 2017; Baki et al., 2017; Örmeci Kart et al., 2017; Sánchez-Toledano et al., 2017; Ayhan and Armağan, 2018; Özüak and Keskin, 2021).

The utility function estimates of the levels of these factors are shown in Table 9:

Table 9. Utility function estimates

Attributes	Levels	Utility	Std. Error
	Low	-.391	.223
Price	Medium	-.782	.447
	High	-1.173	.670
	Low	5.327	.223
Yield	Medium	10.653	.447
	High	15.980	.670
	Low	1.090	.223
Disease resistance	Medium	2.180	.447
	High	3.270	.670
	Low	.993	.223
Drought resistance	Medium	1.986	.447
	High	2.980	.670
	Small	.259	.223
Grain size	Medium	.519	.447
	Large	.778	.670
(Constant)		-5.057	1.016

Among the levels offered for the yield attribute, high (15.98) provided the highest level of utility, while low (5.33) was the least preferred level (Figure 5).

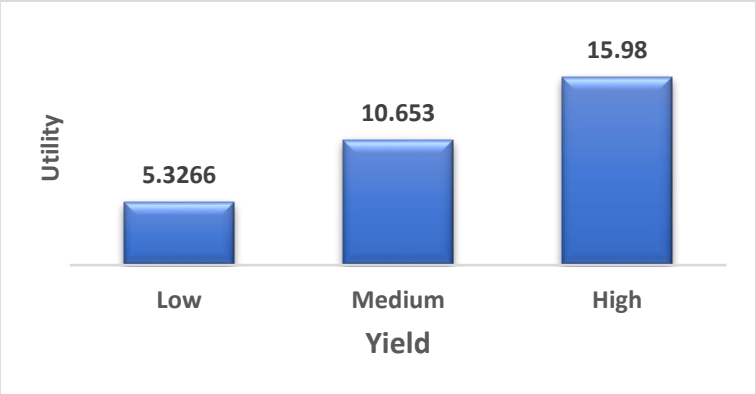

Figure 5. Utility values for yield levels

Among the levels presented for drought tolerance, high (2.98) was the most preferred level and low (0.99) was the least preferred level (Figure 6).

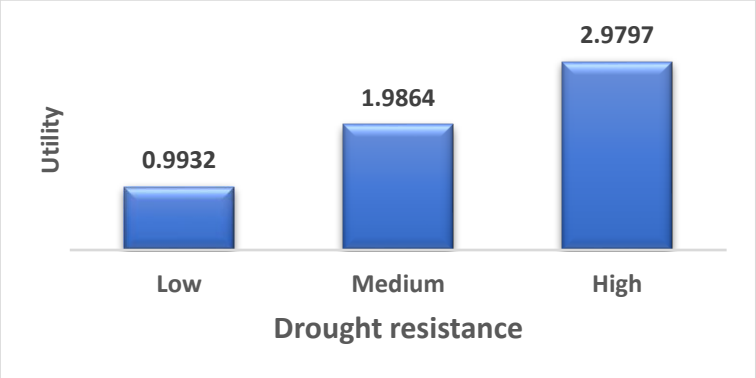

Figure 6. Utility values for drought tolerance levels

Among the levels presented for plant disease resistance, high (3.27) was the most preferred level, while low (1.09) was the least preferred level (Figure 7).

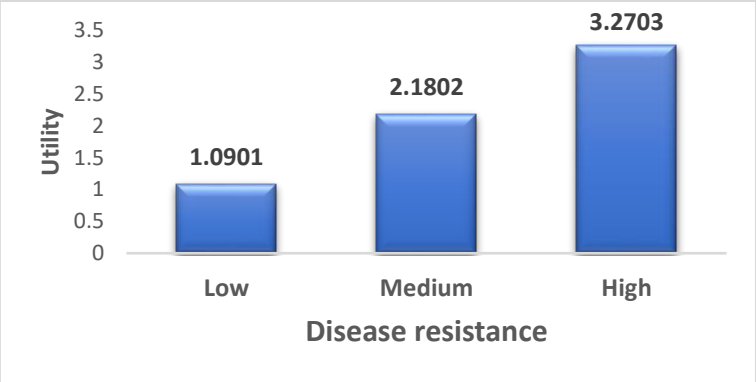

Figure 7. Utility values for disease resistance

Among the levels offered for the price of seed, low (-0.39) was the most preferred level, while high (-1.17) was the least preferred level (Figure 8).

Figure 8. Utility values for price

Finally, large (0.78), medium (0.52) and small (0.26) grain size characteristics are preferred in corn (Fig. 9).

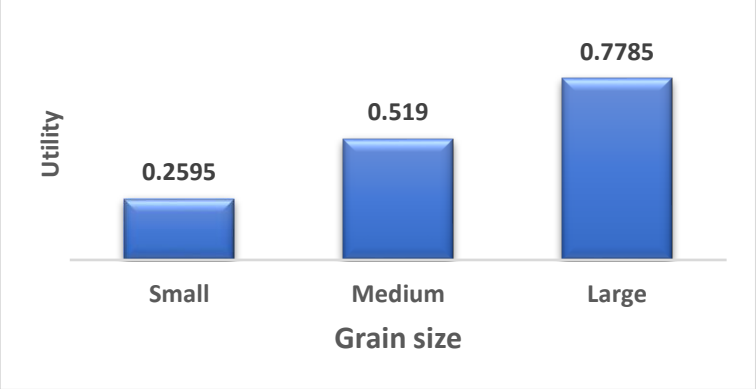

Figure 9. Utility values for grain size levels

CONCLUSIONS

The main objective of this study is to determine the preferences of corn producers in Diyarbakır province in purchasing corn seed varieties by using conjoint analysis. Factors such as price, high yield, drought and disease resistance, as well as the suitability of the crops for their respective regions are of significant value. Conjoint analysis shows companies the paths to follow in determining producer preferences and demands by considering these product characteristics. In the surveys conducted, many different demands come up when asked about many characteristics. With the help of this analysis, it is possible to find out which characteristics of the product are more important for the producer. First of all, although yield expectations are at the forefront, it should not be forgotten that the region struggles with extreme droughts. When choosing a variety, the disease caused by drought and early planting, the fact that the plants are still green and do not lie down during harvesting are among the top preferences. Although all these factors actually affect yield, companies should not ignore the

wishes and preferences of farmers. As a result of the analysis, 60.41% of the importance ranking of the selected traits in grain corn seed preference was found as yield, 11.96% as drought, 11.85% as disease, 8.81% as price, and 6.98% as grain size. Companies have to develop new products while improving existing products or meeting the ever-changing preferences and demands of consumers. For this reason, they need to make use of R&D and marketing departments. While R&D departments meet the needs of producers, marketing teams have to conduct various market researches and know the demands of producers. All these researches are possible with scientific studies. For this reason, conjoint analysis studies are a very reliable guide for all sectors.

Declaration of Competing Interest: The authors declare that they have no conflicts of interest.

Researchers' Contribution Ratio Declaration Summary: The authors declare that they have contributed equally to the article.

¥:The study is based on the first author's master's thesis.

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REFERENCES

Adalıoğlu, H. A., Akkuş, C. İ., Abay, C. ve Kart, Ö. Ç. M. 2017. Aydın ili Söke ilçesinde pamuk üreticilerinin tohum tercihini etkileyen faktörler. Anadolu Tarım Bilim Dergisi, 32: 189-196.

Anderson, N. H. 1981. Foundations of information integration theory. New York: Academic Press.

Annunziata, A. and Vecchio, R. 2013. Consumer perception of functional foods: A conjoint analysis with probiotics. Food Quality and Preference, 28(1): 348–355.

Anonymous, 2017. Hububat Raporu. Türkiye Toprak Mahsulleri Ofisi. https://www.gtb.org.tr/dosya/pdf/hububat-raporu-2017.pdf Erişim tarihi: 2017.

Ayçiçek M, Karakaya E (2022) Bingöl İli Silajlık Mısır Üretim Faaliyetinin Mevcut Durumu ve Ekonomik Analizi. ÇOMÜ Zir. Fak. Derg. (COMU J. Agric. Fac.) 2022:10(2): 254-266, ISSN: 2147–8384 / e-ISSN: 2564–6826.

Ayhan, C. ve Armağan, G. 2018. Pamuk üreticilerinin çeşit tercihini etkileyen faktörlerin belirlenmesinde konjoint analizi uygulaması: Aydın ili örneği. Tarım Ekonomisi Dergisi, 24 (2018): 225-231.

Baki, F., Saner, G., Adanacıoğlu ve H., Güler, D. 2017. Türkiye'de süzme çam balına yönelik tüketici tercihlerinin konjoint analizi: İzmir ili örneği. Balkan ve Yakın Doğu Sosyal Bilimler Dergisi, 3 (02): 50.

Bernabéu, R. and Tendero, A. 2005. Preference structure for lamb meat consumers. A Spanish case study. Meat Science, 71(3), 464-470.

Claret, A., Guerrero, L., Aguirre, E., Rincon, L., Hernandez, M. D., Martinez, I., Benito-Peleteiro, J., Grau, A. and Rodriguez-Rodriguez, C. 2012. Consumer preferences for seafish using conjoint analysis: Exploratory study of the importance of country of origin, obtaining method, storage conditions and purchasing price. Food Quality and Preference, 26(2): 259-266.

Çekmez, U. 2014. Çanakkale ili mısır ekim alanlarında zararlı olan mısır kurtları (Sesamiaspp ve Ostrinianubilalishbn.)'nın tespiti ve popülasyon gelişmesinin belirlenmesi. Çanakkale Onsekiz Mart Üniversitesi, Fen Bilimleri Enstitüsü, Yüksek Lisans Tezi, Çanakkale, 44s.

Dowswell, R. C., Paliwal, R. L. and Cantrell, R. P. 1996. Maize in the Third World. Westview Press. Colorado, USA, 268 p.

Geçit, H., Çiftçi, Y. ve Ünver, S. 1988. Tarla Bitkileri. A.Ü.Z.F. Ders Kitabı: 229, Yayın No: 1037, Ankara.

Green, P. E. and Srinivasan, V. 1978. Conjoint measurement in consumer research: Issues and outlook. Journal of Consumer Research, 5: 103–120.

Güneş, T. ve Arıkan, R. 1988. Tarım Ekonomisi İstatistiği. Ankara Üniversitesi Ziraat Fakültesi Yayınları, No: 1049, Ankara.

Hoffman, P. J., Slovic, P. and Rorer, L. G. 1968. An analysis of variance model for the assessment of congural cue utilization in clinical judgment. Psychological Bulletin, 69:338–49.

IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.

Kibar, M. and Mikail, N. 2018. Application of conjoint analysis to determine consumers' red meat preferences in Siirt province. Scientific Papers. Series D. Animal Science, LXI (1): 303-306.

Krantz, D. H. 1964. Conjoint measurement: The Luce-Tukey axiomatization and some extensions. Journal of Mathematical Psychology, 1: 248–77.

Lancaster, K. J. 1966. A new approach to consumer theory. The Journal of Political Economy, 74: 132–57.

Luce, R. D. and Tukey J. W. 1964. Simultaneous conjoint measurement: A new type.

Nelson, R. G., Jolly, C. M., Hinds, M. J., Donis, Y. and Prophete, E. 2005. Conjoint analysis of consumer preferences for roasted peanut products in Haiti. International Journal of Consumer Studies, 29: 208-215.

Nogay, Y. and Azabağaoğlu, M. Ö. 2024. Analysis of Factors Affecting Corn Seed Preferences of Producers: Case of Sakarya Province, Turkey. *Tekirdağ Ziraat Fakültesi Dergisi*, *21*(1). https://doi.org/10.33462/jotaf.1244525

Orme, B. 2010. Getting Started with Conjoint Analysis: Strategies for product design and pricing research. Second Edition. Madison, Wis.: Research Publishers LLC.

Örmeci Kart, M. Ç., Abay, C. F., Güngör, S. and Özer, Z. 2017. Seed supply and seed preferences of potato farmers: Niğde Central and Izmir Ödemiş Provinces. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 17: 239-250.

Özel, G. ve Ceylan, R. 2016. Dondurma tüketimi tercihini etkileyen özelliklerin konjoint analizi ile belirlenmesi. Alpha Numeric Journal, 4(2): 147-158.

Özüak, A. and Keskin, İ. 2021. Identifying preferences of red meat consumption by means of conjoint analysis. Selcuk Journal of Agriculture and Food Sciences, 35(1): 18–23.

Parker, B. R. and Srinivasan, V. 1976. A consumer preference approach to the planning of rural primary health-care facilities. Operations Research, 24(5): 991-1025.

Patıl, S. B., Mahajanashetti, B. H. and Vijayakumar, H. S. 2006. A conjoint analysis of farmers preferences towards public and private sector seeds in Karnataka. Prasad Journal of Agricaltural Sciences, 19(3): 574-580.

Raghavarao, D., Wiley, J. B. and Chitturi, P. 2011. Choice-based conjoint analysis: Models and designs. Taylor and Francis Group, LLC.

Sánchez-Toledano, B. I., Kallas, Z. and Gil, J. M. 2017. Farmer preference for improved corn seeds in Chiapas, Mexico: A choice experiment approach. Spanish Journal of Agricultural Research, 15 (3): e0116.

Saygılı, R. 2015. http://cografyaharita.com/haritalarim/4l_diyarbakir_ili_haritasi.png Erişim Tarihi 04.09.2019.

Sönmez, H. 2006. Müşteri tercihleri için konjoint analizi uygulaması: Ev bilgisayarı nasıl seçilir. Anadolu Üniversitesi Sosyal Bilimler Dergisi, 2: 185-196.

Srinivasan, V. and Shocker, A. D. 1973. Linear programming techniques for multidimensional analysis of preferences. Psychometrika, 38, 337–369.

TÜİK, 2018. Tarım, Fiyat ve Dış Ticaret Veritabanı. (Erişim: 16/07/2018)

Toklu, İ. T. 2017. Consumer preferences for the attributes of sunflower oil: An exploratory study with conjoint analysis. International Journal of Academic Research in Business and Social Sciences, 7(1): 39-55.

Tversky, A. 1967. A general theory of polynomial CA measurement. Journal of Mathematical Psychology, 4: 1–20.