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Agricultural insurance preferences of apricot farmers: the case of Malatya

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ABSTRACT: *Malatya is an important production centre of apricots in Turkey, and the world. However, a major problem causing product loss, is late spring frosts. Cold damages the flowers and thus, fruit set and yield decrease. As a result, the farmer's income fluctuates from year to year. This study, stated apricot farmers demographics, and technical features of 52 interviewed apricot farms, in Malatya. Also, conjoint analysis (CA) is used to identify the farmers' preferences for agricultural insurance attributes. This method investigated the joint effect of a set of independent variables, on an ordinal scale of a measurement-dependent variable. Of the farmers, 76.9% have done agricultural insurance last year.*
Key words: *Prunus armeniaca, late spring frosts, conjoint analysis, insurance expert.*

Avaliação das preferências de seguro agrícola dos agricultores de damasco: o caso de Malatya

RESUMO: *Malatya é um importante centro de produção de damascos na Turquia e no mundo. No entanto, um grande problema que causa a perda de produto são as geadas do final da primavera. O frio prejudica as flores e, com isso, a frutificação e a produção diminuem. Como resultado, a renda do agricultor varia de ano para ano. No estudo, objetiva-se constatar a demografia dos produtores de damasco e características técnicas de 52 fazendas de damasco entrevistadas, em Malatya. Além disso, a análise conjunta é usada para identificar as preferências dos agricultores por atributos de seguro agrícola. Este método investiga o efeito conjunto de um conjunto de variáveis independentes, em uma escala ordinal de uma variável dependente de medição. 76,9% dos agricultores fizeram seguro agrícola no ano passado.*
Palavras-chave: *Prunus armeniaca, geadas do final da primavera, análise conjunta, especialista em seguros.*

INTRODUCTION

Apricot, known as *Prunus armeniaca L,* belongs to the Rosalesae order, Rosaceae family, Prunus genus. The origin center is reported in China, Central Asia and the Near East. These fruits have 3 important antioxidant molecules, vitamin C, β-carotene and polyphenolic substances. Further, the richness of apricot in terms of protein, mineral, sugar and fiber content increases its importance in terms of nutrition (TOMÁS-BARBERÁN et al., 2013). Apricot is usually consumed as table but also as dried or processed. Besides, sweet kernels are consumed as snacks and bitter ones are used as raw materials in the industry. Although, apricots are widespread in the world, most of the production is provided by the Mediterranean Basin. Turkey produces the highest quality due to several ecological advantages. The most important apricot growing region is Eastern Anatolia, especially Malatya province. (ASMA, 2011). In Turkey, according to 2017 data, the amount of total production was 985 thousand tons and 673 thousand tons in Malatya (FAOSTAT, 2019; TURKSTAT, 2019). Approximately more than half of the production is met by Malatya. Therefore, it is an important production and exportation center of dried apricots, in Turkey and in the world.

One major problem that significantly affects apricot production in Malatya, causing product loss, is late spring frosts. Flowers are damaged and thus fruit set decreases, reducing yield. As a result, the farmer's income fluctuates from year to year. For the sustainability of agricultural production, agricultural insurance is required (AKCAOZ et al., 2006). In

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this context, agricultural insurance in Turkey started in 1995. Later, the Agricultural Insurance Law was launched in 2005, and today it is widespread (YAZGI & OLHAN, 2018). Many research were carried out in different crops and regions related to agricultural insurance in Turkey (AKCAOZ et al., 2006; IKIKAT TUMER 2011; AYDIN et al., 2016; KIZILOGLU, 2017; OLMEZ CANGI et al., 2017; KUTLAR & AKCAOZ, 2022). Similar studies were conducted in Malatya (CUKUR et al., 2008; SARIBAS 2012; PAKSOY & ASLAN, 2020) It was revealed that late spring frost was the main problem for production, in this location. Crop insurance is a coping mechanism and ex-ante adaptation measure by which protection from potential risk is transferred from the insurance organization to the insurer (FARZANEH et al., 2017). According to the above remarks, the general aim of the study is to state the most important factor influencing insurance adoption by apricot farmers. Results will help a better understanding of farmers' behavior towards crop insurance and contribute to more sustainable crop insurance schemes in the future.

MATERIALS AND METHODS

The main goal of this study is to determine the criteria that apricot farmers in Malatya for agricultural insurance. For this purpose, the proportional sample volume method was used to determine the number of farmers interviewed (NEWBOLD, 1995). Main data are obtained in the face-to-face survey with arranged forms, which was carried out with the apricot farmers in Malatya Province Dogansehir district in June 2019. This sample size method is most applicable for studies, which involve sampling from a small area (JAYARAMAN, 1999).

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

n=sample volume

N= number of apricot farmers (3300)

p= rate of apricot farmers (p is taken 0.5 to reach maximum sample size)

σ^2_{px} = population variance (%85 confidential intervals and %10 error margin)

According to these calculations, the sample size was of 52 farmers. Besides the survey, relevant literature was used. The data of survey forms were first transferred to the computer and were presented in tables. These data were interpreted by using the cross-table, Likert scale, arithmetic, and weighted averages method. Single product budget analysis method was used to determine production costs. Accordingly, the income-cost situation was calculated only for the apricot, not for all crops grown in the interviewed farm. As a result of the apricot production, the gross product value was calculated by multiplying the amount of crop and the sales price. Gross profit was calculated by subtracting the variable costs from gross production value (TASKIN & DEMIRCAN, 2014).

Conjoint analysis (CA) is used to determine factors which affected farmers' agricultural insurance choices. CA is the preferred marketing research to analyze consumer preferences for products and services. It is a popular marketing research technique which is used to investigate the joint effect of a set of independent variables on an ordinal scale of a measurement dependent variable. CA is widely used by farmer (NELSON, 2013). KOTLER (2000) defines CA as "a method for deriving the utility values that consumers attach to varying levels of a product's attributes." The first step of the CA is to determine probable factor and features which affect farmers' decision. Generally, several variables are six or seven in the CA. According to the literature many different factors affect farmers' insurance preferences (SHERRICK et al., 2004; CUKUR et al., 2008; KUOAME & KOMENAN, 2012; BRICK & VISSER 2015; JIN et al., 2016). Insurance coverage, expert experience, second check, policy amount and payment options are the five specified features in the study. The number of selection cards including all combinations is 2x3x2x3x3= 108. Sixteen cards were generated with the help of orthogonal design calculated by SPSS package program because it is not possible to get reliable answers by offering all the 108 cards to the farmers. The 16 cards composed and visualized Cards are given to farmer, which ranked from the most to the least prefer.

RESULTS AND DISCUSSION

Interviewed farmers have an average 45 of years old and have a secondary school education approximately 10 years in research areas. Agricultural experience is averagely 23 years, 78.80 % of the interviewed farmers do not have other income sources, and this shows that apricot is the main agricultural crop in that region. The average apricot orchard area is calculated 3.11 hectare. In a study by CUKUR et al (2008), the average apricot orchard area was reported to be of 3.69 hectares. It is noteworthy that apricot orchards are smaller in the research area compared to 10 years ago. It has been calculated that 95.18% of the apricot orchard is property land and the rest of it constitute from rented or collective land. All farms

are irrigated averagely four times a year. The rate of collective lands is lower than Turkey's average in study regions this is because of horticulture farming is a long-term activity. Orchards are averagely constituted from 2 plots per farmer and orchard age is calculated 19 years (Table 1).

Of the farmers 67.30% grow organic apricot. In contrast to the study conducted by OLMUS (2016), it was reported that most of the farmers interviewed made more conscious production due to organic farming. Of the farmers, 69.20% stated that they preferred Kabaasi and 65.40% stated that they grow Hacihaliloglu varieties. The same result found by UCAR et al., (2017) in Malatya province. Almost 89% of the farmers bought their nurseries from the company. The rate of doing soil and leaf analysis is calculated at 78.80 %; 88.50 % of the farmers preferred base dressing while only 34.60% do leaf fertilization. Half of the orchards are irrigated by cablegate irrigation, 48.10% irrigated with drip irrigation system and the rest of the farmers use traditional flood irrigation method. All the interviewed farmers were pruned and the rate of chemical use was 96.20%. Only 1.9 % of the interviewed farmers preferred biological control and 1.9 % does not take any action to combat pests and diseases.

It has been determined that almost 52% farmers benefited from pesticide seller, 40 % from own experiences, only 1.9 % of each from a neighbor, chamber of agriculture, ministry, or private counselor (Table 2).

It was determined that total variable costs are USD 2135.90 per hectare for apricot production. Similar result was obtained by (UCAR et al., 2017). 50.96% of the variable costs were composed of labor costs, 13.29% were insurance costs, 9.35% were from marketing cost, 9.29% were from pesticide cost, 6.36% were fertilizer costs, 5.69% from irrigation, 5.44% from fuel cost and the remaining 3.58% were from drying cost. Labor cost has the highest share in total variable cost (Table 3). Confirming this, PAKSOY & ASLAN (2020) and UCAR et al., (2017) stated that high labor cost is one the main problem faced by farmers.

Table 4 shows some profitability indicators of interviewed apricot orchards. In total farms had 2.74 tons of dry apricot and 0.12 tons of fresh. Dried apricot selling price per tones calculated USD 1793.90 and USD 533.81 for fresh apricot. Gross production value is to USD 5028.58 per hectare. After deducting the variable costs, the gross production value gross margin was calculated as USD 2892.67. Thus, our data are similar to the results obtained by UCAR et al., (2017). This is an indicator that apricot growing is a profitable activity in the study region.

Results shows. that, 76.9% of the farmers have been done agricultural insurance last year. CUKUR et al., (2008) have been determined that agricultural insurance rate was 10.76% and GUNDUZ (2015) calculated as 30%. This datum pointed out government support agricultural insurance schemes has been succeeded. Similarly, KIZILOGLU (2017) reported to be 58.89% of the farmers have the agricultural insurance. Average insurance period was calculated at almost 9.5 years. Only 5% of the farmers have been satisfied from policy price and 52.5% was stated that they are intermediate to policy price and average satisfaction score is calculated 2.50 from policy price. YAZGI & OLHAN (2018) also

Table 1 - Demographics of apricot farmers and general feature of apricot orchards.

	Frequency	Mean (year)	%
Age	52	45.04	-
Experience	52	22.71	-
Education	52	9.62	-
Non-farm income			
Yes	11	21.20	
No	41	78.80	
Own ownership area of apricot orchard (hectare)	52	2.96	95.18
Rented area of apricot orchard (hectare)	52	0.11	3.54
Collective area of apricot orchard (hectare)	52	0.04	1.28
Total apricot orchard area (hectare)	52	3.11	100.00
Number of plots per farmer	52	1.63	-
Orchard age (year)	52	19.42	-
Irrigation count (times)	52	3.67	-

Table 2 - Technical features and information sources of interviewed apricot farms.

	Frequency	%
Organic production	35	67.30
Varieties*	Frequency	%
Kabaasi	36	69.20
Hacihaliloglu	34	65.40
Nursery purchasing place	Frequency	%
Nursery company	46	88.50
Own graft	6	11.50
Rate of soil and leaf analysis	41	78.80
Base dressing / fertilization	46	88.50
Leaf fertilization	18	34.60
Irrigation method	Frequency	%
Cablegation	26	50.00
Drip irrigation	25	48.10
Traditional flood irrigation	1	1.90
Pest and disease management	Frequency	%
Chemical pesticide usage	50	96.20
Biological control	1	1.90
No action	1	1.90
Rate of hail damage and cold weather insurance	40	76.9
Harvesting method	Frequency	%
Mechanical harvesting	16	30.80
Hand picking	36	69.20
----------Information sources----------		
Pesticide seller	27	51.9
Own experiences	21	40.4
Neighbour	1	1.9
Chamber of agriculture	1	1.9
Ministry of agriculture and forestry	1	1.9
Private counsellor	1	1.9

*Farmers can grow two varieties so that the total percentage exceeds 100.

similar result in Tekirdag. Of the farmers, have been done policy payment after the harvesting period. Of the farmers, 72.5% stated that they are intermediate to the experience of insurance expert; 17.5% calculated as less satisfied, and 10% are not happy at all. Average score from satisfaction from expert experience is calculated 2.63. Interviewed farmers are more satisfied from expert decision average score was found 2.70 and 15% of the interviewed farmers are satisfied. Overall damage rate was calculated is 35.88%. The worst average score is found for damage coverage ratio which is calculated 1.93. 30% of the interviewed farmers are not happy at all from damage coverage ratio. Confirming this, YAZGI & OLHAN (2018) emphasized that insurance experts do not have sufficient knowledge and faulty damage detection are important problems. One of the most important findings that 95% of the interviewed farmers can accept to request an extra visit from an expert who works in another independent institution such as a university. Also, 75% of the interviewed farmers stated that they find TARSIM price lower than market prices (Table 5).

Conjoint Analysis is a technique widely used in marketing to measure relative contributions of different product attributes to the overall preference of a product. This analysis is also widely used outside of marketing, for example, to evaluate farmers' preferences for different characteristics of modern crop varieties (HIRPA et al., 2012). In conjoint, farmers were asked to rank the insurance cards, which are combinations of chosen levels of different individual attributes. The selection of insurance feature and levels determined according

Table 3 - Distribution of VC in interviewed apricot farms.

	Mean (USD.ha^{-1})	Share (%)
Labour cost	1088.54	50.96
Insurance cost	283.95	13.29
Marketing cost	199.74	9.35
Pesticide cost	198.37	9.29
Fertilizer cost	124.35	5.82
Irrigation cost	121.50	5.69
Fuel cost	116.15	5.44
Drying cost	3.30	0.15
Total cost (TRY)	2135.90	100.00

*1 USD equals 5.62 TRY in 2019 average.

to the literature and expert opinions. Finally, five features of agricultural insurance are coverage, expert experience, second check, policy amount and payment option. If the expected sign is linear, increase with the preferences rankings it is described as LINEER MORE, if the expected sign is negative it is described as LINEER LESS. Categorical factors are described as discrete. For example, the expert experience is defined LINEER MORE because of expectation is a linear increase. Coverage, second check, policy amount and payment options are defined as discrete because they are categorical. A full factorial design with the management attributes as factors would generate so many profiles that the full design would be too difficult to handle. Therefore, an orthogonal fractional factorial design (HIRPA et al., 2012) was used to generate 16 cards.

Utility scores have been calculated for each attribute. According to the analysis results, the most important factor affecting farmers insurance preferences is expert experience with 26.60 %. It has known that farmers are mostly complaining of damage ration in many studies related to agricultural insurance. More than 5 years of experienced expert insurance received the highest utility value (4.269). This feature is so important that all the levels have positive utility scores. Second important agricultural insurance attributes for apricot farmers have found payment options with 24.08%. Especially payment options are getting more important every year due to high increases in inputs. Farmers preferred to pay insurances fee after the harvesting. Post-harvest payment options increase 0.357; pay in cash increases 0.122 and installments payment options have a negative utility score (-0.479) and it does not prefer by interviewed apricot farmers. Policy amount has found the third important insurance attributes with a rate of 23.47%. Policy amount is important for farmers because production is a result of all the material and moral sacrifices from all the process. In case of damage, all the

Table 4 - Profitability indicators in interviewed apricot farms.

Production Quantity (tones)	Mean
Dry (tones ha-1)	2.70
Fresh (tones ha-1)	0.12
----------Selling price (TRY tones^{-1})----------	
Dry (USD tones^{-1})	1793.90
Fresh (USD tones^{-1})	533.81
Gross production value (TRY ha^{-1})	5028.58
Variable cost (USD ha^{-1})	2135.90
Gross margin (USD ha^{-1})	2892.67

*1 USD equals 5.62 TRY in 2019 average.

Table 5 - Information on agricultural insurance of the interviewed farms.

	Frequency	%
Rate of agricultural insurance	40	76.9
Insurance period (year)	----------9.45----------	
Satisfaction with policy price	Frequency	%
Not happy at all	5	12.50
Less satisfied	12	30.00
Intermediate	21	52.50
Satisfied	2	5.00
Average score*	----------2.50----------	
Policy payment method	Frequency	%
Cash	14	35.00
Post-harvest	26	65.00
Satisfaction with insurance expert experience	Frequency	%
Not happy at all	4	10.00
Less satisfied	7	17.50
Intermediate	29	72.50
Average score*	----------2.63----------	
Satisfaction with insurance expert decision	Frequency	%
Not happy at all	4	10.00
Less satisfied	10	25.00
Intermediate	20	50.00
Satisfied	6	15.00
Average score*	----------2.70----------	
Damage rate (%)	----------35.88----------	
Satisfaction with damage coverage ratio	Frequency	%
Not happy at all	12	30.00
Less satisfied	20	50.00
Intermediate	7	17.50
Satisfied	1	2.50
Average score*	----------1.93----------	
Rate of request extra control from another independent institution	38	95.00
Evaluation of TARSİM product price	Frequency	%
Low	30	75.00
Normal	10	25.00
Average score**	----------1.25----------	

*Five points Likert scale is used. **Three points Likert scale is used.

labor of the farmers is wasted, and they see insurance as a guarantee. According to the results of the research, farmers are willing to pay a medium level policy. In case of damage, they have chosen to receive money to cover the input costs. Confirming this, KIZILOGLU (2017) stated that high exemption rates are the second important problem in his study. The fourth important insurance attributes were insurance coverage with a rate of 14.80%. According to the conjoint, farmers prefer low package which is covers hail and frost more than the full package. As it is known, late spring frosts are the most important problem for Malatya farmers (PAKSOY & ASLAN, 2020). The full package includes not only fruit but also the tree. It has been determined that low package increase 0.442 apricot farmers' insurance and full package coverage attributes decrease 0.442 points. The fifth and the least important factor determined is the second check by an independent organization with the importance rate of 10.99 %. It has been determined that second control increases 0.291. The second control feature was not identified as highly significant as experienced experts would determine the damage rate appropriately (Table 6). It is possible to determine a preferable insurance card by using the utility score for

Table 6 - Factor type, importance values and utility scores.

Factor type	Importance values (%)	Levels of factors	Utility score
Expert experience	26.660	Less than 2 years	1.423
		2-5 years	2.846
		More than 5 years	4.269
Payment options	24.077	Cash	0.122
		Instalment	-0.479
		Pay in post-harvest	0.357
Policy amount	23.471	Low	0.093
		Mid	0.163
		High	-0.256
Insurance coverage	14.801	Low (hail and frost)	0.442
		Wide / Full package	-0.442
Second check	10.991	Yes	0.291
		No	-0.291
Constant	5.956		

each attribute. Each card average important values are calculated with the equation below by using utility scores of each utility coefficient. Each card scores are given in table 7.

UTILITY = Constant + (B1) insurance coverage + (B2) expert experience + (B3) second check + (B4) policy amount + (B5) payment options

According to the results, the highest utility score is belonging to card 10 (11.17). This card is basic coverage (frost and hail), high experienced expert (more than five years), have a second check, low policy amount, and cash payment. The lowest utility score belongs to the card 6 (6.26). This card is high coverage (full package), low experienced expert (less than 2 years), does not include second check, low policy amount and installment payments. The constant term is found at 5.956. Pearson R statistics and Kendal Tau statistics coefficients are found statistically meaningful. These results show that agricultural insurance choices are related to the selected attributes ($P < 0.01$).

Table 7 - Card scores according to conjoint analysis.

Card ID	Constant	Expert experience	Payment options	Policy amount	Coverage	Second check	Total score
10	5.956	4.269	0.122	0.093	0.442	0.291	11.17
1	5.956	4.269	-0.479	-0.256	0.442	0.291	10.22
9	5.956	4.269	0.357	0.093	-0.442	-0.291	9.94
2	5.956	4.269	0.122	0.163	-0.442	-0.291	9.78
12	5.956	2.846	0.122	0.163	0.442	-0.291	9.24
3	5.956	2.846	0.122	0.093	-0.442	0.291	8.87
13	5.956	2.846	0.357	-0.256	-0.442	0.291	8.75
8	5.956	1.423	0.357	0.163	0.442	0.291	8.63
16	5.956	2.846	-0.479	0.093	0.442	-0.291	8.57
14	5.956	1.423	0.122	0.093	0.442	0.291	8.33
15	5.956	1.423	0.357	0.093	0.442	-0.291	7.98
4	5.956	1.423	0.122	0.093	-0.442	0.291	7.44
7	5.956	1.423	0.122	-0.256	0.442	-0.291	7.40
5	5.956	1.423	-0.479	0.163	-0.442	0.291	6.91
11	5.956	1.423	0.122	-0.256	-0.442	-0.291	6.51
6	5.956	1.423	-0.479	0.093	-0.442	-0.291	6.26

CONCLUSION

Agricultural insurance systems in the world vary depending on the development level of the countries, their agricultural structure, climate characteristics, socio-economic structure, and the agricultural policies they implement (KUTLAR & AKCAOZ, 2022). For the sustainability of agricultural insurance, which is rapidly becoming widespread in Turkey, it is important to determine premium criteria that consider the preferences of the farmers. Expert experience has found the first important factor according toCA. This result shows that insurance attributes affect farmers' insurances choices. Payment options are the second important factor after the expert experience. Farmers have many input payments during the growing period, and they want to reduce their risks by doing insurances but also, they want to delay their payments. Installment payment has a negative utility score because it is not an attractive option because farm income is discrete. Policy amount is the third important because production is a result of all the material and moral sacrifices from all the process. In case of damage, all the labor is wasted, and they see insurance as a guarantee. According to the results of the research, farmers are willing to pay a medium level policy. In case of damage, they have chosen to receive money to cover almost the input costs.

Agricultural lands of Malatya are suitable for apricot growing but there is a risk in terms of late spring frost. It is necessary to increase agricultural insurance rates to reduce farmers' risks. This article proposes to insurance companies how to increase agriculture insurance beneficiaries. This study reveals that expert experience can be a suitable insurance criterion in current Turkish agricultural insurance system.

From the perspective of insurance companies, it will help adopt farmers to offer different insurance policies in line with their preferences.

DECLARATION OF CONFLICT OF INTEREST

The authors declare no conflict of interest. Funding sponsors had no role in the study design, collection, analysis, and data interpretation; during the writing of this manuscript, and in the decision to publish the results.

AUTHORS' CONTRIBUTIONS

All authors contributed equally for the conception and writing of the manuscript. All authors critically revised the manuscript and approved of the final version.

BIOETHICS AND BIOSSECURITY COMMITTEE APPROVAL

We authors of the article entitled "Evaluation of Agricultural Insurance Preferences of Apricot Farmers: The Case of Malatya" declared, for all due purposes, the project that gave rise to the present data of the same has not been submitted for evaluation to the Ethics Committee of the Ege University, but we are aware of the contents of Resolution No. 466, of December 12, 2012 of the Brazilian National Health Council "http://conselho.saude.gov.br/ resolucoes/2012/Reso466.pdf" if it involves human. Thus, the authors assume full responsibility for the presented data and are available for possible questions.

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