Determination of factors affecting on dried beans production decisions in Turkey

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Abstract

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In this study, it was examined the dried beans farms in 7 provinces which constitute 61% of total production of Turkey, and putting forwarded the factors affecting on socioeconomic characteristics of producers and farmers' production decisions. In the context of those findings obtained, solution proposals for dried beans production were developed.

According to results, average farm size investigated was 132 da and 25.3 da for dried beans area as well. Average yield of dried beans farms were calculated as 244.4 kg/da.

The factors affecting on decision of farmers were founded as numbers of family member, finance, habit, age, and dried beans farming experience, family labor, and transportation and information source, respectively.

Keywords: legumes, dried beans, logit, regression, Turkey

Introduction

In the second half of 2000's, factors such as climate change, decrease in agricultural product stocks, increase in energy and other input prices, population growth, increased use of agricultural products in alternative areas such as bio-fuel production have led to excessive increases and volatility in food prices. Depending on rising welfare and population, agricultural product demand is expected to increase and food prices are expected to stay at high levels, especially in developing countries. Possible increases in food prices will bring adverse results for those spending big share of their income on food (Anonymous, 2014a). On the other hand, rapid population growth in developing countries causes some issues such as lack of shortage, decrease in development rate and increase in economic and social problems beside food safety issue. Major crops such as wheat, barley, corn, rice etc. which would be accepted as provider of food safety in the world are strategic crops in the region and all over the world. Importance of legumes also was emphasized by some international organization. For example international pulses year was declared by FAO in 2016 (GPC, 2014).

The supply of cereals strictly depends on production and stock availability and varies according to production periods. In 2004-2014 periods, world cereal production raised with 22%, cereal supply with 24%, cereal usage with 22% and cereal trade with 34%. World cereal production has been raised 2.1 million tones to 2.5 million tones between 2004 to 2014. There is an increase with 22% in world cereal production during that decade, considerable fluctuations by years were existed (Anonymous, 2014b). Due to fluctuations in world cereal production and supply, cereal crops are becoming a commercial product, decrease in stocks and speculative shifts in product prices cause sense of worries for the lack of cereal production supply. Under these circumstances, edible legumes which are main source of plant based protein are an important product group in terms of food safety for whole world and Turkey.

Total area planted to legume is approximately 789.000 hectare and legume production is 1.118.000 tonnes (dried beans, chickpea and lentil) in Turkey. There is a decrease in area planted while decrease in amount of production of dried beans though fluctuations in chickpea and lentil production. Legume production has been decreased due to insufficient supports and a high quality of seed, canalization of producers to machine harvesting in agricultural products and high labour and irrigation cost. In this period, supporting policy system changed both to decrease of the global economic crises and drought, and to ensure sustainability in legume production. In 2009, fuel support, chemical fertilizer and rural development supports has been increased compared to previous year at significant rate, certificated seed production and legumes also included to support.

Although there is an increase in terms of production, consumption and trade globally, declining in production and increasing import tendency in Turkey cause both for legume sector and producer and consumers. Opposite to developments throughout worldwide such as production, consumption and trade augmentations, increase in production and increase of import trend cause various problems in terms of legume sector, producers and consumers in country such raw material procurement, nutrition, price fluctuations, failure in production etc. In consideration of average annual 3 kg dried beans consumption, 4.5 kg lentil and 5.5 kg chickpea per person in Turkey, importance of edible legume for consumers would be understood better. Despite self-sufficient ratio in legumes (101%), these ratios are 83.2% in dried beans, 122% in lentil and 94% in chickpea (TUİK, 2014). It is observed that there is a continuity problem in dried beans production. There are various studies from different perspectives on dried beans production. Several studies in literature have investigated on trade of dried beans such as Uzunöz (2013) and Uysal & Subaşı (2014); Legume and its contribution to industry such Ertaş (2013); the analysis of economic and technical efficiencies of peanuts such as Parlakay & Alemdar (2011) and the analysis of economic and technical efficiencies in tomatoes by Engindeniz & Coşar (2013); Agricultural productivity analysis in agricultural sector such as Deliktaş (2002) and Coelliand Rao (2003). But no studies were found to examine the factor affecting on dried beans production decisions.

Therefore, the purpose of this research is to determine the socioeconomic characteristics and determination of the factors affecting the production decisions of dried beans farms. In addition, it was also developed some proposals for more efficient production and marketing plans.

Material and Method

The main material of this research was collected by questionnaire method from dried beans producers. Data is belonging to production period of 2014. "The Purposive Sampling Method" was used to determine the province and districts. By taking into consideration of geographic situation and shares in the total production of provinces, 7 provinces (Konya, Karaman, Niğde, Erzincan, Gümüşhane, Isparta and Çanakkale provinces) which provide approximately 61% of total dried beans production in Turkey was determined. Districts with high production of dried beans in the provinces were determined as research area. By applying Neyman Method (Yamane, 2001; Çiçek & Erkan, 1996), 169 samples were determined with 95% confidence level and 10% standard deviation from frame list of dried bean farms in these districts.

The several alternative groups to determine sample size were investigated and it was considered appropriate to divide the dried beans farms to 3 groups. Layer boundaries for sample farms were determined as 1-2.50, 2.51-15 and 1.51+ decares (Table 1). When the research results were evaluated, 3 questionnaires weren't included and in the end, 166 questionnaires were considered.

In this research, factor analysis were used to determine factors affecting in production decision of dried beans farms and factor scores obtained were used as independent variables in logistic regression (Logit Models).

Factor analysis is a statistical method for modeling observed variables, and their covariance structure by using a small number of variables by combining related variables on multiple data sets (Tatlıdil, 2002).

Logistic Regression: Today, estimating the probability of an event occurred and determining the variables to be used in the forecasting process have become important by scientific studies in real life. Logistic regression model is the appropri-

Table 1. Distribution of sample farms to farm Groups

Farm Groups	Frequency (Nh)	Standard Deviation (Sh)	Variance (Sh^2)	Nh*Sh	Nh*Sh^2	Sample (n)
1-2.50	9.217	0.5	0.2	4.196	1.910	32
2.51-15	26.750	3.5	12.2	93.264	325.163	92
15.1 >	13.236	18.5	341.9	244.734	4.525.138	45
Total	49.203	15.2	229.9	342.194	4.852.212	169

ate regression analysis to conduct when the dependent variable is binary (dichotomous). Like all regression analyses, the logistic regression is a predictive analysis. Logistic regression is used to describe data and to explain the relationship between one dependent binary variable and one or more metric (interval or ratio scale) independent variables and is written mathematically follows;

$$L = \ln\left(\frac{P}{1 - P}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_p X_p \qquad (1)$$

(Albayrak et al., 2005).

Since the parameters of the logistic regression model cannot be analytically obtained, it is estimated by maximum likelihood (Maximum Likehood = ML) which is an iterative method. Despite having a linear relationship between model dependent variables and independent variables, the relationship between probabilities and dependent variable is not linear. Probability values to properties of independent variables given, i.e. probability of an event;

$$Pi = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X_1)}} \qquad (2)$$

can be calculated by using this equation (Albayrak et al., 2005).

e : 2.718 (term used in logarithm)

In this research, as a dependent variable which used in logistic regression model has been taken continuation of dried beans farming of producers in the future. According to this, if the producer is going to continue the farming of dried beans, it is accepted as 1, if not as 0 (Gujarati, 2006).

Variables affecting on producing decision of dried beans; age, education, family size, dried beans farming experience, and family workforce, including factor analysis scores (input, marketing chain, habits, harvesting, financing, intermediary, support and cooperation, transportation, information source and irrigation cost (MLF = Male Labor Force). The analysis results of the farms examined are given in Annex-3. Model used in analysis found generally meaningful (X^2: 34.05). In this study, explanatory power of independent variables on dependent variables was found high (R^2: 0.38).

Results and Discussion

Population Structure in Farms

Average family size in farms investigated was calculated as 4.6 person which is higher than national average. This varies between 4.0 and 5.6 person. According to farm groups, the highest population is in the third group farms with 5.6 people and the lowest in the first group farms with 4.0 people. For the distribution according to sex, 58.8% of family population were male and 41.2% is female (Table 2).

Table 2. Distribution of farms according to age and sex

Farm Groups	Male		Female		Total	
	(Person)	(%)	(Person)	(%)	(Person)	(%)
1	2.1	53.9	1.8	46.1	4.0	100.0
2	2.5	59.0	1.8	41.0	4.3	100.0
3	3.6	63.6	2.0	36.4	5.6	100.0
Average	2.7	58.8	1.9	41.2	4.6	100.0

Farmer's Education Level

Education level of farm manager in that research is given in Table 3. According to, results, the producers are literate but not finished any school, 63.9% are primary school, 13.9% are secondary school, 16.3% are high school and 1.2% is university and post-graduate educated. A few farm managers (1.2%) have agricultural based education formation. According to these results, producers who have been performing the agricultural production in research area composed of primary school graduates. When examined by farms groups; the proportion of primary school graduates is 70% in the first group of farmers and 68.6% in the third group of farmers. The proportion of secondary school graduates was 17.5% in the first group; 14.7% in the second group and 9.8% in the third group.

The farm ownership

The average farm size of farms investigated is found 132.6 da. This is 24.8 da in the first group, 64.7 da in the second group and 308.3 in the third group (Table 4). General average for total dried beans area is 25.3 da which it varies among the groups between 1.9 and 62.6 da. Average dry

Table 3. Education level of farmers (%)

Farm Groups	Literate		Primary		Secondary		High-school		Undergraduate and post-graduate		Total	
	(Number)	(%)	(Number)	(%)	(Number)	(%)	(Number)	(%)	(Number)	(%)	(Number)	(%)
1	–	–	28	70.0	7	17.5	4	10.0	–	–	40	100.0
2	4	5.3	43	57.3	11	14.7	14	18.7	1	1.3	75	100.0
3	–	–	35	68.6	5	9.8	9	17.6	1	2.0	51	100.0
Average	4	2.4	106	63.9	23	13.9	27	16.3	2	1.2	166	100.0

bean farm size composed of 1/5 of cultivated area (19.1%). This ratio is 7.6% in the first group, 17.7% in the second group and 20.3% in the third group farms.

Table 4. Averages and shares in total dried beans cultivated area

Farm Groups	Average Farm Size (1)	Average Dried Beans Farm Size (2)	Share of Dried Beans in (2/1)*100
	(decares)	(decares)	(%)
1	24,8	1,9	7.6
2	64,7	11,5	17.7
3	308,3	62,6	20.3
Average	132,6	25,3	19.1

Status of land irrigation

It is seen that the farms investigated have an average of 132.6 da, 94.2% of theme irrigated and 38.4% of them are unirrigated. These ratios are 71.1% and 28.9% for total farm lands (Table 5). Therefore, irrigated land in dried beans areas investigated is very high. Especially, the ratio of irrigated land increases in second and third group farms. Ratio of unirrigated land is highest in the first farm group (74.6%) and lowest in the third farm group (22.7%) as well.

Table 5. Irrigation level in farms investigated

Farm Groups	Irrigated Area		Unirrigated Area		Total Area	
	(decares)	(%)	(decares)	(%)	(decares)	(%)
1	6.3	25.4	18.5	74.6	24.8	100.0
2	38.0	58.8	26.7	41.2	64.7	100.0
3	238.3	77.3	70.0	22.7	308.3	100.0
Average	94.2	71.1	38.4	28.9	132.6	100.0

Status of land tenure

The average land of the surveyed farms is 132.6, of which 68.9% is property, 12.3% is rented and 18.8% is other forms such as share based and possessed land. The proportion of farms that process their own land is increasing as the farm size increase. In the farms investigated, no property land was found to rent or to the share based (Table 6).

When examining the land ownership status by farm groups in the examined farms, the share of the property land in the total operating land ranges from 39.1% to 77.8%. The third group receives the highest share while the first group receives the lowest. As property land ratio increases, the share of rented land decrease as well. The second farm group has the highest ration with 20.8% in terms of share area sown in total farm land. The level of rented land in the first group is at a very low level. The share of rent land in the total farm land varies between 9.4% and 60.9%. While the property land has the highest ratio in third group, the lowest share in share based and rented land.

Land use

The crop pattern in terms of planting area was examined in this study. According to this, in general average for all farms, of cereals in 31% of total area, 9.2% of legumes, 8.3% of forage crops, 10.2% of sunflower, 8.2% of sugar beets and 4.5% of potatoes. In addition, 12.6% of the arable land is vegetable, and 6.7% is fruit growing. In dried beans farms, the ratio of fallow land in total land is 2.4%, which is lower than the national average (5.6%). When the results analyses by farm groups, cereals, legumes and forage plants are mostly being produced in the first farm group, farms in third group focused on sunflower, sugar beet, potato and vegetable growing.

When crop pattern is analyzed by products, the first crops are corn (grain+silage) with 14.1%, followed by sunflower with 10.2%, wheat with 9.1%, sugar beets with 8.2%, vegetables with %12.6%, vetch with 6.2%, barley with 5.5%, chickpea with 4.7%, potatoes with 4.5% and dried beans with 2.7%. It is determined that crop pattern has been moved to corn and sunflower farming since they need less workforce and more appropriate for agriculture with machinery.

The number of parcel and parcel size

It was determined that total farmland on average is 132.6, the average number of parcels is 10.5 and the average parcel sizes 12.6 da. The average number of parcels is the highest in the second group. The average parcel size is the highest with 29.3 da in the third group and the lowest with 3.8 da in the first group (Table 7).

Table 6. Land tenure of farms investigated

Farm Groups	Property		Rented		Other (Share based, possessed etc.)		Total	
	(decares)	(%)	(decares)	(%)	(decares)	(%)	(decares)	(%)
1	9.7	39.1	15.1	60.9	–	–	24.8	100.0
2	41.4	64.0	9.8	15.2	13.5	20.8	64.7	100.0
3	239.9	77.8	29.0	9.4	39.5	12.8	308.3	100.0
Average	91.4	68.9	16.3	12.3	24.9	18.8	132.6	100.0

Table 7. The number and size of parcel by farm groups

Farm Groups	Average Farm Size (decares)	Number of Parcel (plot)	Average Parcel Size (decares)
1	24.8	6.5	3.8
2	64.7	14.6	4.4
3	308.3	10.5	29.3
Average	132.6	10.5	12.6

Factors affecting on producer decision

In order to analysis research findings, factor analysis was applied to determine the factors affecting and to determine the appropriate variables to be used in this analysis for dried bean farms. The factor scores obtained as a result of factor analysis were used as independent variables in the logistic regression. A very large data set has been prepared which can be effective on the producers' decision to plant dried beans. Within this scope, 62 tendency statements were applied in Likert scale concerning personal, sociocultural, technical and economic issues.

Correlation matrix is not a unit matrix, then the hypotheses of correlation coefficient are unacceptable (Bartlett's Test of Sphericity: 3422.202). The value of the Kaiser-Meyer-Olkin (KMO) statistic is greater than 0.5 (KMO = 0.741). Accordingly, it is possible to say that factor analysis is appropriate for this data. The factor analysis results are given in Annex 2. In the result of factor analysis, 62 variables were reduced to 10 factor groups.

According to the result of factor analysis, all the factors are grouped under factor groups such as input, market-ing chain, habit, harvesting, finance, mediator, support and cooperation, transportation, information source and irrigation cost. In logistic regression analysis of this study, it is assumed that there is no multicollinearity between the variables. As a dependent variable in the logistic regression used in the analysis made, dependent variable is considered as continuation of dried bean farming in future. Accordingly, the dependent variable is assumed to be 1 if the producer continues to cultivate, or 0 if not.

Factors affecting the decision of dried beans farming are especially factor scores (input, marketing chain, habit, harvesting, finance, mediator, support and cooperation, transportation, information source and irrigation cost) derived from factor analysis results and age, education, family size, experience in dried beans and family labor (MLU) variables as well (Table 8).

In general, the logistic regression model obtained as a result of analysis is significant ($p < 0.05$). The explanatory power of dependent variables on dependent variables was found to be high (R^2: 0.38). As a result of the analysis, it is determined that family size, finance, habit, age, experience in dry bean breeding, family labor force, transportation and information source variables are effective for decision making of dried beans cultivation decision.

The family size and the decision to cultivate the dried beans farming are inversely related at a 1% level. As the family size increases, moving away from dry bean cultivation is also increase. When a unit increases in the family size

Table 8. Results of logistic regression analysis for factors affecting production decision of dried beans

Variables	Coefficients	Standard Error	Wald Statistics	Confidence Interval	Exp(B)
Constant	5.812	2.978	3.809	0.051**	334.3
Age	-0.094	0.047	4.078	0.043**	0.91
Education	0.487	0.395	1.517	0.218	1.63
Family size	-0.421	0.167	6.363	0.012***	0.66
Experience in dried bean	0.076	0.038	4.06	0.044**	1.08
Family labour (FLU)	0.756	0.379	3.99	0.046**	2.13
Input factor	-0.423	0.332	1.621	0.203	0.66
Marketing chain factor	0.277	0.409	0.457	0.499	1.32
Habit factor	-1.01	0.412	6.005	0.014***	0.36
Harvesting factor	0.382	0.333	1.317	0.251	1.47
Finance factor	1.033	0.414	6.223	0.013***	2.81
Mediator factor	-0.047	0.367	0.017	0.898	0.95
Support and cooperation factor	0.259	0.287	0.815	0.367	1.30
Transportation factor	-0.752	0.402	3.498	0.061*	0.47
Information source factor	-0.52	0.321	2.612	0.106*	0.60
Irrigation cost factor	-0.349	0.374	0.867	0.352	0.71
Log Likehood: 75.62	X^2: 34.05		R^2: 0.38		

* 0.10; **0.05 and *** 0.01 significant

variable, the probability of giving up the dried bean farming is calculated 34.4%. One of the main reasons for this is migration in rural areas. In particular, the immigration of young generation decreases the possibility of planting cultivation. In a similar study, "as crowded families leave the agriculture, future of legume production will be realized with core families (Hasdemir et al., 2015).

It has been determined that there is a 1% inverse relationship between the practice of dried beans production as a traditional (habit) and the possibility of planting dried beans. This happens because farms are directed to different product planting such as corn and sunflower which have lower labour requirements and higher mechanization use.

On the other hand, there is a positive correlation between the finance structure of agricultural farms and the probability of planting dry beans at 1% level. It has been determined that a unit increase in finance will have a positive impact on the decision to cultivate dried beans. One of the most important problems regarding making a decision seems to be the of credit and finance problem. It can be suggested that when credit and finance problems are solved, dried bean planting possibility will be increased.

Based on these results, some suggestions can be developed. A significant correlation was found between the ages of the farmer and the possibility of dried beans cultivation. It is statistically significant at a 5% level. A unit increase in the age variable will increase the discarding dried beans possibility by 9%. This may be interpreted as young farmers 'dried bean cultivation possibility is higher than older, while the possibility of producers moving away from dried beans cultivation in later ages is increased. It can be said that older producers are moving away from cultivation. In addition, dry beans are more labor intensive than other field crops with higher labor costs. However, higher price fluctuations in dried beans farming have generally negatively effects on dried beans production decision.

It was determined that relation between the family labor and the probability of planting dried beans ties positive and statistically significant at 5% level. A unit increase in the family labor force seems to increase the probability of planting dried beans. It has been seen that the need for intensive labor force in the production firstly met in from inside of family. In this case, it is observed that the farms with adequate family labor are more likely to plant dried beans.

Relation between the dried beans experience and probability of planting dried beans ties positive and statistically significant at 5% level. A unit increase in the dried beans experience seems to increase the probability of planting dried beans with 7.9%.

It was determined that transportation is one of the factors affecting on planting dried beans. Relation between the transportation and probability of planting dried beans ties negative and statistically significant at 10% level. This result is important since farms may experience various problems in terms of accessing to markets.

Relation between the probability of planting dried beans and information sources ties negative and statistically significant at 10% level. It was determined that speculative events as a result of incorrect information source or misinformed producers having effects on planting dried beans decision. Farmers who consider the information sources in making a decision to plant crops are less likely to plant dry beans. A unit change in the information source factor reduces the probability of planting dried beans by 40.5%. This can be interpreted as the fact that the speculative events about dried bean prices are carefully observed by producers.

Conclusions

It is determined that the optimum scale problem has been effected performance of dried beans farms and cause inefficient farming. Besides, there is regional differential in terms of producing dried bean and changes in the product prices directly affect the farms.

It seems that dried beans farms are facing with several problems. These problems can be categorized such as irrigation costs, high input prices, labour, low production scale, and finance. The biggest problem in marketing is fluctuations in product prices, insufficient storage and debts of farms which cause obligations to sell their product immediately.

Habits, finance, transportation, information source, age, family size, dried beans farming experience, and family labor force variables were determined as the most important factors effecting on producer decision.

It would be useful to take regional differences into consideration, regional based analysis/evaluating and doing value chain analysis with including actors in legumes and dried beans products. However, examining the developments in producer and consumer surplus among actors will have positive effects on in terms of enriching the researches.

In order to solve the problem of high input prices in dried beans, despite of increasing of irrigation cost, realizing alternative energy resources like sun and wind will be positive effects for decreasing production cost and using natural resources efficiently. On the other hand, it would be beneficial to organize special training programs aimed at lowering the cost of irrigation and realizing the irrigation plans.

The emphasizing the importance of legume in rotation, the establishment of large-scale market oriented legume

farms in specialized farms as well as doing cooperating in marketing and growing of small farms can contribute to sustainable legume farming.

It is important to develop more efficient and high quality varieties that can directly affect the dried beans production. At this stage, the varieties developed by the Ministry of Food, Agriculture and Livestock should be disseminated. However, no specific production or marketing policy for legumes in Turkey is implemented. In the near future, it is important to determine the specific production and marketing strategies for dried beans and for all legume farms. In this context, it will be an important stage especially for small-scale enterprises to take part in special support programs within the scope of "Family Farming" or "Income Insurance".

Establishing multifunctional producers 'organizations, which can contribute to preventing price fluctuations in the market, ensuring stability in producers' income, providing guidance to producers, streaming information on producers in trade and price issues, and obtaining quality dried beans in terms of quality standards and costs will be an important milestone.

In order to ensure supply-demand balance in the market and prevent fluctuations in the producers' income, it is important to spread the "Licensed Warehousing" activity in legumes. However, completion of the infrastructure works for the sale of the products through "Electronic Product Certificate" will be an important step for solving the current problems.

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