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Farmers Preferences to Plant Crops for Bio-Energy production (Case Study: Sugar Beet in north of Khuzestan Province)

Davood Momeni Choleki[1], Reza Moghaddasi[2]*, Yaghoub Zeraatkish[2], Amir Mohamadinezhad[3]

[1] Ph.D. Candidate, Department of Economic, Agricultural Extension and Education, Science and Research Branch, Islamic Azad University, Tehran, Islamic Republic of Iran,*

2 Associated Professor, Department of Economic, Agricultural Extension and Education, Science and Research Branch, Islamic Azad University, Tehran, Islamic Republic of Iran,

**Corresponding Author Email: r.moghaddasi@srbiau.ac.ir*

[3] Assistant Professor, Department of Economic, Agricultural Extension and Education, Science and Research Branch, Islamic Azad University, Tehran, Islamic Republic of Iran

Abstract

Bioenergy is one of renewable energy types. The expansion of production this type of energy can create employment and sustainable income for society in addition to reducing pollution caused by fossil fuels and protecting the environment. Therefore, the purpose of this research was to investigate the preferences of sugar beet farmers in the north of Khuzestan province to the presumptive contracts of sugar beet planting to use in production of bioenergy. The statistical population of the research included 1890 sugar beet farmers of Khuzestan province in 2017-18 which 320 people were selected through the stratified sampling method. The required data were collected in person by referring to farmers and completing the questionnaire. Factors influencing the preferences of farmers were identified using the experimental approach of the attribute-oriented declared choice method to determine the important attributes of different sugar beet planting contracts and to estimate the conditional Logit regression model. The estimation results of the Logit model showed that coefficients related to the contract period, the area covered by the contract, the contract price, the cost-sharing in the contract, the product insurance in the contract and experience of sugar beet planting are positive and significant. The coefficient of the interaction of the variables of attitude to energy production, area under sugar beet planting, Experience of planting sugar beet and the area under sugar beet planting with ASC is significant and positive and the coefficient of the interaction of Farmer's risk attitude with ASC is significant and negative.

Keywords:
Sugar Beet,
Preferences,
Choice Experiment,
Farmers,
Biomass

Although the growing trend of energy consumption from fossil fuels had a rapid economic growth of societies in recent years, it has had consequences such as global warming and climate change by emitting pollutants from fossil fuel combustion and increasing carbon dioxide in the atmosphere. On the other hand, the limitation and non-renewability of fossil resources have led Iranian policymakers and energy planners to put the preliminaries and the path to clean fuels at the top of their plans in line with international policies for sustainable global development through structural studies. Therefore, the development and expansion of renewable energy resources are one of the vital strategies of many countries to achieve sustainable energy (Sauthoff et al., 2015). One of the most important and exploitable renewable energies is bioenergy (Mansouri et al., 2015). In 2016, biomass has the largest source of renewable energy with a share of 13% of the world's total energy consumption among the resources of renewable energy (biomass, water, wind, solar, geothermal, etc.), which accounted for 70% of the total renewable energy resources with the initial public offering of 56.5 EJ of energy (World Bioenergy Association, 2018). Biofuels can be a good substitute for fossil fuels and reducing the atmospheric pollution caused by combustion (Babaei and

Nowruzi, 2015). The production of biofuels such as biogas and bioethanol from biomass of crops can play a key role in the process of energy change and transformation in Iran (Mansouri et al., 2015). Since sustainable and acceptable energy production through the biomass of crops is very important, the development of suitable and consumable crops, including sugar beet, is essential for the production of biofuels (Sauthoff et al., 2015).

Sugar beet contains sucrose sugar, which is the primary resource of carbon and energy and provides about 30% of the world's sugar. Since it has high sugar content, the amount of ethanol gas produced is twice of corn because the process of converting sugar to ethanol biogas from sugar beet is easier than corn. Therefore, less investment is needed (Maung and Gustafson, 2011). Sugar beet planting for sugar production and supply of biomass raw materials for bio-energy production has been organized as agricultural production contracts in many countries around the world. It seems that in Iran, sugar beet will be planted to produce biofuels in the future, by concluding favorable and acceptable planting contracts for farmers in areas prone to the planting of this crop. Therefore, investigating the preferences of farmers to plant this crop to produce biofuels can play an important role in designing a suitable planting contract for the production of crops and ultimately expanding one of the clean and new energies, namely bioenergy (Sauthoff et al., 2015).

Sugar beet planting in Khuzestan province is concentrated in Dezful, Shush, and Andimeshk counties located in the north of this province. Sugar beet is one of the most important industrial crops and one of the main sources of sugar production in Khuzestan province. The country's growing need for sugar production and supplying about 70% of domestic sugar production from sugar beet show the economic and strategic importance of this product. The production yield of sugar beet in north of Khuzestan is between 65-75 tons per hectare and with a grade above 15%, which is about 1.5 times the national average yield (40 to 45 tons per hectare) (Ministry of Jihad Agriculture , 2019). Since planting crops in Khuzestan is done in the fall, it greatly reduces the amount of irrigation water consumption. This issue is important given the country's special conditions in the scarcity of water resources and the water crisis. The positive effects sugar beet on subsequent crops, as well as the mechanization of all planting, growing, and harvesting operations, has increased its importance in addition to high production potential. Moreover, the production of by-products such as pulp and molasses and job creation in the agricultural and industrial sectors of the region, as well as the supply of sugar beet used by sugar factories in this province and neighboring provinces, clarifies the strategic importance of this product. Therefore, research on various economic issues, policies, and factors that affect farmers in this region is very important in the production of this crop. Therefore, the present study was conducted to fill the research gap on the factors affecting the tendency of sugar beet farmers in the north of Khuzestan province towards sugar beet planting to produce bioenergy.

Some types of research have been conducted by research and academic institutes on technical and feasibility studies of biomass energy production, which has led to the construction of several biogas generators on a trial basis. In recent years, several power plants and biogas production unit waste has been launched in some places from municipal and agricultural waste. Despite the many studies that have been done technically in this regard, so far many economic and social studies have not been conducted to identify the factors influencing the production of biofuels using biomass resources of agricultural products in Iran. Therefore, it is necessary to conduct such research. Therefore, the purpose of the present research is to investigate the preference of sugar beet farmers in the north of Khuzestan province compared to the presumptive contracts of sugar beet planting to use it in the production of bioenergy. The novelty of this research is using the preferential valuation approach by the discrete choice experiment (DCE) method in planting crops to produce biofuels. Therefore, the present research will help the literature on the subject of research, and thus, fill the gap. This research provides important information for policymakers as well as those who produce biofuels about farmers' attitudes toward the used sugar beet in producing biofuels as well as its important and valuable benefits for farmers. In addition, the research results help politicians to apply the right policies that are acceptable to all farmers to supply this product. So far, many studies have been conducted inside and outside Iran in this regard, some of which are mentioned:

Ahmadian et al. (2011) determined the welfare effects of sugar beet production technology improvement policy. The results of the study showed that the price elasticity of demand is -0.02 and the price elasticity of supply is 0.013. The results showed that given the contribution of consumer welfare surplus to total social welfare surplus in all scenarios, the implementation of this policy further supports consumers. Ezzatzadegan Jahromi (2012) examined the production of bioethanol using sugar beet and provided solutions to improve this process. The results showed that medium-sized sugar products, including concentrated syrups, were less effective than molasses in producing less bioethanol, and that sugar factories had to produce bioethanol as a by-product. Aminian (2012) conducted a study entitled Evaluation of biomass resources and the location of relevant power plants in Khorasan Razavi province. The results showed that the province, with an average annual production of 3697 thousand tons of biomass, can to produce 42.3 PJ of energy (equivalent to approximately 7 million barrels of crude oil). Abbasi et al. (2011) in their study evaluated the economic evaluation of bioethanol production from sugarcane waste. The results of their study showed that the production of bioethanol using sugarcane waste in the products of Haft Tappeh Sugar Factory in Khuzestan has an economic justification.

Babaei and Nowruzi (2015) examined the possibility of producing bioethanol from sugar beet in autumn planting. The results of their study showed that about 840 thousand tons of sugar beet are needed to produce about 76,000 cubic meters of ethanol per year, assuming 90 liters of ethanol per ton of sugar beet with an average grade of 15%. The capital required to build a plant with this production volume is estimated at $ 120 million. Moreover, the production of bioethanol from sugar beet in autumn planting has a higher economic justification than sugar production from this product. Paulrud and Laitila (2010) used the choice experiment to assess the attitude of farmers toward crop production for energy production in Sweden. The results of their study showed that the decision to plant energy products depends on the amount of utility that farmers expect to be achieved by producing such crops. Attributes that had a significant effect included the farmer's age, farm size, and geographical area. Broch and Vedel (2012) examined farmers' preferences for agricultural and environmental contracts using the choice experiment. The results of their study showed that farmers prefer the contract period to be short, and also prefer contracts that would allow them to return to their current status if they are unsure of the cost and future benefits of the contracts.

Krah et al. (2015) used a stated choice experiment to identify manufacturers' preferences for production contracts for a risky bioenergy product. The results of the Logit model of their random parameters showed that the price of the product, the harvest by the factory, and the establishment of cost-sharing have positive, and significant effects on the probability of acceptance of a contract by manufacturers, while the contract duration has a negative effect. Wamisho et al. (2015) examined biomass contracts for ethanol production and the role of farmers' risk preferences. They designed an express choice experiment under alternative contracts to extract farmers' preferences for planting energetic sugar beets. The results showed that the way the contract was designed significantly affected farmers' preference for ranking contract options. Some of the criteria of the awareness of the extracted risk from farmers' responses played a significant role in contract preference. Sauthoff et al. (2015) examined the preferences of German farmers over sugar beet supply contracts The results showed that the farmer's risk attitude had a significant effect on the selection or rejection of a contract. Farmers preferred short-term contracts to cover a small share of their arable land.

Embaye et al. (2018) examined the tendency of wheat farmers to accept and allocate land for planting non-food oilseeds as bio-energy products throughout the western United States. The results indicated that 8% of farmers were tended to accept oilseeds as bio-energy products. Given the farmers' decision to accept, factors such as the experience of planting oilseeds, the availability of crushing facilities nearby, the use of non-soil, being the first acceptor, and having a university education had a positive effect on acceptance, while risky behavior, agricultural history, and gender had a negative effect. Guentang (2018) analyzed farmers' preferences for Jatropha production contracts as a bio-energy product in Ghana. They concluded that long-term contracts, written contracts, and customer support increase the likelihood that Jatropha will be accepted by producers. In general, the literature shows various factors such as socio-economic characteristics and individual factors of farmers, such as age, education, income, area of planted lands, risk awareness and risk preferences of farmers that affect the production of bioenergy. Attributes of the crop contract include crop price, contract duration, access to insurance, harvesting for the plant (versus self-consumption harvesting), and supportive policies to share costs, farmers' preferences (Petrolia et al., 2015; Petrolia et al., 2013; Lusk and coble, 2005, Wamisho et al., 2015, Embayea et al., 2018, Guentang, 2018). However, a few types of research that specifically examine how these factors affect farmers' decisions to accept contracts for the production of biomass products such as sugar beet in Iran. Therefore, this study was conducted to identify such factors.

2. Materials and Methods

One of the approaches to valuate for estimating the value of environmental goods and services is the Stated Preference Method. In this method, there are two types of valuation methods depending on the number of measurement traits. If the objective is to evaluate only one property of a commodity in question, the conditional valuation method will be used, and if the multi-attribute valuation of a commodity is to be considered, multi-attribute valuation methods will be used (Merino-Castello, 2003). In using both methods, it is attempted to measure the individuals' willingness to pay directly. The conditional valuation (CV) method is a non-market and flexible valuation method that is widely used in cost-benefit analysis and environmental impact assessment. The presence of Starting Point Bias, Yes-Saying Bias, and Strategic Bias in conditional valuation methods increased the motivation to use other methods of Stated Preferences Methods, including multi-attribute valuation. One of the important and practical methods of multi-attribute valuation is the Choice Experiment (CE) method (Adamowicz et al., 1998). The choice experiment approach was first developed by Louviere and Hensher (1982) and Louviere and Woodworth (1983). However, the first application of the choice experiment for environmental compliance assessment was done by Adamowicz et al. (1994). The reasons for the increased interest in using the choice experiment method are 1) the reduction of some potential biases in the conditional valuation method 2) the extraction of more information from each respondent compared to the conditional valuation method (Alpizar et al., 2001). In a choice experiment, respondents are presented with a series of options with different levels of attributes and they are asked to choose the most preferred one. A baseline alternative related to the status quo of each attribute is usually considered in each choice set. In this choice, any improvements to the attributes of a product or service are considered, and therefore no forced willingness to pay is considered. Therefore, this choice prevents individuals from the forced-choice that causes adverse effects on the results (Eggert and Olsson, 2009).

The choice experiment method is based on Lancaster's theory of microeconomics and Random Utility Method (RUM). The Lancaster's theory of consumption states that the utility derived from the consumption of a commodity is the sum of the utility of the properties and attributes of that commodity, not directly derived from the consumption of the commodity itself (Lancaster, 1996). Random utility theory also states that all components of the utility function resulting from the choices by individuals are not directly observable to the researcher (Hearne & Salinas, 2002). According to this method, the indirect utility function for each respondent *(U)i* is divided into two definite (*V*) and random (*e*) parts according to the following relation:

(1) $$U_{ij} = V_{ij}(X_{ij}) + e_{ij} = bXij + e_{ij}$$

where *X* includes contracts attributes, management characteristics and the socio-economic attributes of the respondents. The probability that each individual prefers *g* choice in the choice set C_i to any other option such as *h* depends on that the utility of the choice g for individual *i* is more than the other choices in the choice set as shown in the following equation:

(2) $$P(U_{ig} \succ U_{ih}, \forall h \neq g) = P\left[(V_{ig} - V_{ih}) \succ (e_{ih} - e_{ig})\right]$$

In the case it is assumed that random terms of the indirect utility function, have Extreme-value Distribution (Weibull distribution), the probability of choosing any more preferred choice such as g from the choice set Ci can be expressed as the logistic distribution presented in the following equation, which it can be estimated using Conditional Logit (McFadden, 1973):

(3) $$\Pr_i(g \mid C_i) = P(U_{ig} \succ U_{ih}, \forall h \neq g) = \exp(\mu V_{ig}) \Big/ \sum_{h \in C_i} \exp(\mu V_{ih})$$

Where, μ is a scale parameter, which depends on the probability distribution type except for the random model and is linked to the amount of variance or dispersion of the distribution. The conditional logit model is estimated by the maximum likelihood method and the corresponding likelihood logarithm function as shown in the following equation:

(4) $$\log L = \sum_{i=1}^{N} \sum_{j=1}^{J} y_{ij} \log\left[\Pr_i(g \mid C_i\right]$$

Where y_{ij} is an index variable that is equal to one if the individual *i* chooses option *g*, otherwise it is zero. In other words, the dependent variable here, unlike the simple logit, which is binary (zero and one), is a multiple (one, zero, and zero) (Rolfe et al., 2000).

In this study, the discrete choice experiment (DCE) data are collected through a designed questionnaire. The decision situations in the questionnaire of the discrete choice experiment (DCE) used in this study were explained to the participating farmers. It is assumed that the bio-energy production plant will offer two different contract options for sugar beet planting as a product of bioenergy origin to the participating farmers. In each decision situation (each choice set), two unique contract options that are different and interacted called "Contract 1" and "Contract 2" is provided. There is also a current status "no contract" option. In each decision-making situation, the participating farmers make their choice between the status quo option and the two options of Contracts 1 and 2, which are described by the following five attributes. Attributes of the sugar beet planting contract include: 1. Contract period, 2. Area covered by the contract, 3. Contract price, 4. Cost-sharing, 5. Product insurance. Their attributes and levels were determined based on research hypotheses, review of the literature on the subject, analysis of sugar beet supply contracts, and the results of conversations with experts and farmers.

* The attribute of "contract period", it was offered to farmers at three levels: 1 year, 3 years, and 6 years.

* The attribute of "area covered by the contract", it can be changed in three levels between the values of 30%, 50%, 100%, and the cultivable area of people's lands. Fixed values are not used for the "area covered by contract" feature, but the levels of this feature were related to the arable land area of the individuals.

* The attribute of "contract price " : We will offer the contract price feature in three different price levels: 3000 Rials, 3500 Rials and 4000 Rials. This price is related to one kilo of freshly weighed sugar beet with a grade of 16% sugar.

* The attribute of "cost-sharing" consists of three levels: These three levels were such that the bioenergy plant paid 30%, 60%, 100% of production costs (including planting, growing, and harvesting) to the producer, and then, it deducts from the funds paid to the farmers after buying the product.

* The attribute of "access to product insurance": if the bioenergy plant accepts the insurance costs of the product, the value is 1, and if it does not cover the insurance costs, the value is 0.

discrete choice experiment (DCE) is selected with two main alternative and four attributes with three-level and one attributes with two level, resulted in a full factorial design with 26.244= (Contract A (2*3 *3*3*3) * Contract B (2*3*3*3*3)) possible decision situation or choice set. This design is very extensive and difficult for practical application. Therefore, the number of choice sets should be reduced. To do this, the performance criterion of D-efficient Bayazian was used (ChoiceMetrics, 2012). Necessary information for the D -optimal Bayazian was obtained using a pre-test on 30 farmers. Consequently, the number of choice sets used for each farmer in the final experiment reduced to 12 using MINITAB 17 software. Table 1 shows one of the choice sets that farmers surveyed.

Table 1. One of the choices set in the discrete choice experiment (DCE)

	Contract A	Contract B	No contract
Contract period	3 years	1 years	
Area covered by the contract	100% of the arable area	50% of the arable area	
Cost-sharing	The factory pays 60% of the production costs to the farmer	The factory pays 100% of the production costs to the farmer	
Product insurance	The factory pays for the costs of the product issue	The factory does not pay for the costs of the product issue	
Contract price	3000 Rial per kilo	3500 Rial per kilo	
Which option do you choose to contract?	◯	◯	◯

Hausman and McFadden test is one of the basic tests required in this type of model. The Hausman & McFadden’s (1984) test examines the hypothesis of Independence of Irrelevant Alternatives (IIA). This attribute states that the probability ratio of two choices in a choice set remains the same with the presence or omission of the other choices and does not depend on the nature of any of the other choices. If the null hypothesis of the Hausman-McFadden test is accepted, IIA hypothesis holds, hence the conditional logit model can be used to estimate the models obtained from the choice experiment. The statistic of this test, which is chi-square, is calculated as follows (the assumptions of this test are also shown below) (Louviere et al., 2000):

(5) $$T = (\hat{\beta}_r - \hat{\beta})'(\hat{V}_r - \hat{V})^{-1}(\hat{\beta}_r - \hat{\beta}), \qquad \begin{cases} H_0 : T = 0 \\ H_1 : T \neq 0 \end{cases}$$

The model used in this study can be described as follows:

(6) $$Y = ASC + \sum_{i=1}^{5} \beta_i X_i + \sum_{k=1}^{n} \alpha_k M_k + \sum \delta_m ASCM_i$$

In the above model, β_i is estimated coefficients of alternative-specific attributes (X), α is estimated coefficient for socio-economic variables (*M*), and δ is socio-economic interaction coefficients with alternative specific constants (*ASC*). In the above model, *Y* is the dependent variable in the regression model that indicates the optimal alternative selection among the three possible alternatives in each choice set (Khodaverdizadeh et al., 2014).

This descriptive-correlational research was conducted to analyze farmers' preferences for the production of bio-energy crops (a case study of sugar beet in Khuzestan province). The research method in terms of data and information collection was fieldwork conducted in 2018-2019. The data collection tool was a questionnaire that was designed according to the required statistics and information and based on the goals and review of resources. Since most farmers in the area were illiterate or low educated, the questionnaires were completed through interviews and direct conversations with them. Library resources and documents were also used to complete the research work. This research is applied in terms of purpose. It is expected that the results of this research can be effective in adopting appropriate policies for the development of planting sugar beet and other energy crops in Khuzestan province, as well as the expansion of bioenergy.

The statistical population of the study includes all sugar beet farmers in the north of Khuzestan province, which are located in areas prone to sugar beet planting. After determining the sample size by Cochran's relationship, the appropriate stratified random sampling method was used to select the samples. The Cochran's formula for calculating sample size is as follows:

$$n = \frac{N\,(t\cdot s)^2}{Nd^2 + (t\cdot s)^2} = \frac{1890(1.96\cdot 0.5)^2}{1890 * 0.05^2 + (1.96\cdot 0.5)^2} = 320 \quad (7)$$

N is the population size, s is the standard deviation of the sample, d is half the distance of the confidence limit, t is the t-statistic at the desired confidence level and n is the sample size.

The independent variables used in econometric modeling are a set of factors influencing farmers' preferences to plant sugar beet to produce bioenergy. These influencing factors include household size, number of household workforce, age, gender, literacy level, risk attitude, attitude towards sugar beet energy production, sugar beet planting history, the minimum bid price for sugar beet, total farmer income and the area under sugar beet planting, which is based on the previous studies and interviews with farmers and agricultural officials in the study area. The data collection tool is a questionnaire that was designed based on research objectives and hypotheses. The validity of the different sections of the questionnaire was approved by the specialists and experts of Agricultural Organization of Khuzestan province and the professors of agricultural economics department of Science and Research Branch, Islamic azad University. The questionnaires were completed in-person after the required corrections. It was used to estimate and analyze the Logit regression model.

In this study Excel software was used to extract the data from the questionnaires. Stata software was used to estimate regression models and analyze the collected data. Table 2 shows the operational definition of the research variables and how to encode the answers.

Table 2. The operational definition of research variables and how to encode answers

Variable name	How to encode and measure
ASC	Alternative Specific Constants variable with a special double option, which takes the value 1 for the contract options and the value 0 for the option without the contract.
Contract period	The contract period is measured in terms of the period of the year in which the farmer undertakes to grow sugar beet for use in a bioenergy plant.
Area covered by the contract	The area covered by the contract means a part (section or percentage) of arable land where the farmer undertakes to produce sugar beet for use in a bioenergy plant.
Contract price	The price that the farmer receives after harvesting sugar beet is related to the amount of sugar beet offered, which has a sugar content of 16% and is measured in Rials per kilogram. price level: 3000 , 35000 and 4000 Rials
Cost-sharing in the contract	The cost-sharing in the contract represents the percentage of production costs (including planting, growing, and harvesting) that bioenergy plant pays to the farmer and deducts from the funds paid to farmers after purchasing the product.
Product insurance in the contract	Product insurance in the contract means that if the bioenergy plant accepts the insurance costs of the product, the amount is 1, and if it does not cover the insurance costs, the value is 0.
Attitude to bioenergy production from sugar beet	This is calculated from the sum of the scores of the answers to the three questions regarding the attitude towards the production of bioenergy from sugar beet.
Farmer's risk attitude	Self-assessment of a risk attitude that is measured on a scale of 1 to 5 (1 = too much willingness to take risks and 5 = unwillingness to take risks in any way)
Experience of sugar beet planting	The years that farmer were planting sugar beet.
Education	The education level is measured with a ranking variable.
The area under sugar beet planting	The area under sugar beet planting is measured in hectares.
Choice	This variable is an encoded virtual dependent variable that explains a choice made by a farmer in a given situation. This variable takes a value of 1 if one of the two contract options is selected and a value of 0 if it is not selected.

3. Results and Discussion

Table 3 shows the mean, standard deviation, maximum, and minimum value for each data of age, gender, household size, income, education, agricultural history, the area under sugar beet cultivation, and sugar beet production costs per hectare. The statistical results that are mentioned in the table show that the average age of respondents is 39.45 years old with a maximum of 78 and a minimum of 21 years old while the average number of members in each household is 3.35 people with a maximum of 8 people and a minimum of 1 person. The standard deviation for the age variable is 9.2 years old, which is 1.37 for the household size. The average educational level of respondents was 8.7. The lowest number of them had a diploma and most of them had a doctoral degree. Meanwhile, the average annual income is 700 million Rials with a maximum of 3500 million Rials and a minimum of 240 million Rials per year. The minimum bid price for sugar beet is in the range of 2800 to 5500 Rials whose average amount is 3910 Rials. The Gender is dummy variable (male: 1, female: 0) whose average is 0.85 and indicates that the average was closer to one and the majority of respondents were male. The average cost of sugar beet production per hectare is 102 million Rials with a maximum of 220 million Rials and a minimum of 100 million Rials. The average area under sugar beet cultivation is 6.5 hectares with a maximum of 60 and at least 3 hectares.

Table 3. Statistical results of socio-economic characteristics of respondents

Variable	Mean	Standard deviation	Minimum	Maximum
Age (years old)	39.45	9.2	21	78
Gender (male: 1, female: 0)	0.85	0.11	0	1
The minimum bid price for sugar beet (Rials)	3910	686.2	2800	5500
Family size	3.35	1.37	1	8
Income (million Rials)	700	32.41	240	3500
Education (Year)	8.7	1.3	6	22
Agricultural years of experience (Year)	18.6	12.8	60	2
Sugar beet cultivation area (hectare)	6.5	13.10	3	40
Production costs of sugar beet per hectare (million Rials)	102	123	100	220

The hybrid model in this study includes farmers' preferences for producing crops, variables of contract attributes, as well as Alternative specific constants (ASC) interaction with Experience of planting sugar beet, Farmer's risk attitude, attitude to energy production and The area under sugar beet planting in addition to managerial features. The results of estimating the conditional Logit model in hybrid mode are given in Table 5.

Table 5. Results of hybrid conditioned Logit estimation model

Variable	Coefficient value
Alternative specific constants (ASC)	***0.513
Contract period	***0.38
Area covered by the contract	***0.53
Contract price	**0.90
Cost-sharing in the contract	***0.826
Product insurance in the contract	**0.14
History of sugar beet planting	*0.59
Experience of planting sugar beet×(ASC)	*0.51
Farmer's risk attitude×(ASC)	-*0.31
Attitude to bioenergy production×(ASC)	*0.20
The area under sugar beet planting×(ASC)	**0.7290
	Pseudo R^2 =0.55
P-Value= 0.000	LR=1352.3

*** , ** and *coefficients levels of 1%, 5%, and 10%

According to Table 5, the statistical value of Pseudo R^2 in the Logit conditional hybrid model is as much as 0.55. Louviere et al. (2000) and Hensher et al. (2005) stated that if the Pseudo R^2 statistic was above 0.2, then it indicates a good fit of the model. The likelihood-ratio is as much as 1352, which is significant at the level of 1%. Consequently, the results of the present model are confirmed. As the coefficients and significance levels of the coefficients of the independent variables of this model show, all the coefficients at the levels of 1%, 5%, and 10% are significant and have the expected signal coefficients.

The Hausman -McFadden test was used to investigate the independence of unrelated options.

Table 6. Hausman-McFadden test results

Deleted option	Statistics	The significance level
The first option	8.2	0.32
The second option	1.7	0.72
The third option	9.5	0.35

The results of the Hausman Test-McFadden test in Table 5 show that the null hypothesis of the Hausman test based on the independence of unrelated options has not been rejected. Therefore, the results of the Logit model are conditional without distortion and the conditional Logit will be a good model for estimating the parameters.

Results of hybrid conditioned Logit estimation model in Table 6 show that coefficient related to the contract period, the area covered by the contract, the contract price, the cost-sharing in the contract, and the product insurance in the contract are significantly positive. The positivity of the ASC indicates that the selection of one of two contract alternative options over the current status option increases the utility (Birol et al., 2006), The results of model reveal a significantly positive coefficient of the "alternative-specific constant (ASC)" implying that the average participating farmer has a general preference to choice one of planting contract option. Consequently, the average farmer demands a contract price of 3910 Rails for choosing a contract for cultivating sugar beets as a bioenergy crop instead of choosing the status-quo.

The coefficient of contract period variable is significantly positive. In terms of the period that in which the farmer undertakes to grow sugar beet for use in a biofuel plant. These results confirm that farmers are willing to contract sugar beets for bioenergy production in longer period. Guentang (2018) obtained the same result. The coefficient area covered by the contract variable is significantly positive. The area covered by the contract means a part (section or percentage) of arable land where the farmer undertakes to produce sugar beet for use in a biofuel plant, So farmers prefer large share of their arable land covered by contract. As in study by krah et al (2015) and sauthoff et al (2105), the coefficient of Contract price attribute is significant and positive. The price that the farmer receives after harvesting sugar beet is related to the amount of sugar beet offered, which has a sugar content of 16% and is measured in Rails per kilogram.

The cost-sharing in the contract attribute is significant coefficient of this variable. This result is the same as that of kerah et al (2015). The cost-sharing in the contract represents the percentage of production costs (including planting, growing, and harvesting) that the factory pays to the producer and deducts from the funds paid to farmers after purchasing the product. The coefficient of Product insurance in the contract attribute is significantly positive. krah et al (2015) obtained the same result. This result show that farmer prefer the contract option that bioenergy plant accepts the insurance costs of the product.

Attitude to bioenergy production from sugar beet is significant variable. This is calculated from the sum of the scores of the answers to the three questions regarding the attitude towards the production of biological energy from sugar beet. The positivity of coefficient of the interaction term ASC*Attitude to bioenergy production, indicates that farmers, who have more positive attitude towards bioenergy production, tend to contract for high sugar beet planting.

As in study by Embaye et al. (2018) experience of planting oilseeds had a positive effect on acceptance, the coefficient of the interaction term "ASC * Experience of planting sugar beet" is significantly positive and farmers who have the necessary experience and knowledge in the field of contracts showed more interest in contract options, As information increases.

As the significant and positive coefficient of the interaction term "ASC *farmer's risk attitude" in model of table 5 reveals, the farmer's risk attitude greatly influences the abovementioned general preference for choosing the status-quo over a planting contract. The negativity of the variable of the risk attitude with ASC shows that they are less inclined to cultivate in risky situations. This result is the same as that of sauthoff et al (2015). The positivity of coefficient of the interaction term of the area under sugar beet planting with ASC indicates that farmers, who have more area under sugar beet planting, more tend to choice contract options to sugar beet planting for bioenergy production.

4. Conclusion and Recommendations

In this research, choice experiment was used to investigate farmers' preferences for planting crops to produce bio-energy from sugar beet crop in Khuzestan province. The results of estimating the conditional Logit model showed that coefficients related to the attributes of the contract period, the area covered by the contract, the contract price, the cost-sharing in the contract, and the product insurance in the contract are positive and significant. In other words, people are in favor of programs that have better conditions for the contract, which considers more periods, more area, higher prices, higher cost-sharing, and insurance in the contract. The positivity of the ASC indicates that the selection of alternative options over the current status option increases the utility. The positivity of coefficients of the variables History of sugar beet planting and Experience of planting sugar beet shows that people who have a higher level of experience are more inclined to sugar beet planting for bioenrgy production. Sauthoff et al (2015) and Li et al. (2004) also found that the education, experience and history of planting had a positive effect on the tendency to plant. The negativity of the variable of the risk attitude with ASC shows that they are less inclined to cultivate in risky situations. The positivity of the variable of attitude towards energy production and the area under sugar beet planting with ASC indicates that farmers, who have more planted area as well as a positive attitude towards energy production, tend to conclude a contract for high sugar beet planting. There may be other factors that have a greater impact on the decision to conclude a contract or not, for example, the contract partner. However, our findings reveal that a farmer’s risk attitude has an influence on choosing an offered contract or not. Farmers who are willing to contract are more likely to be risk-averse and aim to test contracting sugar beets for biogas production as a risk reduction alternative. These farmers prefer long contract periods and a large share of their arable land covered by contract, which is contrary to the interests of biogas operators who want a secure substrate supply on a long-term basis. This objective of biogas operators can only be reached with high, probably non-economic markups. Therefore, the following recommendations can be given to improve planting:

1. There is a need to develop appropriate strategies and a strict regulatory framework for exploiting the potential economic opportunities of sugar beet planting to promote sugar beet planting to produce bioenergy in fertile lands used in the production of other crops. At the same time, the people of the village should be supported to allocate part of their fertile lands for sugar beet planting instead of food products.
2. Low-educated farmers should be targeted to promote energy-efficient sugar beet planting, as they appear to be far from sugar beet planting. For example, promotional training by bioenergy expert and the use of leading farmers is recommended to develop sugar beet planting among farmer.
3. Appropriate promotional and educational programs and access to credit mechanisms should be developed to extension the acceptance of bio-energy products. Promotional and agricultural service centers should work closely with those who accept sugar beet planting and allow them to be considered part of the information system and upgrading the bio-energy industry.
4. The development of cooperative farms, funds, and organizations is recommended to support sugar beet farmers through training and financial assistance, and increase their negotiation and bargaining power. The price of sugar beet in Iran is always low, and farmers do not have the negotiating power to determine the price and terms of sale to large private enterprises, unless they organize themselves in the form of farmers' cooperatives.
5. The attributes of the planting contract should consider the concerns of farmers for the success of the sugar beet planting contract. Therefore, understanding farmers' priorities for designing a planting contract is a key source of information for this purpose. In this study, the design of a sugar beet planting contract is recommended based on contract in which the content of the contract between farmers and bioenergy investors (bioenergy plants) is clearly stated. This contract should be promoted in the form of buyer support and sharing the planting costs in the form of transportation costs, technical training and seed supply, fertilizers, pesticides and product insurance cost.
6. It is recommended to define the term acceptance in a time frame such as early, late recipients, and so on when examining farmers' acceptance and willingness for bio-energy products such as sugar beet. Further studies will help policymakers and investors identify the willingness to accept planting contracts in other areas. The Discrete Choice Experiment (DCE) is specific to the location. Therefore, it is not clear how the results can be generalized to other locations. Preferences related to contract features vary according to location. Therefore, more repetitions are required. Priorities related to contract attributes such as quality, penalties for non-fulfillment of obligations, and delays in payments should also be considered.

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