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THE RELATIONSHIP PRODUCTION BEHAVIOURS AND PERCEPTION OF GENETIC RESOURCE CONSERVATION OF THE FARMERS PRODUCING DRY BEAN LANDRACES IN TURKEY

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ABSTRACT

Turkey to be an important gene center for many plants and animals in the world, carry Turkey to a significant position both in terms of biodiversity and genetic resources. However, technological advances, developments in the use of inputs in agriculture, growing population and nutritional needs have confronted manufacturers with the fact that their production resources could be used more efficiently. The producers are planning their production with the level of consciousness and behavior in production, and also with genetic resource-landraces perception, which affects the sustainability of genetic resources-landraces. This study reveals the relationship between genetic resource-landraces perception and production behaviors of dry bean landrace (DBL) producers as a result of the survey conducted with 140 DBL producers from 27 districts of a total of 8 provinces located in Middle Kızılırmak Valley in Turkey. Genetic Resource-Landrace Perception (GRLP) and Production Behavior (PB) indexes of the producers were established by factor analysis. As a result, even though the economic value is high, landraces are being produced more by old school producers, which are defined as "conservative". Moreover, it has been determined that these producers are higher in genetic resource-landraces perception than that defined as “innovative”. While the state is making policy regarding the protection of genetic resources and the sustainability of landraces, innovative and prominent individuals need to be taken more into consideration when determining the target population. Although the aforementioned individuals represent an innovative and environmentally conscious high-level, they are composed of individuals with low genetic resource- landrace perception and are the groups that trigger more erosion of genetic resources with more commercial-oriented thinking.

KEYWORDS:
Natural Resources and Environment, Middle Kızılırmak Valley, Dry Bean Landraces, Genetic Resources, Production Behaviour, Turkey

INTRODUCTION

Rapid developments in agriculture, particularly in the second half of the 20th century, have brought about significant increases in productivity. Progress in plant breeding, as well as this intensification in agriculture, has begun to cause the introduction of high yielding new varieties into the market and the production of lower-yielding landraces to decline. The period named as a green revolution characterized by the use of technological and chemical inputs, also has a separate prescription for plant rehabilitation, especially the achievements achieved in wheat and paddy have marked this period. When evaluated in terms of meeting the growing food needs of the population, the results of this period have led most industrial countries to achieve sustainable food surplus in the second half of the twentieth century and the threat of hunger has ceased to exist [1].

When the ecological, economic and social cost of this process, which is perceived as modernization, is understood to be rather heavy, one of the most important problems experienced emerged as an erosion of genetic resources. Genetic erosion is a process involving the replacement of traditional, indigenous and landraces with genetically uniform, highly efficient modern varieties. Insufficient knowledge about climate change intensive agriculture, rapid development processes and urbanization, the destructive effect of modern agriculture on habitat, especially the scientific, social, cultural and economic importance of plant germplasm are the main drivers of this process [2]. Especially with the green revolution, it is reported that in many countries modern varieties have taken the place of most of the landraces [3, 4, 5]. Looking at the positive direction of this process, although the increase in yield seems to be important, the contraction of the gene pool and the loss of biodiversity constitute an environmental problem.

Turkey in the world of agriculture, is the gene center of many cultivated plants. In terms of origin of the cultured plants in the world, a total of eight gene centers were determined including Turkey (Near East and Mediterranean) [6]. Mediterranean and Near Eastern Centers of diversity and origin centers that was announced by the Vavilov (1994) also

coincides with Turkey [7]. Turkey is one of the world's richest countries in terms of plant genetic resources. In addition, according to J. Harlan there are 5 micro-gene centers with more than 100 species shows widespread variations in Turkey, which is primary and secondary gene center of many plants [7]. In our micro gene centers; varieties and form richness are observed in feed plants of barley, rye, oat, rape, lentil, chickpea, faba bean, kidney bean, vetch, sainfoin and leguminous crops [8].

Despite the lack of advantages, Turkey is an important diversity area for many vegetable species. Kidney bean, which is one of them, is one of the most important plant species for Turkey in terms of direct use in human nutrition and nutrients it contains. Beans have arrived in Turkey in the 17th century and is a legume crops that can be grown by aiming to have both dry or fresh in almost every part of Turkey and showed wide variation [9]. This legume grain contains about 22-24% protein, mineral matter and vitamin-rich contents, being an important agriculture product for human nutrition as referring "both meat and bread" [10].

South-Eastern Anatolia and Samsun-Tokat-Amasya micro gene centers are centers of genetic diversity for beans although they are not the gene center [11]. In Turkey, there are many studies on the subject of beans as the genetic resources in terms of collection, assessment and using in breeding [12]. Turkey on the fertile lands of Anatolia, thanks to the fact that Anatolian lands have hosted many civilizations and thanks to the ecological diversity that it has, like on that in almost all plant species, that also led beans to the emergence of variations in many years. materials that enter the country from different sources have been cultivated for many years in the regions they are located and different kinds of bean landraces have been formed. Locally grown bean plants contain a large number of different genetic material features [13]. Although there are improved bean varieties in the world and in Turkey, many producers are still producing and marketing local bean genotypes [14]. Therefore, in different regions of Turkey it is still possible to find bean landraces genotypes. In particular, the Middle Kızılırmak Basin, which is close to the Samsun-Tokat-Amasya micro gene centers, is an important center for the richness of dry bean landraces.

One of the effective ways to increase grain yield and quality is the use of genetic resources in breeding [14]. Thus, the sustainability of genetic resources is ensured as well as preventing genetic erosion. Although ex-situ method used to protect genetic resources is one of the important methods, in-situ conservation [15] and usage of them in as economic development tool [16] provide significant advantages in terms of sustainability. There are studies that suggest that there is a relationship between protecting genetic resources and biodiversity and ensuring sustainability, and people's environmental awareness [17, 18, 19, 20, 21]. For this reason, activities to improve environmental awareness in society can contribute to the conservation of biodiversity, and will also have a positive impact on the conservation and sustainability of genetic resources. In addition, according to TurkStat statistics in Turkey, negative pressure of 42.12% shrinkage in the field of dry bean cultivation between 2004-2017 [22] on both production and genetic resources makes it important to determine the factors that can be effective in farmers' production decisions.

With this study, in the Middle Kızılırmak Basin which is an important gene center for dry bean landraces (DBL), it is intended to reveal the general characteristics of producers dealing with dry bean landraces production and the perceptions of genetic resources / landraces. Thus, the conclusions have been drawn about what are the production decisions of DBL producers about genetic resources / landraces and what might be the factors that affect this perception. The basis of this work is both the original field data and the results of similar studies on the subject. Therefore, the generated synthesis is one of the important studies in the field with the identification of factors that may be effective in ensuring the protection of genetic resources and sustainability in Turkey. In particular, measures for the protection of genetic resources in agriculture policy in Turkey, considering that constitutes one of the most important items in agenda, the results of the study are also important in terms of policy makers.

MATERIALS AND METHODS

Data and Study Area. The main material of the study consists of the data obtained through a questionnaire survey with 140 DBL producers from a total of 8 villages (Ankara, Aksaray, Çankırı, Kayseri, Kırıkkale, Kırşehir, Nevşehir, Sivas) in the Middle Kızılırmak Basin within the scope of the "Middle Kızılırmak Valley Morphological and Molecular Characterization of Dried Bean Landraces and Determination of Genotypes Resistant to Root Nematode and Socio-Economic Characteristics of Producers" Project supported by the R & D Projects Program of the General Directorate of Agricultural Research and Policy (TAGEM) of the Ministry of Agriculture and Forestry (MoAF) (Figure 1).

The lack of a specific database on the producers engaged in the production of landraces in Turkey, makes it difficult to sample for the work to be done with DBL producers. In such studies, preliminary interviews with relevant experts and local residents prior to the study are indicative of the areas in which the study will be conducted, and interviews with producers meeting these criteria can be conducted in these areas. A similar approach on this issue has been applied in the study conducted in Turkey with wheat landraces by [5]. The database of the study of dry

FIGURE 1
The Map of Survey Area

bean and soil samples from the producers of DBL breeding in 2016 was used to determine the producers to collect data in the middle Kızılırmak Basin where the work was carried out. Producers included in the survey conducted in the region in 2016 formed the sample set of the survey works conducted in 2017. Negotiations with Provincial / District Agriculture and Forestry Directorates experts, Agricultural Chambers and local people have been effective in identifying DBL producers. As a result of interviews and surveys conducted in the region, a total of 140 producers were reached (78.21%) from the manufacturers that were sampled in 2016 and face-to-face questionnaires were completed.

In the study, the personal characteristics of the DBL producers were questioned using a 5-point scale (5 = Strongly agree / 1 = Strongly agree) to measure GRLP. In this context, 12 variables to determine the personal characteristics of the producers, and 18 variables to determine the genetic resources / local population perceptions were assigned. A reliability test was applied to the questionnaire in order to show whether the collected Likert scaled data reflects a measured likelihood. To test the reliability of the generated scale, the Cronbach Alpha coefficient was examined in the reliability analyzes most commonly used. The Cronbach Alpha coefficient is 0.60 and above, indicating that the developed scale is reliable [23, 24].

Due to the excess of variables, index values were created by using Factor Analysis Method for personal characteristics and GRLP variables. Factor analysis is one of the multivariate analysis techniques commonly used in various fields, particularly in the social sciences. Factor analysis aims to find a small number of new unrelated variables by combining the variables associated with each other in a (p) variable event. This analysis is applied to reduce the number of variables if there are too many variables and to easily interpret them [25]. Kaiser-Meyer-Olkin (KMO) and Bartlett tests were performed to evaluate whether the data set is appropriate in factor analysis [24]. The value found in the KMO test gives information about the suitability of the data set for factor analysis and if the calculated value is less than 0.50, it can not be accepted, 0.50 weak, 0.60 medium, 0.70 good, 0.80 very good, 0.90 excellent [26]. The Bartlett Test of Sphericity is used to test whether the correlation matrix is a unit matrix with all diagonal terms 1 and non-diagonal terms 0. This test requires that the data come from multiple normal distributions [25]. The Varimax rotation technique has been utilized in the rotation processes for better interpretation of the factors [23]. The variables used in factor analysis are presented in Table 1.

In addition, chi-square independence tests were performed in order to obtain information on whether the independent variables were independent of each other or not, and the results were interpreted according to the chi-square dependence coefficients in the study [27]. In the analysis of continuous variables, Variance Analysis was used to determine whether there was a statistically significant difference between groups with more than 2 levels. In the case of significant difference in statistics, Duncan Analysis of Multiple Comparison Methods was applied in order to show which group the difference originated from [28].

RESULTS AND DISCUSSION

Along with the Green Revolution, both the use of chemicals and the development in the breeding process have led to a dramatic increase in the productivity of producers. Many studies indicate that landraces are not used by many producers, especially

large producers, especially those following developments, due to reasons such as poor yield, and that these productions remain in restricted areas [15]. When looking at the factors affecting the use of landraces; the demographic, social and economic factors of the producers as well as the geographical structure of the place where the production takes place affects. Both studies conducted both in Turkey in the international arena, it is stated that the probability of reaching such landraces increases under difficult geographical conditions in rural areas remote from the main centers [15]. For this reason, some demographic and geographical variables belonging to the producers of DBL production in the Middle Kızılırmak Valley where the study is conducted are given in Table 2. Table 2 shows that DBL producers are over 50 years old, education is low (have more than 85% primary and below education levels) and household width is about 4 people. In particular, the low number of households can create a negative production pressure for products based on human labor, such as dried beans. In recent years, the production of the dry beans has decreased due to the fact that the dry bean is based on human labor during the harvest and the production of chickpeas, which are suitable for machine-harvesting, is increasing.

Another variable that is examined under the demographic characteristics is the social security situation of the producers. As seen in Table 2, only 37.14% of producers make farming as a profession. The rest of the group operates in other occupational groups (workers, civil servants, trades, etc.) besides farming. When the geographical characteristics of the producers' locations are examined, it is determined that the producers live at an average altitude of 1,155 m (Table 2). If we call the geographical area for 1,200 m and above of the Central Anatolia Region as mountainous area [29], it is determined that 42.14% of the producers live in these mountainous areas above 1,200 m. Another important factor in deciding landraces production is the distance from the main settlements. According to the results of the research, producers indicate that DBL productions are usually made in areas remote from the main centers [15] along with the average distance of DBL producers to the nearest district center İs calculated as 16.27 km and the distance to the nearest provincial center is 71.96 km (Table 2).

TABLE 1
Variables for Factor Analyses

	Production Behaviours (PB) of Dry Bean Landrace (DBL) Producers		Genetic Resources-Landrace Perception (GRLP) of DBL Producers
1	Be the first to adopt new technologies.	1	Landraces have been replaced by commercial varieties in many cases
2	Consult with the people aroun, search and then innovate.	2	The productivity of landraces is decreasing day by day
3	Investigate the development of all kinds of agriculture and animal husbandry.	3	In the disappearance of landraces in the region, too many trade-type inflows to the market/region are effective
4	Take care to participate in all kinds of activities related to agriculture and animal husbandry.	4	Year by year produced landraces began to change color, type and shape.
5	Also give information to others about the techniques learned or practiced.	5	No longer there are landraces seeds as before.
6	The manufacturers around, imitate what practiced.	6	Trying to plant the most productive variety instead of many kinds of bread.
7	First see the result of tried techniques in production then apply..	7	Landraces are more adaptive to the region than the developed varieties.
8	There are producers that taken as examples and followed their applications.	8	Farmer no longer has landraces.
9	Investigate where is the mistake when could not get the results that wanted in production.	9	It was difficult to reach the landraces seed.
10	Do not need to consult anyone other than myself.	10	There is tenderness in our village for the protection of landraces
11	Not afraid to try something new.	11	Do not think it will be too much trouble if landraces disappear
12	Consider whether applications are harmful to nature and then apply according to that	12	We lost the seeds of landraces. Planted seeds are not landraces.
		13	There is very special genes in landraces.
		14	These varieties must be state-protected. The farmer has nothing to do.
		15	The landraces that used to produce have disappeared. Do not think no one can find their seed anywhere.
		16	These varieties are produced only for home needs. Do not make money.
		17	Producing only landraces is not a good economic strategy. Must be produced with commercial varieties.
		18	As a farmer we are responsible for the protection of landraces.

TABLE 2
Some Statistical Data Belonging to DBLP and Their Settlement

Demographic Variables	Minimum	Maximum	Mean
Farmer Age	28.00	84.00	54.09
The Number of Household Member (Woman)	1.00	6.00	2.15
The Number of Household Member (Man)	1.00	5.00	2.02
The Number of Household Member (Total)	2.00	11.00	4.17
Education Level (%)			
Illiterate		0.71	
Literate		4.29	
Primary School		82.14	
Secondary School		9.29	
Vocational High School		1.43	
University		2.14	
Social Security (%)			
No Social Security		5.00	
Government Retirement Fund		4.29	
Social Security Authority (Worker)		29.29	
Social Security Organization (artisans and the self-employed)		17.14	
Social Security Organization (Farmers)		37.14	
Other		7.14	
Geographical Variables	**Minimum**	**Maximum**	**Mean**
Altitude (m)	625.00	1691.00	1155.25
Altitude (%)			
Highland (<1200 m)		42.14	
Lowland (>=1200 m)		57.86	
Distance to District Center (km)	0.00	55.00	16.27
Distance to City Center (km)	16.00	200.00	71.96

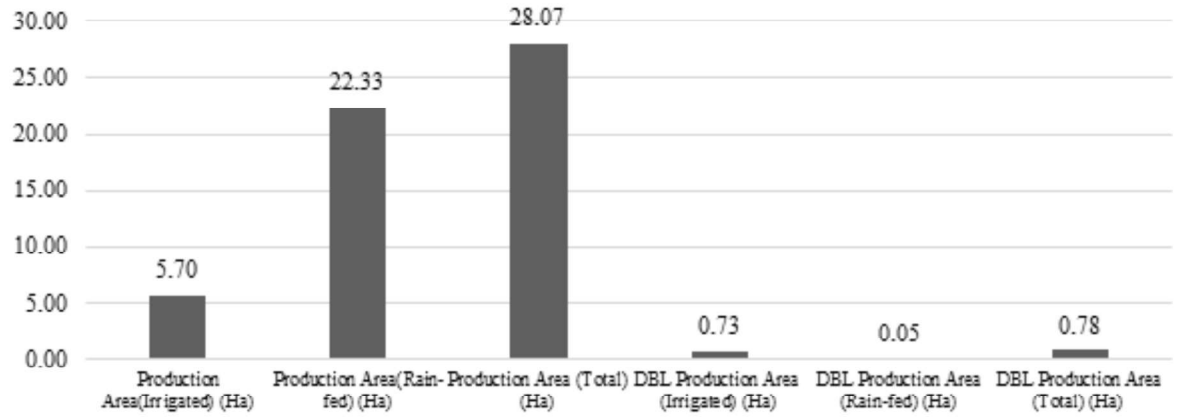

FIGURE 2
Agricultural Statistics Belonging to The Dry Bean Landrace (DBL) Producers

Some agricultural statistics of DBL producers are given in Figure 2. Dry bean production is mostly based on a watery production system, and in some regions it has been determined that the production is made as dry. The total amount of DBL producers processed in 2016 is 28.07 ha, of which 79.57% is composed of dry agricultural land. 2.79% of total production land is devoted to DBL production and 37.86% of this production is made in very small land like garden type and 62.14% of the production is made in field type land greater than 0.1 hectare.

The main purpose of the study is to demonstrate the production behavior and genetic resource / landraces perception of DBL producers and indicate the change in dry bean landraces production according to determined indices. For this reason, 2 different data collection tools were used in the research. In the first part, a scale of 12 items developed by the researchers was used to determine the production behavior of DBL producers. The KMO coefficient of the 12-item scale was 0.827; Bartlett Test X^2 = 531.45; $p < 0.01$ and factor analysis was deemed appropriate. As a result of the factor analysis, it was determined that the scale, on which item analysis and

Varimax rotation operation carried out, was collected in three dimensions. The four-factor scale, that eigenvalue is greater than 1, with 12 items accounts for 56.59% of the variance. The Cronbach Alfa reliability coefficient of the dimension which is related with the DBL producers' production behavior was calculated as 0.69 (Table 3).

The second dimension of the scale contains 18 items. This dimension identifies the safety perception of the producers for landraces and genetic resource perception. The KMO coefficient of the scale consisting of 20 items is 0.775; Bartlett Test X^2 = 965.03; $p < 0.01$ and factor analysis was deemed appropriate. As a result of the factor analysis, it was determined that the scale, on which item analysis and Varimax rotation operation carried out, was collected in four dimensions. The four-factor scale, that eigenvalue is greater than 1, with 20 items accounts for 62.44% of the variance. The Cronbach Alfa reliability coefficient of the landraces and genetic resource perception dimension was calculated as 0.69. Production behavior and genetic resources / landraces and environmental perception indexes were established by gathering the reduced factors obtained in the first and second dimensions (Table 3).

In the production behavior index, the fact that the index value goes from negative to positive suggests that the producers are more innovative, use more technology, take more risks, follow information and technology, and are environment-conscious producers in their practice. The index value created in this context was used both as a continuous variable and divided into quartiles to group DBL producers as traditionalists, middle traders, middle innovators and innovators. In addition, in the calculation of descriptive statistics for producers, producers classified as traditionalists and innovators according to median value.

In the genetic resource / landaces and environmental perception index, as the index value goes from positive to negative indicates that the producers think, that landraces are lost, that these seeds are difficult to find; and that the producers who produce landraces do not produce it as an economic gain but rather produce with the aim of meeting household needs. Manufacturers with high index value believe that a production strategy based only on landraces will not be economically feasible and that responsibility for the protection of landraces and genetic resources is much more on the state. In addition, these producers have a strong belief that the disappearance of landraces will not be a problem and that no special genes will be found in these varieties.

When Table 4 is examined, it is seen that the producers dealing with DBL production in the research area are divided into quartiles according to the production behavior index and variance analysis and descriptive statistical results are given accordingly. Firstly, it is seen that GRLP index values have statistically meaningful difference according to production behavior. Both Table 4 and Figure 3 are examined; it is seen that the group identified as "Conservative", which has a negative GRLP index value, has higher GRLP. It has been found that innovative producers, who are environmentally responsible and able to be leaders in the society, mostly do not adopt a production strategy based on local populations, often do not have enough knowledge about the value of landraces as genetic resources. Also these producers think these varieties are lost and the disappearance of such varieties does not constitute a major problem. These producers believe that the protection of genetic resources and is a more state policy.

The studies on environmental perception in Turkey are mostly about energy consumption, economic growth, development and climate change interactions. Many studies have been conducted within the framework of the Environmental Kuznet Hypothesis. The Environmental Kuznets Hypothesis implies that growth will not ultimately have a negative impact on the environment, on the contrary, growth will affect the environment positively. In Turkey, some studies [30, 31, 32, 33] on this subject suggest that along with the growth the default Environmental Kuznets Hypothesis has not taken place and continuation of environmental pollution.

TABLE 3
Kaiser-Mayer-Olkin (KMO) and Bartlett Test Results

Dry Bean Landrace Producers' Behavior Data Set		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.827
Bartlett's Test of Sphericity	Approx. Chi-Square	531.45
	df	66
	Sig.	0.000
Total Variance		56.59
Cronbach Alpha		0.69
The Producers' Genetic Resource/Landraces and Environement Perception Data Set		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.775
Bartlett's Test of Sphericity	Approx. Chi-Square	965.03
	df	153
	Sig.	0.000
Total Variance		62.44
Cronbach Alpha		0.69

TABLE 4
Descriptive Statistics and Variance Analyse by DBL Producers' Behaviors

Variables	Production Behavior Index Quartiles of DBLP Producers					F Value/Kruskall Wallis (K-W) Chi Square
	Conservative	Mid-Conservative	Mid-Innovative	Innovative	Average	
The Index of Genetic Resource-Landrace Perception	-0.63 ***a***	0.02 ***ab***	-0.19 ***ab***	0.80 ***b***	0.00	2.60*
Age (Year)	59.51 ***a***	54.80 ***ab***	50.57 ***b***	51.46 ***b***	54.09	5.38***
Education (Year)	5.51 ***a***	5.66 ***ab***	7.09 ***b***	6.57 ***ab***	6.21	(K-W) 8.51**
Distance to District Center (Km)	17.17	15.71	14.49	17.71	16.27	(K-W) 1.11
Altitude (m)	1213.97 ***a***	1197.29 ***a***	1064.91 ***b***	1144.83 ***ab***	1155.25	2.65*
Total DBL Production Area (Ha)	0.35	0.44	1.16	1.18	0.78	(K-W) 4.47
Private Production Area (Ha)	10.16	9.91	14.96	16.00	12.76	(K-W) 6.73*
Irrigated Production Area (Ha)	3.83 ***a***	2.11 ***a***	5.98 ***ab***	10.88 ***b***	5.70	(K-W) 22.54***
Share of DBL Prod. Area in Irrigated Prod. Area (%)	9.18	20.49	19.36	10.89	13.72	
Total Production Area (Inc. Rented and Sharecropping) (Ha)	21.24 ***a***	21.21 ***a***	38.91 ***b***	30.92 ***ab***	28.07	(K-W) 10.35**

* Statistically significant at 90% confidence level, ** Statistically significant at 95% confidence level, *** Statistically significant at 99% confidence level

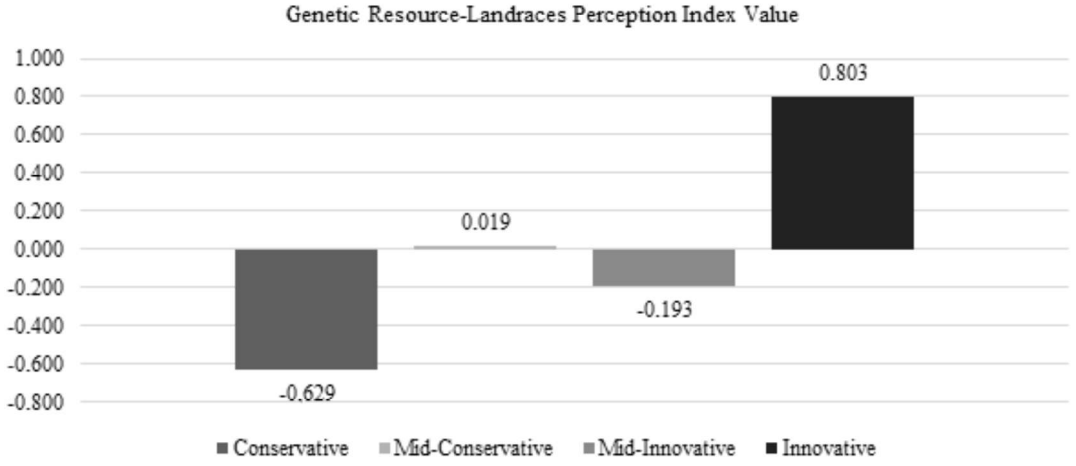

FIGURE 3
Genetic Resources-Landraces Perception Index Value by Production Behaviors of DBLP

The mass of high GRLP index value producer qualified as conservative, mostly represents high-age, low-educated, living in high-altitude areas in terms of the geographical location they live in and producing in smaller areas (Table 4). The group that gives more importance to the production of land-races and conservation of genetic resources, shows similarities with the studies of [34] and [35] who work in wheat landraces in Turkey.

CONCLUSION

Turkey is one of the rare countries in the world in terms of genetic diversity, with each passing day landraces disappear and places with high productiv-ity varieties. Many factors affect the disappearance of local populations, especially the genetic resource and landraces perception of producers, as well as in-novation and environmental considerations in pro-duction behavior. With this study, the relationship between genetic resources-landrace perception and production behavior of farmers growing the local population in Turkey has been demonstrated through DBL producers. As a result, it is seen that manufac-turers with high genetic resource-landrace percep-tion, who are still seeing landraces as an economic asset in Turkey and think that landraces must be pro-tected and maintained by both the state and the pro-ducers, are the part of the traditional structure which is defined as conservative. Contrary to what is known, although innovative groups seem to be highly sensitive to the environment, they think that genetic resources do not create economic value.

Within the framework of the Environmental Kuznets Hypothesis studies in Turkey is reviewed based on genetic resources; it is seen that Turkey still do not evaluate the terminology of development and growth along with environmental protection, conservation of genetic resources, sustainable use of local potential and economic value creation. It is necessary that the group defined as Innovative should be guided to have more willing and pioneering attitudes towards the protection of genetic resources and existing values, and policies should be designed accordingly. In ensuring the sustainability of landraces during policy development, targeting the group identified as innovative will ensure that it has a more effective policy implementation outcome.

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