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THE DEVELOPMENT OF TRITICALE PRODUCTION IN TURKEY: THE CASE OF CORUM PROVINCE

Bahri KARLI, Arif ÖZUYGUR, Mevlüt GÜL, Bektas KADAKOGLU

Isparta University of Applied Sciences, Faculty of Agriculture, Department of Agricultural Economics, Isparta-Turkey, Phone: +902462146233, Fax: +902462146399, Emails: bahrikarli@isparta.edu.tr, ozuygur.11@gmail.com, mevlutgul@isparta.edu.tr bektaskadakoglu@isparta.edu.tr

Corresponding author: bahrikarli@isparta.edu.tr

Abstract

In this study, socio-economic structure and producing problems of triticale cultivation farms in Corum province were analysed. The study was carried out in Sungurlu district of Corum Province where the triticale cultivation is intensive in 2019 production period. According to the Neyman method, the sample farms were determined, and the data were obtained by face-to-face interviews with 53 triticale cultivate farmers. The farms were classified according to their size as Group I (≤ 15.00 decares; 18 farms), Group II (15.01-25.00 decares; 16 farms), and Group III (>25.01 decares; 19 farms). Average triticale land presence in farms was 27.26 da, and the share of triticale lands in total land presence was calculated as 9.58 %. It was determined that the average farmers' age of 46.36 years, duration of education received 8.19 years, an average of 5.02 people per house, and 2.11 years of experience in the farmers' triticale cultivation. It was determined that the most important problems of the farms having problems in triticale production; were high input costs, proper credit and fertiliser supply, low triticale sales price, cooperation and organisation between farmers, quality seed supply, water and irrigation problems. Triticale has become an important product for human and animal nutrition due to its ability to grow in marginal environments and its nutritional properties. It is thought that triticale production will increase in the coming years in the region if the triticale farmers' problems are solved.

Key words: *triticale, production, farming problems, socio-economic structure, Turkey*

INTRODUCTION

Cereals are the most significant cultivated crops and reason for the primary energy and protein source for both humans and animals' nutrition [8, 9]. Cereals are a group of plants in the Graminae (*Poaceae*) family. Cereals are divided into two critical groups according to climate demands. These are cool-climate cereals and warm climate cereals. Among the cool-climate cereals are wheat (*Triticum*), barley (*Hordeum*), oat (*Avena*), rye (*Secale*) and triticale (*xTriticosecale*) plants [1].

Among cool-climate cereals, the most grown crop in the world is wheat. Barley, oats, rye and triticale are the most planted areas after wheat. Triticale is the 5th most grown among cool climate cereals plant [3].

Triticale (*xTriticosecale*), the product of wheat and rye hybridisation, was proved high yield potential even under adverse growing (resistant to cold and drought) conditions [7]. Also, the nutritional value it contains is higher than wheat and rye [6].

As a global product, triticale production in the world was slow until 1985. Since then, triticale production and cultivation area have increased rapidly. In 2019 years, the total area cultivated to triticale worldwide is roughly 3.8 million ha. In the same year, production was 14 million tons (Fig. 1).

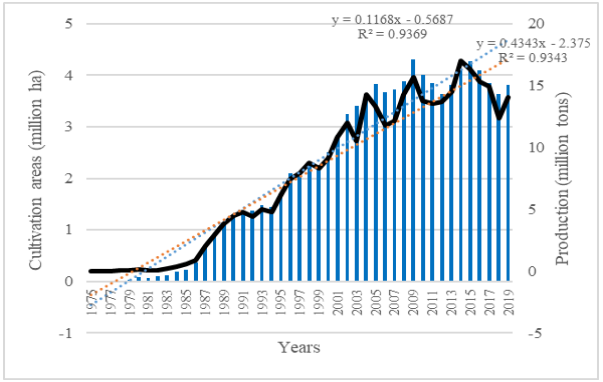

Fig. 1. Triticale cultivation areas (million hectares) and production (million tons) in the world
Source: [3].

Turkey is ranked number eleventh in the world by triticale cultivation area share of 1.53% after Poland (34.53%), Belarus (11.92%), Germany (9.41%), France (8.02%), Spain (6.59%), China (5.54%), Russian (3.56%), Lithuania (2.77%), Hungary (2.20%) and Romania (2.07%) (Fig. 2).

Turkey is ranked number twelfth in the world with a triticale production share of 1.53% after Poland (31.99%), Germany (15.61%), France (11.67%), Belarus (9.32%), Spain (4.27%), China (3.20%), Russian (2.53%), Lithuania (2.47%), Hungary (2.41%), Austria (2.32%) and Romania (2.23%) (Fig. 3). Accordingly, a third of triticale agriculture is carried out in Poland regarding both production and cultivation area.

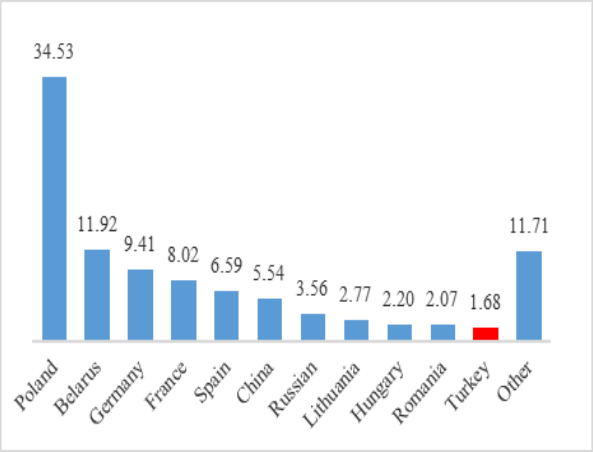

Fig. 2. The shares of countries in the world triticale cultivation area (%)
Source: [3].

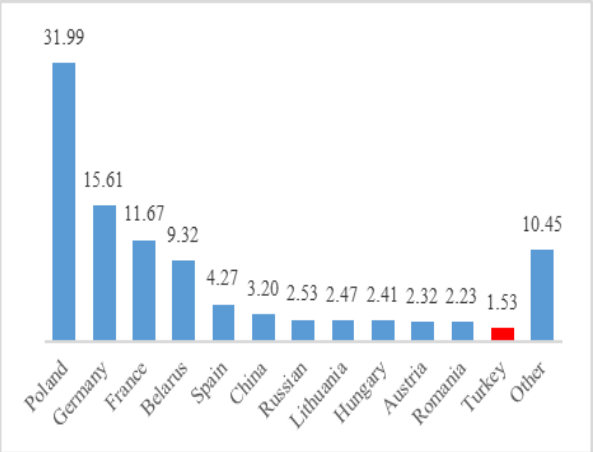

Fig. 3. The shares of countries in the world triticale production
Source: [3].

According to 2019 data, Turkey's triticale planting area has 641 thousand decares. The production amounted to 215 thousand tons. Triticale yield is 336 kg per decare. Triticale cultivation areas increased by 123%, and production amounts increased by 128% compared to the average of 2004-2006. The yield per decare remained almost the same. It increased by 2.13% in the same periods (Table 1).

Corum province as of 2019 in terms of production and cultivated area of triticale is in first place in Turkey. The Corum's triticale cultivated area share is 26.47%, and production share is 26.78% of Turkey. Sivas is the second important triticale producers with 7.52% share of Turkey, Mugla is third with 6.02%, Denizli is fourth with 4.66%, Konya ranks is fifth with 4.09% (Table 2).

Table 1. Triticale production in Turkey

Years	Cultivation area		Production		Yield
	Da (1000)	Index	Tons (1000)	Index	Kg/da
2004-2006	287	100.00	94	100.00	329
2007-2009	278	96.70	93	98.94	335
2010-2012	296	103.19	101	107.45	341
2013-2015	358	124.84	118	125.53	328
2016	376	131.11	125	132.98	332
2017	456	159.01	150	159.57	329
2018	503	175.18	170	180.85	338
2019	641	223.32	215	228.82	336

Source: [11].

Table 2. Triticale production in Turkey by province

Provinces	Cultivation area		Production		Yield
	Decares (1000)	Share (%)	Tons (1000)	Share (%)	Kg/da
Corum	170	26.47	58	26.78	340
Sivas	48	7.52	13	6.11	273
Mugla	39	6.02	17	8.06	449
Denizli	30	4.66	10	4.78	344
Konya	26	4.09	9	4.21	345
Other	328	51.23	108	50.06	318
Turkey	641	100.00	215	100.00	336

Source: [11].

Triticale is a grain with resistance and tolerance to the research area's climate, cold and drought. Due to the low nutritional value of rye and low oat yield, triticale has become an alternative product in low wheat yield regions. For this reason, triticale has become a new crop for Turkish farmers [2].

Figure 4 presents the share of Corum province in Turkey according to the area of triticale production, and cultivation is presented. Corum is Turkey's highest triticale producer.

Corum province in 2004, a total of 95 thousand tons of triticale was produced by making 300 thousand decares of triticale in the field. The cultivation area has started to increase since 2015. The production also increased with an increase in cultivation areas. The last five years (2015-2019) of triticale production and cultivation of the Corum's share increased to about 30% in Turkey. As of 2004-2019 years of triticale production share's 0.70% to 26.7% in Turkey was carried out by Corum. In 2019, a total of 58 thousand tons of triticale was produced by making 641 thousand decares of triticale in the Corum.

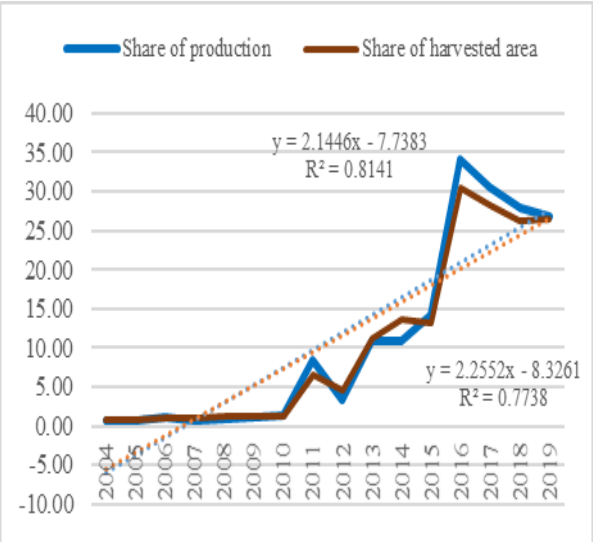

Fig. 4. Corum's triticale production and harvested area share in Turkey
Source: [11].

Studies on the socio-economic structure about triticale are very few. In this study, socio-economic structure and producing problems of triticale cultivation farms in Corum province were analysed.

MATERIALS AND METHODS

The study's primary material was comprised of original data obtained via face-to-face survey method from 53 triticale farms at the Sungurlu district of Corum province. Corum province has 24.47% triticale production area and 26.78% triticale production of Turkey. For this reason, Corum province was chosen as the study area. In addition to similar studies conducted by the related people and institutions, reports and statistics were used. Survey data belongs to the 2019 production period.

Neyman Method was used to determine the sample volume of the survey [13]. The number of samples was calculated with the formula given below.

$$n = \frac{(\sum N_h S_h)^2}{N^2 D^2 + \sum N_h S_h^2} \quad (1)$$

n; Sample size, N; Total number of units in the population, Nh; Number of units in group h, Sh; Standard deviation of group h, Sh^2; Variance of group h, D^2; d^2/z^2, d^2; Allowed error from population average, z^2; Value of the allowed safety limit in the distribution table.

The producers participating in the research were divided into groups according to their triticale production areas. According to this, the farms were divided into three groups as "I. Group (15 decares and less; 18 farms), II. Group (15.01-25.00 decares; 16 farms) and III. Group (>25.01 decares; 19 farms)" (Table 3). The data obtained from the identified farms through questionnaires were uploaded to the computer environment and evaluated in tables by making calculations in Microsoft Excel and SPSS software.

Table 3. The sample volume of triticale producers

Groups	Triticale production area (decare)*	Number of farms	Percent
I	<15.01	18	33.96
II	15.01-25.00	16	30.19
III	25.01<	19	35.85
Total		53	100.00

Source: Own calculation.
*1 decares = 0.1 hectares

RESULTS AND DISCUSSIONS

Triticale farms were divided into three groups according to triticale production areas. The farms' average production area in the groups was determined as 13.06 decares for I. group farms, 21.25 decares for II. group farms, 45.79 decares for III. group farms and 27.26 decares for all farms. Of the 53 farms interviewed in the region; 18 farms were in I.

group, 16 farms were in II. group, and 19 farms were in III. group.

Table 4 presents the data on the age, education level, household population, farming experience and triticale cultivation experience. It was determined that the age averages of the producers varied between 45.56-47.44 years according to the farm groups, the duration of education varied between 7.83-8.26 years, the household size of the producers varied between 4.75-5.26 person, their farming experience varied between 24.56-25.00 years, and their level of experience in triticale cultivation varied between 1.89-2.26 years. It was determined that the region's farming experience period was high, but the triticale experience period was low. Tasci et al. (2014) [10], in a study, carried out in the same region, determined the average age of farmers at 54 years and the experience of farming at 33 years.

Although there were enough agricultural organisations in Turkey, there were problems in their economic activities and efficiencies [5]. Table 5 presents the membership status of triticale producers to agricultural organisations. It was determined that all farmers interviewed in the research area were members of agricultural organisations. The ratios of farmers who were members of the Chambers of Agriculture, Agricultural Credit Cooperatives, Agricultural Sales Cooperatives, Agricultural Development Cooperatives and Irrigation Cooperatives were determined respectively as 100.00%, 90.57%, 52.83%, 5.66% and 3.77%. It was observed that producers in all groups were members of the Agricultural Chambers. Besides, it was determined that all the producers in the I. group were members of the Agricultural Credit Cooperatives. Farmers' membership in the Agricultural Irrigation Cooperative was low (3.77%), as irrigated farming was limited in the research area.

Rotation is critical in reducing the population of post-harvest crop residues or disease organisms living in the soil. This system is very often used in the region, especially in grain cultivation. The application states of the rotation system of triticale farms were presented in Table 6. It was determined that farms that applied rotation varied 57.89% and 87.50% between groups, and the average of all farms was 75.47%. A quarter (24.53%) of farms did not implement the rotation system.

The land status of farms groups was provided in Table 7. It was determined that the triticale land size varied between 13.06 da and 45.79 da according to farm groups with an average of 27.26 da. The shares of owned land, rented land and sharecropped land in total land size were determined as 84.45%, 12.80% and 2.75%, respectively.

Table 4. Producers' features

Some social-economic indicators in triticale cultivation	Farm groups (da)			Average
	I	II	III	
Age (year)	47.44	45.56	46.00	46.36
Education level (year)	7.83	8.50	8.26	8.19
Population (person/family)	5.00	4.75	5.26	5.02
Agricultural experience (year)	25.00	24.56	24.74	24.77
Experience in triticale production (year)	1.89	2.19	2.26	2.11

Source: Own calculation.

Table 5. Cooperative membership of producers (%)

Agricultural organisations*	Farm groups (da)			Average
	I	II	III	
	Percent (%)			
Chambers Of Agriculture	100.00	100.00	100.00	100.00
Agricultural Credit Cooperatives	100.00	81.25	89.47	90.57
Agricultural Sales Cooperatives	61.11	50.00	47.37	52.83
Agricultural Development Cooperatives	5.56	12.50	0.00	5.66
Irrigation Cooperatives	0.00	6.25	5.26	3.77
Others	0.00	0.00	10.53	3.77

Source: Own calculation.
*Farmers are members of one or more agricultural organisations.

Table 6. The rotation application status of producers

Do you apply rotation?	Farm groups (da)						Average	
	I		II		III			
	N	%	N	%	N	%	N	%
Yes	15	83.33	14	87.50	11	57.89	40	75.47
No	3	16.67	2	12.50	8	42.11	13	24.53
Total	18	100.00	16	100.00	19	100.00	53	100.00

Source: Own calculation.

Table 7. Savings of triticale cultivation area in farms (da, %)

Land savings status	Farm groups (da)						Average	
	I		II		III			
	da	%	da	%	da	%	da	%
Own property	12.22	93.57	18.75	88.24	36.84	80.45	23.02	84.45
Rent	0.00	0.00	1.25	5.88	8.68	18.96	3.49	12.80
Sharecropper	0.84	6.43	1.25	5.88	0.27	0.59	0.75	2.75
Total	13.06	100.00	21.25	100.00	45.79	100.00	27.26	100.00

Source: Own calculation.

Table 8. Grown products in farms (da, %)

Products	Farm groups (da)						Average	
	I		II		III			
	da	%	da	%	da	%	da	%
Barley	60.67	27.39	80.94	27.62	102.11	30.29	81.64	28.69
Wheat	38.06	17.18	52.19	17.81	59.21	17.56	49.91	17.54
Sugar beet	32.61	14.72	33.75	11.52	52.11	15.46	39.94	14.04
Chickpea	18.44	8.32	46.88	16.00	28.42	8.43	30.60	10.75
Triticale	13.06	5.90	21.25	7.25	45.79	13.58	27.26	9.58
Onion	9.17	4.14	5.75	1.96	2.37	0.70	5.70	2.00
Sunflower	6.94	3.13	7.19	2.45	2.11	0.63	5.28	1.86
Fallow	42.56	19.22	45.06	15.98	45.00	13.35	44.19	15.54
Total	221.51	100.00	293.01	100.00	337.12	100.00	284.52	100.00

Source: Own calculation.

Table 9. Problems faced by farms in triticale production

Problems	Farm groups (da)			Average
	I	II	III	
	%			
High input costs	31.48	31.25	29.82	30.82
Proper credit supply	18.52	22.92	14.04	18.24
Fertilizer supply and fertilization	11.11	20.83	19.30	16.98
Low triticale sales prices	22.22	8.33	17.54	16.35
Cooperation and organization between producers	12.96	0.00	7.02	6.92
Quality seed supply	1.85	4.17	5.26	3.77
Water supply and irrigation problems	1.85	6.25	1.75	3.14
Other problems	0.00	6.25	5.26	3.77
Total	100.00	100.00	100.00	100.00

Source: Own calculation.

Table 10. Suggestions of farmers' for the improvement of triticale production

Suggestions	Farm groups (da)			Average
	I	II	III	
	%			
Triticale support fee should be increased	27.50	17.14	23.81	23.08
Irrigable land should be increased	22.50	31.43	16.67	23.08
Input prices should be reduced	17.50	14.29	19.05	17.09
Efficient seed varieties should be used	15.00	14.29	9.52	12.82
The sale price of the product should be increased	7.50	8.57	14.29	12.82
Supports should be paid on time	10.00	14.29	16.67	11.11
Total	100.00	100.00	100.00	100.00

Source: Own calculation.

The production pattern of the interviewed farms was presented in Table 8. The share of triticale cultivation areas in the farms' total land assets was determined as 5.90% and 13.58% within the group, with the average of all farms being 9.58%. It was determined that as the farms' size increased, the share of triticale production in total production also increased. Barley ranks first with a share of 28.69% in total land assets according to

agricultural averages. This was followed by wheat (17.54%), sugar beet (14.04%) and chickpea (10.75%), respectively. Besides, onion (2.00%) and sunflower (1.86%) production was also observed in the farms' cultivated areas. The amount of fallow lands between farms groups varies between 42.56 decares to 45.06 decares. The fallow land average of all farms is 44.19 decares. The share of fallow lands in the total land area was determined as 15.54%.

In a study conducted in the same region [4], the production model of farms was determined as wheat (49.75%), barley (20.90%), vetch (13.68%), chickpeas (5.35%), onions (3.47%) and fallow land (2.27%), respectively.

Vural et al. [12] carried out a study entitled econometric analysis of wheat production in the same region. It was determined as a result of the study that the average land width of wheat at 83 decares.

The main problems faced by farms in triticale cultivation is presented in Table 9. According to the farms' average, the most important problem was determined as the high input prices (30.82%). This was followed by proper credits supply (18.24%), fertiliser supply and fertilisation (16.98%) and low selling price (16.35%), respectively. In addition to these problems, cooperation and organisation among producers (6.92%), quality seed supply (3.77%), water supply and irrigation problems (3.14%) was also observed in farms. It was determined that as the farms' size increased, the share of high input costs problem also decreased.

The farmers made some suggestions for the improvement of triticale production. These suggestions are presented in Table 10. According to the farms' average, the first suggestions were determined as the triticale support fee should be increased (23.08%) and irrigable land should be increased (23.08%). Input prices followed this should be reduced (17.09%), efficient seed varieties should be used (12.82%), the sale price of the product should be increased (12.82%) and supports should be paid on time (11.11%), respectively.

CONCLUSIONS

In conclusion, it was determined that the average ages of producers were 46.36 years, their duration of education were 8.19 years, their population of the household of the producers were 5.02 people and their farming experience was 24.77, their agricultural experience in triticale production was 2.11 years, cooperative membership share was 100%. It was determined that the most important problems of the farms having problems in triticale production; high input costs, proper credit and fertiliser supply, low triticale sales price, cooperation and organisation between producers, quality seed supply, water supply and irrigation problems.

If agricultural organisations' efficiency is increased, farmers can provide affordable inputs for production and sell post-harvest products at reasonable prices.

Triticale is advantageous compared to other grains due to its resistance to cold and drought, growing in poor and problematic soils, and high nutritional value. Therefore, it is thought that triticale production will increase in the region in the coming years.

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