Original Research Article

Calculation of wheat production costs in Lalapaşa district, Edirne province

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Abstract: This study aims to determine the quantities of inputs used in wheat production activities in agricultural enterprises in Lalapaşa district, Edirne province, and calculate the absolute production costs. Lalapaşa is a district that exhibits richness in terms of location, land structure, and productivity. In the villages located on the Balkans side of our country, wheat cultivation shows relatively low productivity (300–350 kg/da), whereas in the villages close to Edirne city, wheat yield exceeds the country's average (500 kg/da). Since the expenses for wheat production do not differ significantly in the villages where wheat is cultivated in Lalapaşa district, an income/cost calculation has been made based on three different yield groups, considering the yield criterion. The average yield of these groups in terms of wheat cultivation is rounded to 350 kg/da, 400 kg/da, and 500 kg/da, respectively. The purpose of this grouping is to calculate the income that can be obtained from 1 hectare of land in the villages by fixing the wheat yield averages in 3 different groups in the most transparent way possible. A survey was conducted in the district's 28 villages using stratified sampling method. The villages selected for the sample and the grouping of the enterprises in these villages according to yield criteria were used to calculate the wheat cost for 1 hectare of wheat production area for the 2022–2023 production year. According to the results obtained from the research, the average production costs of wheat yield groups were calculated as 1018.92 TL, 1441.42 TL, and 2276.42 TL, respectively.

Keywords: cost; wheat; Lalapaşa; wheat production; production

1. Introduction

The most effective and realistic approach in calculating production costs in agricultural enterprises is to use cost accounting techniques. Especially for perennial crops like fruit orchards, accounting records are crucial in making future plans. Accounting is a technique that involves recording, classifying, summarizing, analyzing, and interpreting financial transactions and events in a systematic manner in businesses[1]. However, it is well known that a large majority of Turkish farmers do not keep accounting records[2].

In Turkey, there are numerous cost analysis studies related to wheat cultivation. These studies calculate input costs using different methods and at different time intervals. Some of these studies are institutional, while others are individual research efforts. The first institutional study related to cost calculation in Turkey was conducted by Ankara University. Later on, a table developed by the Ministry of Agriculture was used for cost calculations[3]. A project that lasted for years with the participation of the Turkish Grain Board (TKB), the Union of Turkish Agricultural Chambers (TZOB), the Ministry of Trade, and the administrative and financial support of the Export Promotion Center of Turkey (İGEME) under the scientific coordination of Ankara University's Faculty of Agriculture was carried out. With the transition to the watershed-based production model by the Ministry of Agriculture and Forestry, the number of products for which costs were calculated decreased, and certain limitations were applied to cost calculations. Various institutions in Turkey, including the Ministry of Agriculture and Forestry, the General Directorate of Agricultural Enterprises (KHGM), the

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Union of Turkish Agricultural Chambers, and the Turkish Sugar Factories Corporation, along with several universities, have conducted periodic studies on cost analysis[4]. Individual studies have also been conducted[5]. mentioned the complexity of this situation in their study titled "Cost Calculations for Annual Plants: Current Situation, Problems, and Suggestions." There is currently no valid model widely used for up-to-date cost calculations in the country. The terms "yard cost" and "market cost" are commonly used in calculating production costs. Yard cost includes cultivation expenses, harvesting, and transportation to the farmyard. Market cost includes storage and sales expenses in addition to the yard cost[6,7]. However, some experts argue that marketing expenses should not be included in production expenses[8]. Another point of debate regarding production expenses is related to the occurrence of variable costs at different time intervals. While production is realized after a certain period, expenses may occur at different time intervals and cover a longer duration, which becomes particularly important during periods of high inflation[9]. Özkan and Yılmaz[5] found that in most of the cost calculations they analyzed, interest expenses were applied to the cost calculation, leading to exaggerated cost results. For instance, Özkan and Aydın[10] examined comparative wheat costs in Kırklareli, Tokat, Şanlıurfa, Konya, and Menemen. They determined that due to the high costs of land rental, labor, and inputs, wheat production costs were higher in Menemen, located in the coastal Aegean region, compared to other cities. Kocaköse and Aktürk[11] used a method called the Analytic Hierarchy Process (AHS) to determine the most important criteria for farmers when choosing which crop to grow. In their study conducted in Çanakkale, they found that farmers were most willing to choose wheat due to its reliance on intensive mechanization. In another research about wheat costs in Erzurum, it was found that the most cost-intensive item was machinery power in both fixed and variable cost categories[12]. Similarly, in a study conducted on wheat costs in Ağrı, it was determined that soil preparation costs were the highest expense category with a 30.26% share[13].

Researches on production costs or farm income can be used for various purposes, including evaluating the economic efficiency of enterprises, farm accounting, producer welfare analysis, agricultural income calculations, regional, national, and international competitiveness analyses, economic rent calculations, agricultural policy tools or analyses, income support, agricultural credit, production planning, etc.[4]. The aim of this study is to determine the absolute cost items of wheat cultivation on 1 hectare of dry agricultural land based on yield in 28 villages of Lalapaşa district in Edirne Province. This research is conducted with the idea that the most determining factor in cost calculations is the yield criteria.

2. Materials and methods

2.1. Study area

The study area encompasses all villages in Lalapaşa district of Edirne Province. The data used in this study were obtained through surveys conducted with agricultural enterprises that cultivate wheat, an economically important crop. The researcher's experience of over 10 years as a technical staff member of the Ministry of Agriculture and Forestry provides certain advantages. These advantages include the ease and accuracy of conducting surveys, being present in the field at every stage of wheat cultivation from seeding to harvest, and having a close knowledge of criteria such as farmers' economic conditions and level of awareness[14]. Kıral and Kasnakoğlu[4] state that the use of the survey method is essential for data collection and ensuring the reliability of the data in research studies.

2.2. Sampling and data collection

For selecting the farms to be included in the population, 1548 agricultural enterprises registered in the Farmer Registration System (ÇKS) of Lalapaşa District Directorate of Agriculture and Forestry were

considered, and the data is for the year 2023. In the selection of sample farms for the survey, the land areas where farms cultivate wheat were taken into account. A stratified sampling method was used in the study. In stratified sampling, the population is divided into homogeneous strata, and samples are taken from these strata and combined. The advantage of stratified sampling is that when there is a relationship between the variable under study and the stratification criterion, more accurate results can be obtained[15]. In this study, the division of villages into three strata based on variables such as land yield and soil structure, which significantly affect wheat yield in rain-fed agriculture, is important in terms of increasing the validity and reliability of the research.

2.3. Calculation of sample size

To determine the number of farms representing the population, Equation (1) was used[16]. In formal survey studies, the population under investigation generally consists of finite populations. Equation (1) is used to calculate the sample size in finite populations[17].

$$n = N\ S2\ t2/\ [(N-1)2 + S2\ t2] \quad (1)$$

where:

n: Number of farms representing the population,
N: Total number of farms in the population,
$S2$: Variance of the population,
t: Table value at 95% confidence level (1.65),
d: Acceptable margin of error.

The data used in the study represent the 2022–2023 production period. Based on the physical and financial data collected from the farms, the absolute unit costs for cultivating wheat on one hectare of land were calculated.

2.4. Cost calculation

The cost calculation includes all absolute expenses incurred for the production of wheat under dryland conditions. It covers land preparation (plowing, harrowing, and tilling), sowing (using a seed drill), fertilization (with basic fertilizer 20-20-0), pesticide application (using a sprayer with herbicides and fungicides), and harvest and marketing expenses. Since irrigation is not practiced in rain-fed cereal cultivation in Lalapaşa District, irrigation expenses were not included. Similarly, other variable costs such as machinery repair and maintenance, caretaker, and other expenses were excluded from the calculations. Fixed costs, such as land rental and crop insurance, were also not taken into account since the farms own their land.

2.5. Data analysis

The data obtained from the surveys were analyzed using a computer and the Excel program. All data from the surveys were analyzed in accordance with the determined strata.

2.6. Cost calculation

The cost calculation was performed by grouping the production expenses that include all absolute expenditures made for the production of a product. Expense items included land preparation (using plow, disc harrow, and tine harrow), sowing with a seed drill, seed cost, and fertilizer (basic fertilizer 20-20-0). As the Trakya region frequently utilizes mechanization in agriculture, fertilizer costs were calculated based on the use of a fertilizer machine and the cost of urea-nitrate. For pesticide application, the use of herbicides and fungicides with a knapsack sprayer was taken into account. As mentioned earlier, since there is no irrigation in rain-fed cereal cultivation in Lalapaşa District, irrigation expenses were not included. Harvest and marketing costs were calculated based on harvest, transportation to the barn, transportation to the market, and marketing

expenses.

When calculating the costs in agricultural enterprises, sales prices and gross production values take into account the sales prices of main and by-products that farmers receive. By-products refer to the stems of wheat after harvest, which are utilized as straw. Simple and compound cost calculation methods were used together in calculating unit production costs. Profitability levels of activities on a unit area were calculated to evaluate the success levels of production activities. The study area practices traditional methods of wheat cultivation, and cost calculations were made considering this criterion.

In the calculation of gross and net profits, the following formulas were used[18]:

$$\text{Gross Profit} = \text{Gross Production Value} - \text{Variable Costs},$$

$$\text{Net Profit} = \text{Gross Production Value} - \text{Production Expenses}.$$

Gross profit is calculated by deducting total variable costs from the gross production value of the product, while net profit is calculated by deducting total production expenses from the gross production value. The amount of gross income and net income obtained for 1 TL of gross production value; gross income was divided by total variable costs, and net income was divided by total production expenses. The amounts of variable and total expenses required for 1 TL of gross income and net income were found by dividing variable and total production expenses, respectively, by gross income and net income[12].

3. Results and discussion

General information about the research area

Lalapaşa, a district of Edirne Province, is located 22 km away from the city center. The district is bordered by Bulgaria to the north and west, Süloğlu district to the east, and the central district of Edirne to the south (**Figure 1**). The total area of the district is 536,788 hectares, with an elevation of 72 m. The terrain of the district is predominantly flat, except for the Balkan region located along the border, which is hilly and characterized by eroded sharp granites. The research area is dominated by a continental climate, and the annual precipitation in the district ranges from 350 to 450 mm. The economy of the district relies primarily on agriculture and animal husbandry, with approximately 95% of the local population deriving their livelihood from these activities. The main crops cultivated in the majority of agricultural lands in the district include wheat, barley, canola, and sunflowers[19].

Figure 1. Map of Lalapaşa villages.

The Socio-Economic Development Ranking (SEGE) objectively examines the development levels of provinces and districts in Turkey by utilizing various statistical data from the Ministry of Industry and Technology[20]. According to SEGE, Edirne province ranks 21st among Turkey's 81 provinces. Lalapaşa, one of the 9 districts of Edirne province, is placed in the 4th category out of the 6 development levels defined by SEGE. In the report, which ranks 973 districts, Lalapaşa is listed at the 522nd position. The ranking of other districts in Edirne province is as follows: Merkez is ranked 1st at 40th position, Keşan is 2nd at 195th position, Uzunköprü is 3rd at 301st position, Havsa is 4th at 435th position, Enez is 5th at 483rd position, Süloğlu is 6th at 484th position, Lalapaşa is 7th at 522nd position, İpsala is 8th at 560th position, and Meriç is 9th at 842nd position. For the producers in Lalapaşa, whose income relies heavily on agriculture and animal husbandry, wheat production is of great importance as it constitutes a significant portion of their agricultural income.

Wheat cultivation is carried out in almost every region of Turkey. According to data from the Turkish Statistical Institute (TÜİK), as of the 2020–2021 production season, Turkey accounts for 3.2% of the world's total wheat cultivation area[21]. As of 2022, the total area of wheat production in Turkey is 66,287,386 hectares, yielding 19,750,000 tons of wheat with a yield of 298 kg/da[22]. A research study titled "Evaluation of Wheat Self-Sufficiency and Dependence on Imports in Turkey" found that there was a 17% decrease in wheat production areas in Turkey between 2010 and 2020. However, the same study indicated that the average self-sufficiency level for wheat in Turkey ranged from 85% to 115%. According to the researchers, these values indicate that Turkey is at a level of self-sufficiency where it produces close to the amount of food it consumes and meets its needs at a relatively low hunger level, which is about 5%[23]. The variation in wheat self-sufficiency in Turkey can be attributed to fluctuations in food industry and wheat productivity[24]. According to the TEPGE report[21], 80% of wheat usage in Turkey is for food, 11% for feed, and 6% for seed. Edirne province has a total area of 3,409,302 hectares, with 3,304,070 hectares used for the cultivation of cereals and other crops. The wheat cultivation area in Edirne province is 1,442,775 hectares.

In the 2023 production season, wheat cultivation was carried out on 103,584.34 hectares of land in Lalapaşa. From this area, 37,998,975.75 kg of wheat was produced, with an average wheat yield of 416.6 kg/da. For ease of understanding, the yield value in the wheat cost table for Lalapaşa district was taken as 400 kg/da.

Based on statistical calculations, the average wheat yield for the year 2023 was determined as 400 kg/da. The selling price is 8.25 TL. The by-product yield is 175.0 kg/da, and the by-product selling price is 0.40 TL.

Variable costs include soil preparation, sowing, fertilization, pest control, irrigation maintenance, harvest and marketing, and other variable expenses, totaling 1882.12 TL. Capital interest includes production cost interest or opportunity cost. If production inputs were used in another area, a certain amount of interest income would be earned, so it needs to be considered as an expense. According to the report, interest expenses have not been extensively addressed in cost calculations in our country. The interest is defined as the value to be calculated based on the current interest rate in the country for the capital used in the production of the products to be costed. It is suggested that this rate can be 5% for fixed assets. However, Talim[3] emphasized that the interest rate applied to equity could vary from the normal interest rate applied in the country. In this research, the interest rate determined by T.C. Ziraat Bank A.Ş. for the year 2023 was used, which is taken as 5%. The total fixed costs are 55.23 TL.

The detailed wheat cost calculation table (**Table 1**) is given below included in the production operations, the name of the process, process date, used equipment and capacity, used materials and price.

Table 1. Wheat cost calculation table.

Production operations	The name of the process	Process date	Used equipment and capacity	Used materials			Price (TL/da.)
				Name	Quantity (kg./da.)	Unit price (TL./da.)	
Soil preparation	Soil processing 1	October	Plow	-	-	-	150.0
	Soil processing 2	September–October	Discharrow	-	-	-	90.0
	Soil processing 3	October	Harrow	-	-	-	75.0
Sowing	Sowing Operation	October	Seed drill	-	-	-	60.0
	Seed cost	-	-	-	-	-	260.0
	Base fertilizer 1	-	-	-	-	-	300.0
Fertilization	Fertilization operation 1	February	Fertilizer machine	-	-	-	60.0
	Fertilizer 1	February	-	Urea	15	13.0	195.0
	Fertilizer 2	March	-	Nitrate (26%)	25	10.0	250.0
Pest control	Pest control operation	March	Pulverizator	-	-	-	60.0
	Pesticide 1	March	-	Herbicide	0.100	300.0	31.12
	Pesticide 2	March	-	Fungicide	0.100	400.0	30.0
Harvest and treshing	Harvest and treshing	June	Combine Harvester	-	-	-	155.0
	Transport to storehouse	June–July	Balling machine	8	15.0	-	120.0
	Transport and marketing	July	Tractor-trailer	-	-	-	60.0

Total production costs consist of the sum of total variable costs and total fixed costs, totaling 1938.5 TL.

The main product income is the yield (kg/da) multiplied by the selling price, totaling 3300.0 TL. By-product income = by-product yield multiplied by the by-product selling price, totaling 70.0 TL.

Gross production value = main product income + by-product income, totaling 3440.0 TL.

Total expenses for the main product = total production costs − by-product income, totaling 1868.5 TL.

Product cost = total expenses for the main product/yield, totaling 26.6 TL.

After years of field studies, Lalapaşa district has been categorized into three categories. In the wheat cost, while fixed and variable cost items remain unchanged, the critical and determining factor for increasing income is the yield.

In **Table 2**, income determination based on the categories identified for Lalapaşa district is given. The revenues and net profit higher in the third categories when compare with the other categories.

Table 2. Income determination based on the categories identified for Lalapaşa district.

Category	1.	2.	3.
Yield	350	400	500
Straw	175	200	225
Revenues	2957.50	3380.00	4215.00
Expenses	1938.58	1938.58	1938.58
Net Profit	1018.92	1441.42	2276.42

It is observed that villages in Category 1, with a wheat yield of 350 kg/da, earn a profit of 1018.92 TL per hectare of wheat field. The same situation is observed in villages in Category 2, where they earn 1441.42 TL per hectare. In Category 3 villages, with a yield of 500 kg/da, their income amounts to 2276.42 TL. The wheat yields in these villages are close to the average wheat yield in Turkey, which is 500 kg/da. The yields of Category 3 villages are similar to those of Kırklareli and Tekirdağ provinces in the Thrace region. In a study conducted in Adana province, Çakır[25] stated that the wheat yield was 550 kg/da. According to Şehirali at al.[26] the wheat yield in Turkey is below the average world yields. To increase the yield, it has been mentioned that reducing the negative factors limiting the yield and increasing genetic potential can lead to a 100% increase in yield[27]. For example, according to the TMO (Turkish Grain Board) 2005 cereals report, the average wheat yield in France is 700 kg/da. In the same year, the world average wheat yield was 290 kg/da, and Poland's yield was 350 kg/da. According to the Ninth Development Plan report[28], the main reason for such variations in wheat yield averages is the small-scale and fragmented nature of the farms. In Turkey, wheat cultivation is carried out in almost all provinces except for a small strip in the Eastern Black Sea Region. In terms of average yield, Istanbul, Tekirdağ, and Aydın are in the top 3. The lowest yield is in Van province. In provinces with high yields, although production is relatively low, especially in provinces with large cultivation areas like Konya, the yield is below the average, which leads to a lower overall yield.

In agricultural commodity markets, there are short-term and long-term factors that influence the supply and demand balance. While markets are affected by climate conditions in the short term, in the long term, developed countries, where the income elasticity of demand is low and the price elasticity of demand is close to zero, tend to be more easily regulated under free market conditions. Even in developed countries where wheat markets operate according to certain rules, interventions can be observed. Considering this, it can be seen that in developing countries where market rules are less effective or do not work at all, government interventions are necessary. In situations where there is a surplus or deficit in the market, the government intervenes directly through general support purchases or indirectly through agricultural support mechanisms such as linking production to quotas or providing incentives for production[29].

In wheat markets, where prices vary from year to year due to climate conditions and market uncertainties, the prices can follow an unstable course if left unregulated. For agricultural products, prices have an influence on the production decisions of some producers. As a result, the instability in wheat prices can lead to uncertainty in the production quantity for the following year. The market price affects the next year's harvest, while the harvest of the production year also influences the price in the same year. This creates an environment of uncertainty where each production period affects the next production season in the market[30].

4. Conclusion and recommendations

The wheat yield in 2023 is better compared to the previous year, mainly due to favorable weather conditions during the wheat's growth period. Natural conditions have been the determining factor in achieving a higher wheat yield. This indicates that farmers in Lalapaşa will generate income from wheat this year.

The wheat buying price at ECE[31] ranges from a minimum of 6.401 TL to a maximum of 7.202 TL, with an average of 6.783 TL. The price is determined based on the wheat's quality, specifically its protein content. The highest price set by the Turkish Grain Board (TMO) for the year 2023 is 8.25 TL. TMO's announcement of a price above the market price for 2023 has led to farmers selling their wheat to TMO and long queues forming in front of TMO. The key institution that plays an effective role in determining the wheat market in Turkey is TMO. While it is desired for licensed warehousing to develop, it is not yet at the level of developed countries. Due to the lack of organization among producers and the prevalence of unorganized small and medium-sized farming operations, traders are the ones determining the prices. This necessitates TMO's

intervention in the market. To address this, long-term agricultural policies are necessary. Farmers' ability to stand strong against traders can be achieved through land consolidation, more effective cooperatives, increased awareness through education and agricultural extension services, and greater use of technology by farmers (digital agriculture).

Currently, agricultural operators rely on various statistical reports and even data from the Ministry of Agriculture and Forestry, analyzing parameters such as yield (kg/da), production quantity (ton), and quality (gluten value) for strategic products like wheat. However, the soil is a living and finite resource that is continuously exploited in traditional farming systems. While efforts are made to increase yield and improve quality through new varieties, there is a lack of government policies focusing on ensuring soil sustainability for farmers. Although gaining this awareness may take time, it is essential to initiate policies that promote awareness. For instance, using animal manure to enrich organic matter in the soil, increasing soil pH (which is usually measured around 3.4–4 in Trakya) by using lime, promoting the use of soil conditioners and regulators, and providing government support or incentives for these practices are necessary. Even a small increase of 1 unit in pH means moving from acidic to a more neutral character, which allows the soil to absorb chemical fertilizers more effectively and improve water retention capacity. Ultimately, these improvements in soil structure will lead to more effective nutrient uptake and utilization by plants, resulting in positive developments in the long run.

Overall, it is crucial for the government to take a more active role in promoting sustainable agricultural practices, supporting farmers' awareness of soil health, and implementing policies that ensure the long-term health and productivity of agricultural lands.

Author contributions

Conceptualization, MS; methodology, MS; software, EI; validation, EI; formal analysis, EI; investigation, EI; resources, EI; data curation, EI; writing—original draft preparation, EI; writing—review and editing, MS; visualization, EI; supervision, MS; project administration, MS. All authors have read and agreed to the published version of the manuscript.

Conflicts of interest

The authors declare no conflict of interest.

References

1. Çobanoğlu F. Agricultural production and cost analysis (Turkish). Available online: https://www.siirt.edu.tr/dosya/personel/analiz5-siirt-20224893322398.pdf (accessed on 25 April 2023).
2. Bayramoğlu Z, Aktürk D, Tatlıdil F. The effect of rational use of resources on production costs: The case of canola cultivation (Turkish). Selçuk Tarım ve Gıda Bilimleri Dergisi 2010; 24 (3): 62–68.
3. Talim M. Labor and Draught Power Requirements of Some Important Agricultural Crops in the Gediz Basin of the Aegean Region (Turkish). Ege Üniversitesi, Ziraat Fakültesi; 1973.
4. Kıral T, Kasnakoğlu H. Cost calculation methodology and database guide for agricultural products (Turkish). Available online: https://kutuphane.tarimorman.gov.tr/vufind/Record/1178895 (accessed on 1 January 2023).
5. Özkan B, Yılmaz İ (1999). Cost calculations for annual crops: Current situation, problems and suggestions (Turkish). Tarım Ekonomisi Dergisi 1999; 4(1,2): 64–80.
6. Açıl AF. Calculation of Agricultural Product Costs and Developments in Agricultural Product Costs in Turkey (Turkish). Ankara Üniversitesi, Ziraat Fakültesi; 1977.
7. Aras A. Agricultural Accounting (Turkish). Ege Üniversitesi Ziraat Fakültesi Yayınları; 1988.
8. Ali MB, McBride WD. Corn: State-Level Production Costs, Characteristics and Input Use, 1991. Rpplied Imrge. Inc.; 1994.
9. Yılmaz İ. Calculation of fixed capital interest cost in agricultural enterprises (Turkish). Çukurova Üniversitesi Ziraat Fakültesi Dergisi 1997; 12(1): 187–194.

10. Özkan E, Aydın B. Comparative evaluation of various agricultural product costs and affecting factors in different regions of Turkey (Turkish). Tarım Bilimleri Araştırmaları Dergisi 2012; 5(1): 134–138.
11. Kocaköse B, Aktürk D. Evaluation of production preferences and production costs of agricultural enterprises in Çanakkale. Turkish Journal of Agriculture—Food Science and Technology 2019; 7(11): 1990–2000. doi: 10.24925/turjaf.v7i11.1990-2000.2985
12. Birinci A, Küçük N. Calculation of wheat production cost in Erzurum Province agricultural enterprises (Turkish). Atatürk Üniversitesi, Ziraat Fakültesi Dergisi 2004; 35 (3–4): 177–181.
13. Karadaş K. Calculation of Wheat Production Cost in Agricultural Enterprises in Ağrı Province (Turkish). Iğdır İli Ziraat Fakültesi; 2016.
14. Arslan A. A village sociology study: Socio-economic structure and problems of Kavaközü Village (Turkish). Eskişehir Osmangazi Üniversitesi Sosyal Bilimler Dergisi, 1 March 2003.
15. Kilic S. Sampling methods. JMOOD 2013; 3(1): 44. doi: 10.5455/jmood.20130325011730
16. Karadas K, Tariq M, Tariq MM, Eyduran E. Measuring predictive performance of data mining and artificial neural network algorithms for predicting lactation milk yield in indigenous Akkaraman sheep. Pakistan Journal of Zoology 2016; 49(1): 1–7. doi: 10.17582/journal.pjz/2017.49.1.1.7
17. Çiçek A, Erkan O. Research and Sampling Methods in Agricultural Economics (Turkish). Gaziosmanpaşa Üniversitesi; 1996.
18. Karagölge C. Agricultural Management (Turkish). Atatürk Üniversitesi; 1996.
19. Anonymous, Lalapaşa (Turkish). Available online: https://tr.wikipedia.org/wiki/Lalapa%C5%9Fa (accessed on 25 April 2023).
20. T.C. Sanayi ve Teknoloji Bakanlığı. Socio-economic development ranking surveys (SEGE) (Turkish). Available online: https://www.sanayi.gov.tr/merkez-birimi/b94224510b7b/sege/il-sege-raporlari (accessed on 24 May 2023).
21. TEPGE. Agricultural products market wheat (Turkish). Available online: https://arastirma.tarimorman.gov.tr/tepge/Belgeler/PDF%20Tar%C4%B1m%20%C3%9Cr%C3%BCnleri%20Piyasalar%C4%B1/2021-Haziran%20Tar%C4%B1m%20%C3%9Cr%C3%BCnleri%20Raporu/Bu%C4%9Fday,%20Haziran-2021,%20Tar%C4%B1m%20%C3%9Cr%C3%BCnleri%20Piyasa%20Raporu,%20TEPGE.pdf (accessed on 18 April 2023).
22. TEPGE. Agricultural products markets (Turkish). Available online: https://arastirma.tarimorman.gov.tr/tepge/Belgeler/PDF%20Tar%C4%B1m%20%C3%9Cr%C3%BCnleri%20Piyasalar%C4%B1/2022-Ocak%20Tar%C4%B1m%20%C3%9Cr%C3%BCnleri%20Rapor%C4%B1/Bu%C4%9Fday,%20Ocak-2022%20Tar%C4%B1m%20%C3%9Cr%C3%BCnleri%20Piyasa%20Raporu--+.pdf (accessed on 12 June 2023).
23. Yilmaz AM, Tomar O. Assessment of wheat in turkey in terms of self-sufficiency and import dependency (Turkish). European Journal of Science and Technology 2022; 41: 449–456. doi: 10.31590/ejosat.1192874
24. Demirbaş N, Atış E. Analyzing the problem of food security in Turkish agriculture with the case of wheat (Turkish). Ege Üniversitesi Ziraat Fakültesi Dergisi 2005; 42(1): 179–190.
25. Çakır S. Evaluation of Agricultural Production Cost Calculation Methods of Agricultural Organizations in Adana Province [Master's thesis]. Çukurova Üniversitesi; 2005.
26. Şehirali S, Gençtan T, Avcı Birsin M, et al. Current and future dimensions of cereal and edible grain legume production in Turkey. In: Proceedings of Odası, Türkiye Ziraat Mühendisliği V. Teknik Kongresi; 2000; Ankara, Turkey.
27. Roth GW, Marshall HG, Hatley OE, Hill RR Jr. Effect of management practices on grain yield, test weight, and lodging of soft red winter wheat1. Agronomy Journal 1984; 76(3): 379–383. doi: 10.2134/agronj1984.00021962007600030007x
28. Ninth development plan 2007–2013 (Turkish) [Government report]. Turkey: State Planning Organization; [updated 2022 Jul; cited 2023 Apr 25]. Available from: https://www.sbb.gov.tr/wp-content/uploads/2022/07/Dokuzuncu_Kalkinma_Plani-2007-2013.pdf (accessed on 12 June 2023).
29. Nacar E. Functioning and Regulation of the Turkish Wheat Market (Turkish). Yıllık Programlar ve Konjonktür Değerlendirme Genel Müdürlüğü; 2009.
30. Eraktan G. Fundamentals of Agricultural Policy and Agricultural Support Policy in Turkey (Turkish). İstanbul; 2001.
31. Edirne Commodity Exchange (Turkish). Available online: https://www.etb.org.tr/tr/index.html# (accessed on 25 April 2023).