Trend analysis of cotton production and trade

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Abstract

The aim of this study is to analyse the cultivation areas, production amounts and foreign trade data of cotton plant in the world and Turkey from an economic point of view. The data on Turkey's cotton cultivation area, cotton production and fiber cotton import and export data for the 20-year period 2003-2022 were obtained from the Food Agricultural Organization (FAO). The data set was transferred to MS Excel spreadsheets and the trend analysis technique was used in MS Excel programme to obtain the trends in cotton cultivation area, cotton production amount and near future forecast values for eight years between 2023-2030. In addition, for the foreign trade balance data obtained from fiber cotton import and export data for the period 2000-2022, the change trends of the 23-year period and the eight-year near future forecast values between 2023-2030 were calculated. Cotton cultivation area has a decreasing trend between 2023-2030. While the forecast value of cotton cultivation area for 2023 is 417 thousand hectares, this value is predicted to decrease to 373 thousand 722 hectares in 2030. The trend in the amount of cotton production has a decreasing trend after 2022 and it is predicted that there will be no break in the amount of production between 2023-2030. The estimated foreign trade deficit in fiber cotton for 2023 is 964,516 tonnes and for 2030 is 1,106,672 tonnes. The main reasons for the decrease in cotton cultivation areas are the increases in input prices such as fertilisers, pesticides and seeds. In order to eliminate the foreign trade deficit in cotton, studies should be carried out to enter new markets and increase the share in existing markets. In addition, it should be aimed to create a sustainable cotton sector by investing in R&D activities and entering new markets.

Keywords: Cotton Production, Trend Analysis, Export, Import

INTRODUCTION

Cotton is an important source of fiber, providing raw materials for a range of industries, not only textiles (Yılmaz et al., 2005). Cotton has a variety of uses, but its most prominent feature worldwide is that it provides natural fiber. Among the valuable agricultural products, cotton's unique fibers are the driving force of the textile industry. Today, the increasing use of synthetic fibers in textiles and apparel has reduced cotton's share of the global fiber market by up to 35%, but cotton is still the most important source, used as the main natural fiber in textile and medical applications. As a renewable resource, cotton makes a significant contribution to the economy by providing employment of economic factors, natural resources and labor force with this feature and irreplaceability (Tokel, 2021).

The oil obtained from the cotton seed, called cottonseed, is used in a variety of fields ranging from human nutrition to the cosmetics industry, while the pulp obtained after oil extraction is utilized as an important feed source in animal nutrition.

Cotton is an industrial plant that directly concerns many countries around the world in terms of production and consumption. Nearly all of global cotton production (99.5%) is concentrated in a select group of countries that rank among the top ten cotton producers worldwide. These nations include China, India, the United States, Brazil, Australia, Turkey, Pakistan, Uzbekistan, Argentina, and Greece.

In our country, cotton cultivation areas, which had a downward trend due to the unfavorable conditions in the cotton balance sheet, was 359 thousand hectares in the 2020/21 season, the lowest value of the last forty years,

increased to 432 thousand hectares in the 2021/22 season with the improvement in the balance sheet, and as a result of the improvement in the balance sheet in the same season, the cultivation areas increased and increased to 550 thousand hectares in the 2022/23 season (ICAC, 2022).

According to the Food and Agriculture Organization of the United Nations (FAO) data for 2022, cotton is cultivated on a total of 32 million hectares in 84 different countries around the world. India, the USA and China, which rank in the top three in terms of the size of agricultural areas allocated for cotton production, are home to approximately 59% of the total cotton production areas in the world (Table 1).

Table 1. Cotton cultivation areas in the world by country (ha) (FAO, 2024)

Countries	2018	2019	2020	2021	2022	Average	%
India	12.586.000	12.614.000	13.477.000	13.285.890	12.371.520	12.866.882	39,48
USA	4.130.190	4.699.460	3.348.610	4.157.100	3.011.180	3.869.308	11,87
China	3.354.410	3.450.000	3.250.000	3.028.170	3.000.000	3.216.516	9,87
Pakistan	2.372.968	2.517.287	2.078.899	1.936.969	2.143.605	2.209.946	6,78
Brazil	1.150.014	1.627.163	1.633.091	1.369.430	1.648.836	1.485.707	4,56
Uzbekistan	1.108.246	1.050.631	1.057.794	1.022.448	1.026.858	1.053.195	3,23
Burkina Faso	473.375	590.999	566.635	611.325	692.036	586.874	1,80
Mali	698.184	738.193	164.833	720.093	596.093	583.479	1,79
Benin	640.000	670.000	620.000	640.000	580.000	630.000	1,93
Turkmenistan	546.351	551.061	620.797	620.000	580.000	583.642	1,79
Turkey	518.634	477.807	359.220	432.279	573.223	472.233	1,45
Other countries	5.182.585	4.990.256	4.959.107	4.819.255	5.203.383	5.030.917	15,44
World	32.760.957	33.976.857	32.135.986	32.642.959	31.426.734	32.588.699	100,00

Almost all cotton cultivation in Turkey is carried out in the Aegean Region, Southeastern Anatolia Region, Çukurova and Antalya regions (Anonymous, 2018). Cotton cultivation areas by region are given in Table 2. Accordingly, it is seen that the region with the highest cotton cultivation area in 2023 is the Southeastern Anatolia Region with an area of 2 million 998 thousand decares and a share of 60.27% (TUIK, 2024) (Table 2).

Table 2. Cotton cultivation areas by regions (decares) (TUİK, 2024)

Regions	2020	2021	2022	2023	Average	%
Mediterranean	679.991	722.016	929.841	680.658	753.127	16,35
Aegean	1.011.626	979.762	1.211.686	1.093.400	1.074.119	23,32
Southeast Anatolia	1.895.537	2.619.897	3.587.358	2.998.800	2.775.398	60,27
Other regions	5.046	1.115	2.728	1.526	2.604	0,06
Turkey	3.592.200	4.322.790	5.731.613	4.774.384	4.605.247	100,00

In 2022, total world cotton production amounted to 69 million 668 thousand tons, with China, India and the USA accounting for approximately 62% of the total production. Turkey's cotton production amount in 2022 is 2 million 750 thousand tons and ranks seventh in the world in terms of production amount (Table 3).

Table 3. Amounts of cotton production in the world by countries (tonnes) (FAO, 2024).

Countries	2018	2019	2020	2021	2022	Average	%
China	18.493.333	23.504.576	17.910.606	17.366.363	18.121.818	19.079.339	25,69
India	14.657.000	18.558.000	17.731.050	17.204.000	14.990.000	16.628.010	22,39
USA	11.098.490	12.765.628	9.204.679	11.559.278	8.468.691	10.619.353	14,30
Brazil	4.956.125	6.893.340	7.070.136	5.711.692	6.422.030	6.210.665	8,36
Uzbekistan	2.285.560	2.691.698	3.063.998	3.372.924	3.500.680	2.982.972	4,02
Australia	2.450.000	1.150.000	290.000	1.450.000	2.800.000	1.628.000	2,19
Turkey	2.570.000	2.200.000	1.773.646	2.250.000	2.750.000	2.308.729	3,11
Pakistan	4.828.439	4.480.230	3.454.334	4.096.106	2.409.642	3.853.750	5,19
Turkmenistan	1.101.073	1.110.050	1.280.220	1.280.512	1.201.421	1.194.655	1,61
Argentina	813.692	872.721	1.046.043	1.040.334	1.115.510	977.660	1,32
Other countries	9.031.547	9.455.027	8.634.641	8.966.635	7.888.351	8.795.240	11,84
World	72.285.259	83.681.270	71.459.353	74.297.844	69.668.143	74.278.374	100,00

When cotton production amounts by regions are analyzed, the cotton production amount of the Southeastern Anatolia Region in 2023 is 1 million 293 thousand tons and ranks first in terms of production amount. In the average of 2020-2023, the Southeastern Anatolia Region (58.38%) is followed by the Aegean Region (24.53%) and the Mediterranean Region (17.05%) (Table 4).

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Table 4. Amount of cotton production by regions (tonnes) (TUİK, 2024)

Regions	2020	2021	2022	2023	Average	%
Mediterranean	356.311	382.648	460.539	313.407	378.226	17,05
Aegean	527.244	542.832	613.729	492.581	544.097	24,53
Southeast Anatolia	888.035	1.324.004	1.674.630	1.293.458	1.295.032	58,38
Other regions	2.056	516	1.102	554	1.057	0,05
Turkey	1.773.646	2.250.000	2.750.000	2.100.000	2.218.412	100,00

As seen in Table 5, which includes the ten countries with the highest cotton exports in the world, the average world fiber cotton exports between 2018 and 2022 were 9 million 144 thousand tons. In 2022, the USA ranks first in world exports with a share of approximately 3.4 million tons and 38.02%. The USA is followed by Brazil (18.54%), Australia (6.61%) and India (9.70%). Approximately 72.87% of world exports are realized by these four countries, while the remaining 13.13% is accounted for by other countries. Turkey's fiber cotton exports account for approximately 1.31% of world fiber cotton exports (Table 5).

Table 5. World fiber cotton exporting countries (tonnes) (FAO, 2024)

Countries	2018	2019	2020	2021	2022	Average	%
USA	3.574.865	3.562.772	3.822.303	2.976.628	3.445.820	3.476.478	38,02
Brazil	915.542	1.613.670	2.125.418	2.016.572	1.803.737	1.694.988	18,54
Australia	477.534	541.447	170.282	716.854	1.116.123	604.448	6,61
India	1.137.357	615.816	965.240	1.289.837	427.486	887.147	9,70
Benin	259.577	269.717	280.064	359.022	320.540	297.784	3,26
Greece	214.684	360.266	289.294	381.990	268.300	302.907	3,31
Burkina Faso	197.687	218.401	166.652	258.200	262.973	220.783	2,41
Ivory Coast	165.433	211.566	187.124	258.249	220.430	208.560	2,28
Sudan	91.229	204.550	98.324	75.414	185.705	131.044	1,43
Turkey	95.404	131.371	86.899	135.690	147.871	119.447	1,31
Other countries	1.219.106	1.403.690	1.205.494	1.273.596	901.414	1.200.660	13,13
World	8.348.418	9.133.266	9.397.094	9.742.052	9.100.399	9.144.246	100,00

According to FAO data, world fiber cotton imports averaged 8.7 million tons between 2018 and 2022. In 2022, China has the largest share in world fiber cotton imports with 22.14%. China is followed by Vietnam (15.83%), Bangladesh (14.65%) and Turkey (11.71%). In general, approximately 64.34% of world imports are realized by these four countries, including Turkey (Table 6).

Table 6. World fiber cotton importing countries (tonnes) (FAO, 2024)

Countries	2018	2019	2020	2021	2022	Average	%
China	1.572.760	1.849.186	2.158.095	2.142.264	1.927.386	1.929.938	22,14
Vietnam	1.405.665	1.340.652	1.388.528	1.512.475	1.252.438	1.379.952	15,83
Bangladesh	1.051.620	1.215.222	1.323.245	1.579.631	1.216.127	1.277.169	14,65
Turkey	751.703	946.099	1.064.782	1.191.084	1.148.397	1.020.413	11,71
Pakistan	605.984	399.428	818.737	903.459	782.921	702.106	8,06
Indonesia	762.949	653.435	486.258	561.788	490.958	591.078	6,78
India	270.126	686.815	174.121	193.021	389.687	342.754	3,93
Egypt	123.820	239.482	189.497	177.106	186.048	183.191	2,10
Thailand	258.912	205.258	133.589	156.314	171.424	185.099	2,12
Malaysia	170.290	205.354	121.620	114.081	135.543	149.378	1,71
Other countries	1.172.696	1.026.034	765.250	900.052	910.231	954.853	10,96
World	8.146.525	8.766.965	8.623.722	9.431.275	8.611.160	8.715.929	100,00

The aim of this study is to analyse the cultivation areas, production amounts and foreign trade data of cotton plant in the world and Turkey from an economic point of view. World cotton production has an important place in the agricultural sector and textile industry and Turkey's situation in this field is analysed in detail in this study. The changes in Turkey's cotton cultivation areas and production amounts over the years have been evaluated in comparison with the world. In addition, the analysis of Turkey's cotton import and export data will shed light on economic trends. In this context, the causes and consequences of the changes observed in cotton production and trade will be discussed and predictions will be made about the future trends of the sector. By providing information for cotton producers, exporters, importers and policy makers, the research aims to increase the competitiveness of Turkey's cotton industry in the global market and to provide the necessary data to make strategic decisions.

MATERIALS AND METHODS

The data on Turkey's cotton cultivation area, cotton production and fiber cotton import and export data for the 20-year period 2003-2022 were obtained from the Food Agricultural Organization (FAO). The data set was transferred to MS Excel spreadsheets and the trend analysis technique was used in MS Excel programme to obtain the trends in cotton cultivation area, cotton production amount and near future forecast values for eight years between 2023-2030. In addition, for the foreign trade balance data obtained from the fiber cotton import and export data for the period 2000-2022, the change trends of the 23-year period and the eight-year near future forecast values between 2023-2030 were calculated. In this study, sector reports and other researches on the subject were also utilised.

RESULTS

The 20-year change course of the cultivation areas allocated for cotton production in Turkey for the period 2003-2022 and the eight-year future forecasts for the period 2023-2030 calculated by the Trend Analysis Technique are shown in Figure 1. The trend equation is estimated as $y = -7213x + 2E+07$. According to this, cotton cultivation area has a decreasing trend between 2023-2030. While the estimated value of cotton cultivation area for 2023 is 417,000 hectares, it is predicted that this value will decrease to 373,722 hectares in 2030 (Figure 1).
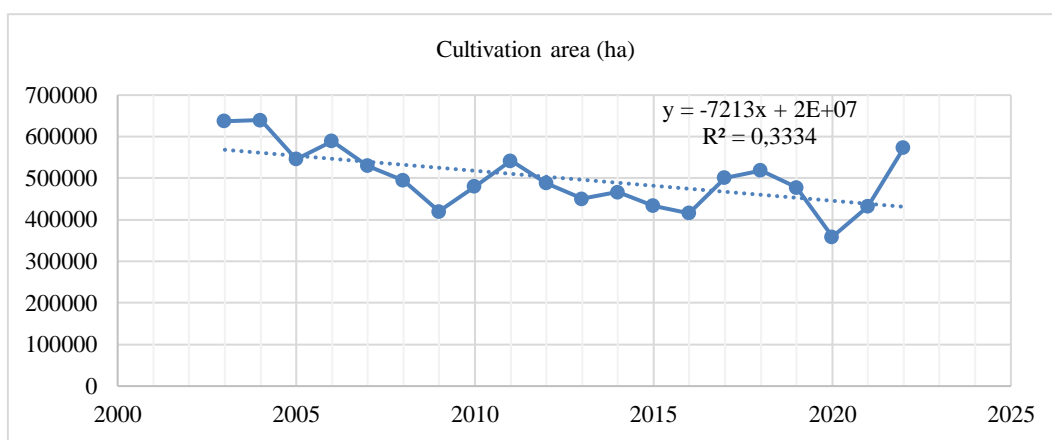

Figure 1. 2003-2022 Turkey cotton cultivation area trend analysis

The 20-year trend of change in the amount of cotton production in Turkey for the period 2003-2022 is presented in Figure 2. The trend equation calculated for the amount of cotton production is estimated as $y = 2030,6x + 2E+06$. The estimated cotton production amount was calculated as 2,044,673 tons in 2024 and 2,056,857 tons in 2030. The trend in the amount of cotton production has a decreasing trend after 2022 and it is predicted that there will be no break in the amount of production between 2023-2030 (Figure 2).
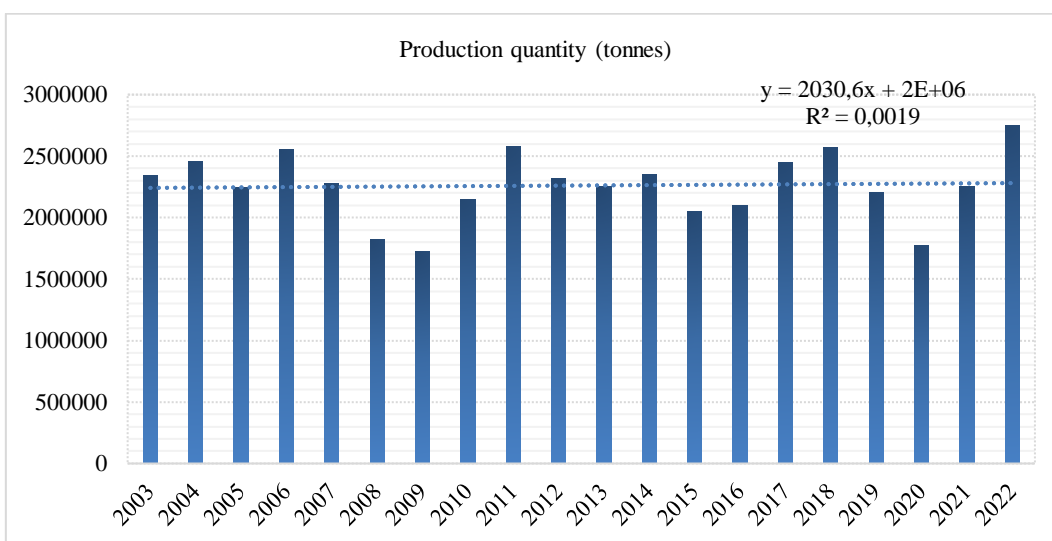

Figure 2. 2003-2022 Turkey cotton production amount trend analysis

For the 20-year period 2003-2022, Turkey's fiber cotton exports averaged 70,228 tonnes. The ten-year trend of Turkey's fiber cotton exports is shown in Figure 3. The amount of exports followed a decreasing fluctuating course between 2003-2015. After 2015, there was an increase in exports, but it started to decrease again in 2020 due to the pandemic and started to increase again after 2021. The trend equation of fiber cotton exports was estimated as y = 3710x + 31274. According to this equation, the amount of exports estimated for 2023 is 109 thousand 184 tonnes and 135 thousand 154 tonnes for 2030. It is predicted that the increasing trend will continue in the eight-year future period of 2023-2030 and the regression coefficient (R^2) for this analysis is determined as 41% (Figure 3).
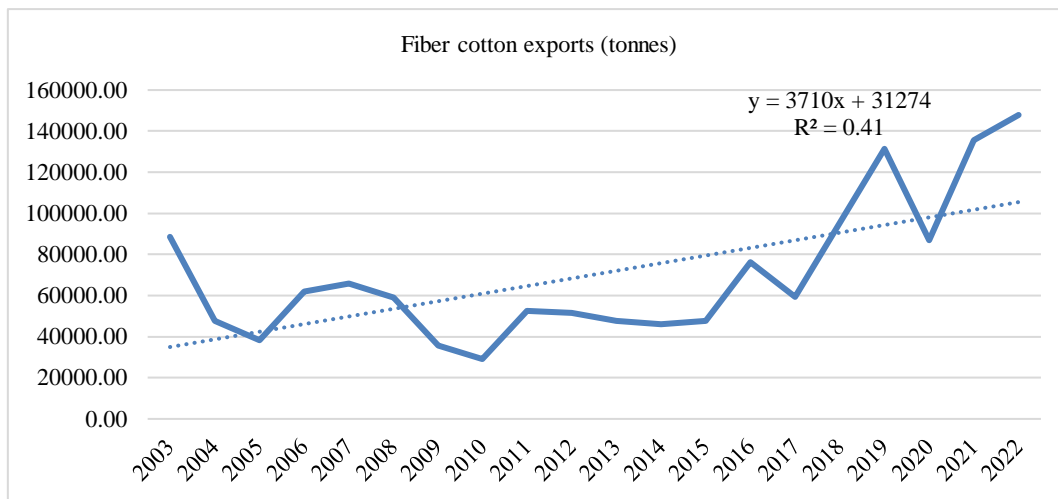

Figure 3. 2003-2022 Turkey's fiber cotton exports change course

In the twenty-year period between 2003 and 2022, Turkey imported an average of 825,622 tonnes of fiber cotton. The trend of change in this period is generally increasing. The trend equation of fiber cotton imports was estimated as y=22705x+587223. According to this equation, the amount of imports estimated for 2023 is estimated to be 1 million 064 thousand tonnes and 1 million 222 thousand tonnes for 2030. It is predicted that the increasing trend will continue in the eight-year period between 2023-2030 and the average import amount will be 1 million 143 thousand tonnes (Figure 4).
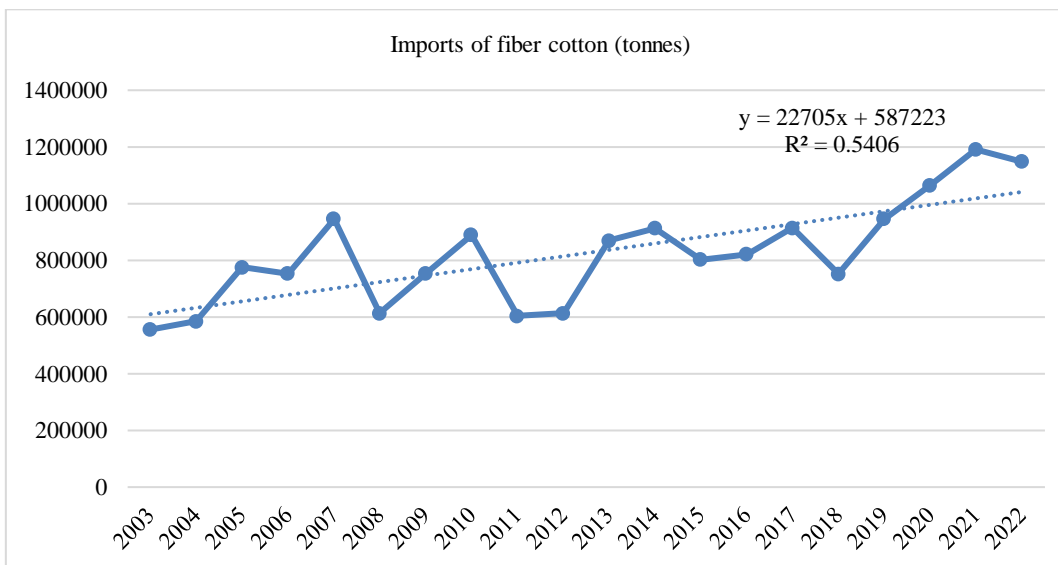

Figure 4. 2003-2022 Turkey's fiber cotton imports change course

Trends of the 23-year period for the foreign trade balance data obtained from fiber cotton import and export data for the period 2000-2022 are shown in Figure 5. Accordingly, Turkey's fiber cotton imports exceed its exports in the same period and Turkey has a foreign trade deficit. Between 2000 and 2022, the foreign trade deficit was 720,820 tons on average. The trend equation for the foreign trade balance is estimated as y = -20308x - 477124. According to this equation, the foreign trade deficit for 2023 is estimated to be 964,516 tons and for 2030 it is estimated to be 1,106,672 tons (Figure 5).
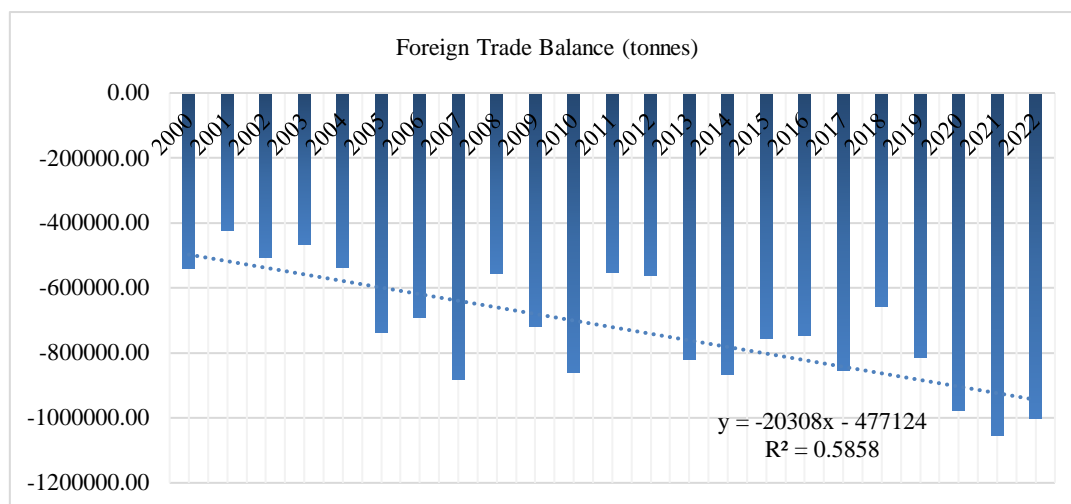
Figure 5. Trend analysis of foreign trade balance in fiber cotton

DISCUSSION AND CONCLUSION

In this study, it is predicted that cotton cultivation area will decrease to 373,722 hectares in 2030. The main reasons for the decrease in cotton cultivation areas can be listed as increases in input prices such as fertilisers, pesticides and seeds, increases in energy and irrigation costs, increase in Turkey's cotton imports as a result of the increase in cotton production in the world, and decrease in cotton yield as a result of drought and climate change in recent years. Krieg (1997) and Başal et al. (2016), stated that although cotton is tolerant to drought compared to other cultivated plants, the rate of decrease in cotton yield can reach up to 70-80% depending on the duration of drought and the growing period in which drought occurs. At the same time, high-temperature stress leads to the shedding of squares, flowers, and bolls in cotton plants, causing significant yield losses (Gören, 2017). In addition, producers' orientation towards alternative crops (maize, grapes, etc.) that bring more income also leads to a decrease in cotton supply. In addition to the change in land use pattern, the use of some cotton production areas for housing, industry and other purposes also causes a decrease in cultivation areas. Similarly, Kaya et al. (2015), stated that the increasing housing need as a result of rapidly increasing urbanisation is met from agricultural areas, and the motorways, airports, hotels and dams built lead to a decrease in agricultural areas. In terms of subsidies, the fact that the current cotton subsidy policies are inadequate for producers leads to a decrease in cultivation areas and cotton supply. Adjustments to be made in support policies and additional incentives for producers may contribute positively to the increase in cotton production. Uzmay (2009), stated that it is necessary to increase the amount of support applied in order to prevent the decrease in cotton cultivation areas and the shift of producers to other alternative products. On the other hand, uncertainties in the world economy and fluctuations in cotton prices may cause producers to hesitate and lead to the shrinkage of cultivation areas. Okumuş (2012), stated that the cotton price in the previous year emerged as the determining factor in cotton production, therefore, input prices should be provided at world standards within agricultural policies. The amount of cotton production was 1,773,646 tonnes in 2020 and was at the lowest level. After 2020, it showed an increasing trend. In 2030, it is calculated to be approximately 2,056,857 tonnes. However, it is predicted that there will not be a significant break in the production amount between 2023-2030. Özüdoğru (2021), stated that despite the limited increase in cotton cultivation areas, production increased more, and the reason for the increase in production was that innovations in areas such as mechanisation and irrigation led to an increase in cotton fiber yield. As a result of trend calculations, the foreign trade deficit of cotton is estimated to be 1 million 106 thousand tonnes in 2030. Accordingly, it is thought that Turkey will continue to be a net importer of cotton. Paksoy and Şahin (2023), stated that Turkey's competitiveness in cotton exports has been in a systematic downward trend since 2016. In order to eliminate the foreign trade deficit in cotton, efforts should be made to enter new markets and increase shares in existing markets. In the short term, practices such as developing drought-resistant cotton varieties, using modern irrigation systems and adopting new technologies in agriculture, reviewing and increasing support policies for producers, and orientation towards value-added products (yarn, fabric, etc.) will be effective in eliminating the foreign trade deficit. In the long term, it should be aimed to create a sustainable cotton sector by increasing competitiveness in the global market, investing in R&D activities and entering new markets.

Compliance with Ethical Standards
Peer-review
Externally peer-reviewed.

Declaration of Interests
The authors declare that there is no conflict of interest between them.
Author contribution
The authors declare that they have contributed equally to the article and have not plagiarised.

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