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Evaluation of Self-Sufficiency in Lentil Production in Turkey

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Abstract: Lentil in the legume family, with vegetable protein and minerals it contains, is a high nutritional value product. Also it is a healthy nutritional source with its low calorie level. Therefore the lentil production and the self-suffiency level is a very important issue for Turkey as it is for many other countries. Nevertheless, while in the past Turkey was one of the leading countries in the production and export of lentil; the production gradually decreased and in 1994 for the first time lentil was imported. In the later years, the lentil production gradually decreased and import gradually increased in Turkey. In this study, the lentil production area and production, consumption, export, import and the prices in the last eleven years (2005-2015) were evaluated; the developments were shown with the method of chain index because the fluctuation intensity in the period was different. In the context both red lentil and green lentil are included. The trend analysis done with the data of the last sixteen years (2000-2015) in order to predict future trends in terms of self-sufficiency. According to the results of analysis, the production will decrease, export will remain stable, but consumption and import will increase.

Keywords: Lentil, self-sufficiency, trend analysis, Turkey

Türkiye'de Mercimek Üretiminde Kendine Yeterliliğin Değerlendirilmesi

Öz: Mercimek baklagiller grubunda içerdiği bitkisel protein ve mineraller ile besin değeri yüksek bir üründür. Aynı zamanda düşük kalori düzeyi ile sağlıklı bir besin kaynağıdır. Bu nedenle mercimek üretimi ve kendine yeterlilik düzeyi diğer birçok ülke gibi Türkiye için de önemli bir konudur. Bununla beraber, Türkiye geçmişte mercimek üretim ve ihracatında lider ülkelerden biri iken, üretim giderek azalmış ve 1994 yılında ilk kez mercimek ithal edilmiştir. Daha sonraki yıllarda, Türkiye'de mercimek üretimi azalmış ve ithalat giderek artmıştır. Bu çalışmada, son on bir yılda (2005-2015) mercimek üretim alanı ve üretim miktarı, tüketimi, ihracatı, ithalatı ve fiyatları değerlendirilmiş, dönem içinde dalgalanma şiddeti farklı olduğu için gelişmeler zincirleme indeks yöntemiyle gösterilmiştir. Kapsamda hem kırmızı hem de yeşil mercimeğe yer verilmiştir. Kendine yeterlilik düzeyi açısından gelecekteki eğilimlerin tahmin edilmesi için son 16 yıllık (2000-2015) verilerle yapılan trend analizleri, üretimin azalacağını, ihracatın sabit kalacağını, tüketim ve ithalatın ise artacağını göstermektedir.

Anahtar Kelimeler: Mercimek, yeterlilik, trend analizi, Türkiye

1. Introduction

Due to the increasing world population, food and nutrient requirements are also ascending. In particular, the price of animal products may not be accessible for all, in the presence of protein requirements. They also have storage difficulties due to their rapid deterioration. Vegetable protein can be stored for a longer time than the animal protein and is relatively accessible. In human nutrition, 22% of vegetable proteins and 7% of carbohydrates, 38% of proteins in animal feed and 5% of carbohydrates are supplied from edible grain legumes (Adak et al., 2010). Legumes, and especially lentils, are an important source of vegetable protein. Lentils are thought to be produced 7000-8000 years ago in legumes (Uyanık, 2001). Legumes that make up the main source of vegetable protein are important not only for Turkey but for the whole world. The lentil nutrient value is quite high. There are 25-27

grams of protein in 100 grams (Anonymous, 2017a; Anonymous, 2017b). In addition to being rich in minerals, the level of cholesterol is also very low. Also, in the case of balanced nutrition, 60% of the total amount of protein consumed should be of vegetable (Gaytancıoğlu et al., 2003).

In Turkey, rural development projects implemented in early 1982 on the basis of illiteracy and the subsequent research and publication project of narrowing down fallow fields have led to an increase in legume production areas (especially lentils). In the beginning of the 1990s, production area and production have been fluctuated and since 1994, lentils have started to be imported (Özel, 2004). Two main types of lentils, red and green are produced.

The world's total lentil production area has increased from 4 076 102 hectare (ha) to 4 524 043 ha in the last decade (2005-2015). In the mentioned period, the share of Turkey in the area of production is 10.8% and 7.6%. Total lentil production was 4 040 196 tons in 2005 and Turkey's share was 14.1%. By 2014, production rose to 4 827 122 tons while Turkey's share fell to 7.1%. Turkey's share in world lentil exports has decreased from 15.1% to 6.7% in the last decade respectively. In imports, Turkey's share increased from 0.5% in 2005 to 8% at the end of the period (FAO, 2016). Increasing demand in the face of declining production, such as increasing drought in Turkey in recent years, creates problems with sufficiency. It is extremely important to increase the production level due to the increase of the decreasing the sufficiency level and the export potential of the product. The purpose of this study is to calculate Turkey's self-sufficiency rate of lentil production and to estimate the trends for the coming near future.

2. Materials and Methods

The main material of the study consists of various studies published in the same subject and data related to lentils of TSI (Turkish Statistical Institute), FAO (Food and Agricultural Organization) and AEPDI (Agricultural Economic and Policy Development Institute).

The aim of this study is to calculate Turkey's self-sufficiency rate of lentil production and to predict the trends in the coming years for production, consumption, import and export in the period of 2005-2015 in Turkey. Trends of production, consumption, export and import have been predicted for red lentils, which are much more subject to production and commercialization by Least Squares Method (Parlakay et al., 2008). Trend analysis means looking at how a potential driver of change has developed over time, and how it is likely to develop in the future (OECD, 2017).Y is the dependent variable and X is the predictor, the causal relationship between the two variables is expressed by a linear model.In the study, graphs were used to show the general trends.

Five-year period 2010-2014 for red and green lentil prices; the 11-year period between 2005 and 2015 was considered for production, consumption, import and export and levels of sufficiency. The developments that occurred during the period were calculated by using the chained index. Self-sufficiency level is calculated by using following formula. Self-sufficiency level=(Usable production/Domestic use) x 100 (FAO, 2012; Unakıtan, 2016).

The prices examined in this study were converted to real prices using the Consumer Price Index based on 2010 year (TSI, 2017a). The real exchange rates were converted to dollars and the Central Bank of the Republic of Turkey used the midterm dollar rates (CBRT, 2017).

3. Result and Discussion

Turkey’s red and green lentil production areas are examined between 2005 and 2015; the cultivation area is getting smaller every year (Table 1). One of the reasons of this is the increase in the cultivation area of irrigated agricultural crops such as cotton and corn (Arslan et al., 2012). In 11 years of red lentil, production area is reduced by 46%, while in green lentil is 70%. When the indices are examined, it is seen

that both red and green lentils production areas are fluctuating (Table 1).

Table 1. Red and green lentil production area in Turkey (ha)
Çizelge 1. *Türkiye'de kırmızı ve yeşil mercimek üretim alanları (ha)*

Year	Red Lentil (RL)	Share of RL in Total Lentil Production Area (%)	Chain Index	Green Lentil (GL)	Share of GL in Total Lentil Production Area (%)	Chain Index
2005	386 700	87.91	100.00	53 200	12.09	100.00
2006	378 707	89.28	97.93	45 462	10.72	85.45
2007	357 233	91.71	94.33	32 308	8.29	71.06
2008	290 977	91.31	81.45	27 698	8.69	85.73
2009	189 378	88.11	65.08	25 553	11.89	92.25
2010	211 600	90.24	111.73	22 892	9.76	89.59
2011	192 323	89.52	90.89	22 525	10.48	98.40
2012	214 788	90.45	111.68	22 690	9.55	100.73
2013	260 500	92.65	121.28	20 678	7.35	91.13
2014	232 446	93.17	89.23	17 048	6.83	82.44
2015	207 469	92.68	89.25	16 388	7.32	96.13

Between 2005 and 2015, the amount of red lentil production fluctuated and there was a declining trend compared to the beginning of the period (Table 2). In 2006, the highest amount of production in the last 11 years was caught (580 thousand tons) and in 2015 it decreased to 340 thousand tons. There is a similar situation for green lentil.

Although Turkey's lentil yield is over the world average, Turkey is in the 12th place in 2015(FAO, 2016). The world lentil yield average is 0.99 tons/ha in 2005, while it is 1.29 tons/ha in Turkey. In 2014, the world average yield increased by 1.07 tons/ha while in Turkey it was 1.38 tons/ha. Turkey's output is above the world average and increases over the years. The lowest yield was realized in 2008 with 0.41 ton/ha, whereas the average annual yield in 2010-2012 was the highest yield with 1.88 ton/ha. Although the productivity of leguminous crops has been decreasing, production has also decreased, yielding an increase in favor of imports in lentils (TOBB, 2013).

Although Turkey is one of the major lentil producer countries, exports are fluctuating and a decrease compared to the beginning of the period (Table 3). Turkey is the second largest exporter of lentil after Canada, while 98% of Turkey's exports are carried out with red lentils in 2015 (FAO, 2016).Turkey primarily imports lentils from Canada and exports them to the Middle East and Africa. Iraq, Sudan, Egypt and Saudi Arabia are respectively the main export markets for Turkey. More than half of total legumes exports consist of the exports to these four countries (USDA, 2016).

Table 2. Red and green lentil production in Turkey (tons)
Çizelge 2. *Türkiye'de kırmızı ve yeşil mercimek üretimi (ton)*

Year	Red Lentil (RL)	Share of RL in Total Lentil Production (%)	Chain Index	Green Lentil (GL)	Share of GL in Total Lentil Production (%)	Chain Index
2005	520 000	91.23	100.00	50 000	8.77	100.00
2006	580 298	93.20	111.60	42 326	6.80	84.65
2007	508 378	94.99	87.61	26 803	5.01	63.32
2008	106 361	81.08	20.92	24 827	18.92	92.63
2009	275 050	91.02	258.60	27 131	8.98	109.28
2010	422 000	94.32	153.43	25 400	5.68	93.62
2011	380 000	93.61	90.05	25 952	6.39	102.17
2012	410 000	93.61	107.90	28 000	6.39	107.90
2013	395 000	94.72	96.34	22 000	5.28	78.57
2014	325 000	94.20	82.28	20 000	5.80	90.91
2015	340 000	94.44	104.61	20 000	5.56	100.00

Table 3. Red and green lentil export in Turkey (tons)
Çizelge 3. *Türkiye'de kırmızı ve yeşil mercimek ihracatı (ton)*

Year	Red Lentil (RL)	Share of RL in Total Lentil Export (%)	Chain Index	Green Lentil (GL)	Share of GL in Total Lentil Export (%)	Chain Index
2005	207 945	99.24	100.00	1 596	0.76	100.00
2006	263 547	99.43	126.74	1 507	0.57	94.42
2007	132 228	99.00	50.17	1 335	1.00	88.59
2008	98 844	97.79	74.75	2 235	2.21	167.42
2009	145 447	99.46	147.15	795	0.54	35.57
2010	190 243	99.38	130.80	1 179	0.62	148.30
2011	224 168	99.22	117.83	1 768	0.78	149.96
2012	178 090	99.26	79.44	1 322	0.74	74.77
2013	191 359	99.20	107.45	1 551	0.80	117.32
2014	183 851	98.91	96.08	2 030	1.09	130.88
2015	235 710	99.42	128.40	1 370	0.58	67.49

When Turkey's imports were examined, no imports were realized until the mid-90s of lentils, but the import volume increased over time, in 2005, 24% of consumption was covered in imports and it's increasing to 82% by 2015.Lentils are imported from Canada and Australia (Özden, 2014).

When the indices were examined (Table 4), it was observed that imports were fluctuating for

both red lentils and green lentils. The biggest break for red lentils was in 2008.

When the lentil consumption of the last 11 years is examined, it is seen that consumption has increased over the years, contrary to the decrease in production and production area in red lentils (Table 5). Consumption in green lentils has followed a more stable. Especially during the arid years, the consumption has decreased seriously due to the decrease in the production. While 85% of the consumption of lentil in 2005 was red, by 2015, this ratio was 90% and the share of green lentil in total consumption decreased gradually.

When the consumption per capita of red and green lentil in Turkey is examined (Table 6), average consumption of red lentil is 4.6 kg in the last 9 years; whereas green lentil consumed an average of 0.6 kg.

Lack of support given to producers and lack of efficient seed support are among the most important causes of declining production (Aral, 2015). For this reason, within the framework of the National Agricultural Project, which was started to be implemented on January 1, 2017, it is expected that the legacy of the "Basin-based Support Model" (Arslan, 2016).

In 2016, according to the production and support model of Turkey agricultural basins, to the production of lentils in Söğüt, Çoruh, Kıyı Ege, Van Gölü, Erciyes, Kazdağları, İç Ege, Gediz, Yeşilırmak, Karacadağ, Zap, GAP, Batı GAP, Doğu Akdeniz, Orta Kızılırmak, Orta Anadolu, Fırat, Göller basins in a total of 18 basins 0.11 dollar/kg difference payment support is given. In addition, for the lentil production in 2016, 6.82 dollar is given as support for domestic certified seed usage per decare. Within the support of organic agriculture, the third category is lentil production, which is subject to production with a 10.23 dollar support (GTHB, 2016).

Annual average producer prices of red and green lentils tend to decrease (Table 7).

Annual average consumer prices decline between 2010 and 2013, prices increase in 2014 (Table 8).

Table 4. Red and green lentil import in Turkey (tons)
Çizelge 4. *Türkiye'de kırmızı ve yeşil mercimek ithalatı (ton)*

Year	Red Lentil (RL)	Share of RL in Total Lentil Import (%)	Chain Index	Green Lentil (GL)	Share of GL in Total Lentil Import (%)	Chain Index
2005	85 077	84.39	100.00	15 733	15.61	100.00
2006	3 196	20.09	3.76	12 709	79.91	80.78
2007	44 237	61.71	1384.14	27 449	38.29	215.98
2008	224 524	93.80	507.55	14 843	6.20	54.07
2009	200 712	88.58	89.39	25 871	11.42	174.30
2010	229 198	92.45	114.19	18 720	7.55	72.36
2011	216 867	92.55	94.62	17 445	7.45	93.19
2012	104 994	81.17	48.41	24 349	18.83	139.58
2013	232 922	88.07	221.84	31 538	11.93	129.52
2014	291 311	89.97	125.07	32 493	10.03	103.03
2015	310 227	91.97	106.49	27 080	8.03	83.34

Table 5. Red and green lentil consumption in Turkey (tons)
Çizelge 5. *Türkiye'de kırmızı ve yeşil mercimek tüketimi (ton)*

Year	Red Lentil	Chain Index	Green Lentil	Chain Index
2005	343 725	100.00	57 630	100.00
2006	268 659	78.16	48 532	84.21
2007	368 411	137.13	48 330	99.58
2008	200 266	54.36	33 654	69.63
2009	299 934	149.77	48 170	143.13
2010	421 805	140.63	39 392	81.78
2011	338 363	80.22	38 128	96.79
2012	300 905	88.93	47 226	123.86
2013	394 796	131.20	48 475	102.64
2014	394 814	100.00	47 331	97.64
2015	378 938	95.98	42 749	90.32

Table 6. Red and green lentil consumption per capita in Turkey (kg)
Çizelge 6. *Türkiye'de kişi başına kırmızı ve yeşil mercimek tüketimi (kg)*

Year	Red Lentil	Green Lentil
2005	*	*
2006	*	*
2007	5.2	0.7
2008	2.8	0.5
2009	4.1	0.7
2010	5.7	0.5
2011	4.5	0.5
2012	4.0	0.6
2013	5.1	0.6
2014	5.1	0.6
2015	4.8	0.5

*Information not available.

Table 7. Annual average producer prices (dollar kg^{-1})
Çizelge 7. *Ortalama yıllık üretici fiyatları (dolar* kg^{-1}*)*

	2010	2011	2012	2013	2014
Red Lentil	1.14	0.77	0.62	0.54	0.53
Green Lentil	1.19	1.06	0.92	0.83	0.72

Source: AEPDI, http://www.tarim.gov.tr/ (Last Accessed: 05.01.2017).

Table 8. Annual average consumer prices (dollar kg^{-1})
Çizelge 8. *Ortalama yıllık tüketici fiyatları (dolar kg^{-1})*

	2010	2011	2012	2013	2014
Lentil	2.56	1.94	1.53	1.44	1.50

Source: AEPDI,http://www.tarim.gov.tr/(Last Accessed: 05.01.2017).

Annual average market prices of red lentils have reached the lowest level in 2012, the highest level in 2010; green lentil price is decreasing by the years (Table 9).

Table 9. Annual average market prices (dollar kg^{-1})
Çizelge 9. *Ortalama yıllık piyasa fiyatları (dolar kg^{-1})*

	2010	2011	2012	2013	2014
Red Lentil	2.21	1.66	1.12	1.32	1.46
Green Lentil	2.46	2.39	1.98	1.51	1.49

Source: AEPDI, http://www.tarim.gov.tr/ (Last Accessed: 05.01.2017).

The degree of sufficiency (%) shows how the available production of a region (domestic production) is in a position to meet the demand of that region or its domestic use (all needs of human, animal and industry). In short, Sufficiency Level=(Usable production/Domestic use) x 100 (FAO, 2012).

A value of less than 100 indicates that production cannot fully meet domestic demand, while a value greater than 100 indicates the presence of exportable and/or storable quantities passing through internal needs (TSI, 2008).

Despite being the third largest lentil producer is Turkey in the world after Canada and India, the level of self-sufficiency has declined over the years. Turkey, which has a level of self-sufficiency of 45% in 2008, which is affected by the drought, is only a self-sufficient country in 2011 and 2012 after this year, but has not reached self-sufficiency in other years (Table 10).

Table 10. Turkey's red and green lentil sufficiency level (%)
Çizelge 10. *Türkiye'de kırmızı ve yeşil mercimek yeterlilik düzeyi (%)*

Year	Red Lentil	Green Lentil
2005	132.0	77.5
2006	185.4	78.6
2007	121.6	50.0
2008	45.2	65.7
2009	82.9	51.3
2010	91.3	58.5
2011	102.0	61.7
2012	122.4	54.2
2013	90.3	41.7
2014	74.7	39.0
2015	81.6	53.1

According to a trend analysis of Turkey's lentil production, it is determined that production will show a steady decline between the years 2016 and 2020 and will fall to 250000 tons in 2020 (Figure 1).Turkey that cannot meet the domestic consumption requirement especially in red lentils since 2008 and unfortunately decreases in the production will continue.

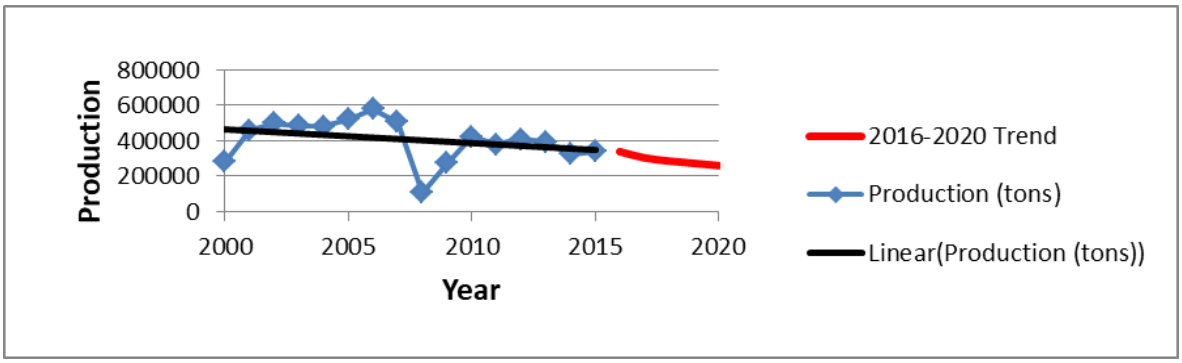

Figure 1. Estimated lentil production (2016-2020)
Şekil 1. *Tahmini mercimek üretimi (2016-2020)*

According to the trend analysis of Turkey made with lentil consumption data of 2000-2015, it is estimated that the total consumption amount tends to increase continuously between the years of 2016-2020 (Figure 2). Increased population and nutritional needs are the main reasons for the increase in consumption.Figure 1 shows a decline in lentil production while Figure 2 shows an increase in consumption trend. Accordingly, it is expected that Turkey will be in a tendency to import with the aim of meeting the consumption need.

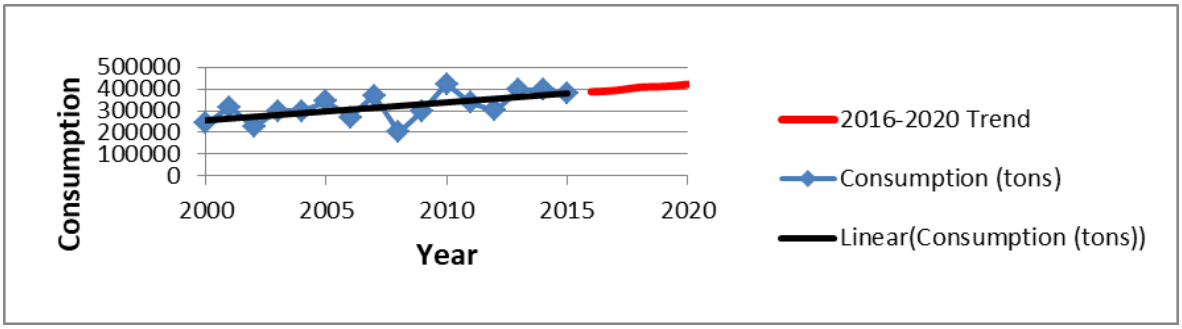

Figure 2. Estimated lentil consumption (2016-2020)
Şekil 2. *Tahmini mercimek tüketimi (2016-2020)*

According to the trend analysis of Turkey's lentil export data for 2000-2015, it is estimated that the export amount will not change in the period 2016-2020 (Figure 3).

In parallel with the expectation of a decrease in lentil production, an increase in exports is not expected. The increase in exports will only be possible if production exceeds domestic consumption requirements.

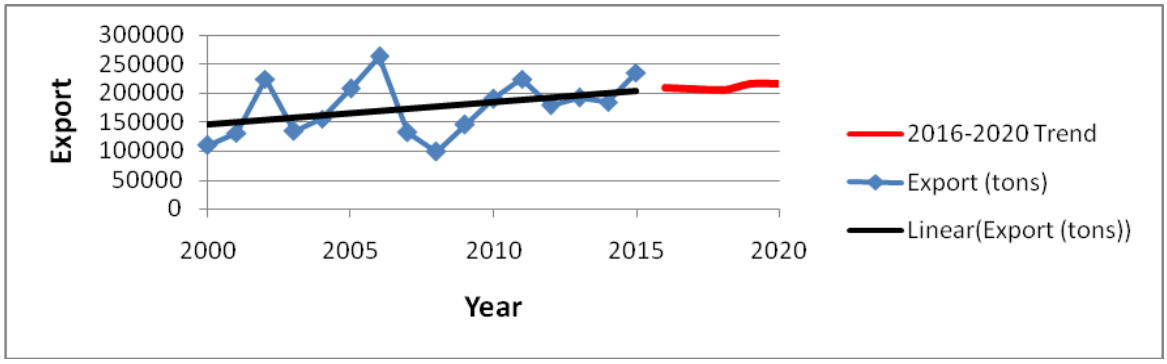

Figure 3. Estimated lentil export(2016-2020)
Şekil 3. *Tahmini mercimek ihracatı (2016-2020)*

According to a trend analysis carried out by Turkey with lentils imports for the years 2000-2015, it is estimated that in the period of 2016-2020 the import will increase continuously and will reach to 400000 tons (Figure 4). As a result of the decreasing tendency of lentil production and increasing tendency in the consumption, increase in imports was expected towards 2020. Imports are expected to increase steadily, as expected in Figure 4.

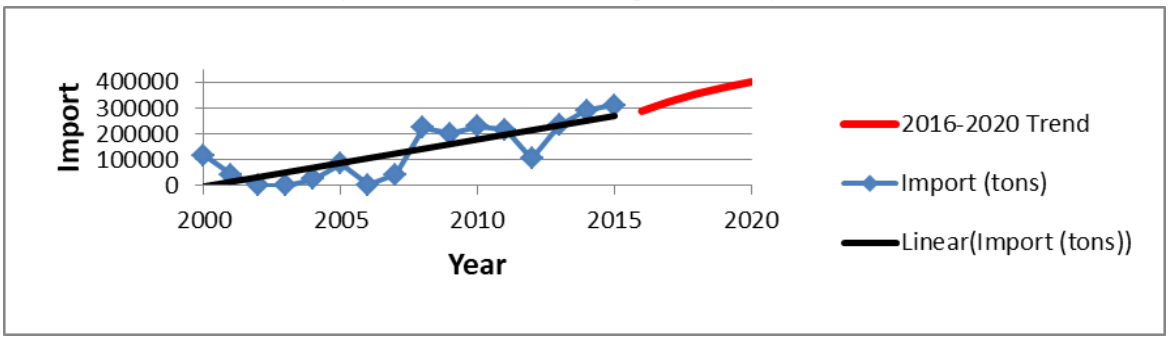

Figure 4. Estimated lentil import(2016-2020)
Şekil 4. *Tahmini mercimek ithalatı (2016-2020)*

According to the trend analysis of Turkey's lentil production, consumption, export and import data according to 2016-2020; it is anticipated that imports will increase in order to meet increasing consumption, which will decrease production, and accordingly increase consumption. This indicates that Turkey's self-sufficiency level in lentil production will decrease over the years.

4.Conclusion

In this study, Turkey's lentil production area, production, export and import amounts between 2005 and 2015 were examined.

According to this, between 2005 and 2015, the production areas of lentil have been decreased gradually. The amount of lentil production during the same years has showed a fluctuating structure. Lentil production in 2015 was 35% less than production in 2005.Although Turkey ranks third in the world in the production of lentils; it is not self-sufficient in some years. For this reason, imports of lentils have increased gradually between 2005 and 2015 in Turkey.

Within the scope of this study, projections of lentil production, consumption, export and import amounts were made by Trend Analysis method for 2016-2020. Accordingly, while no significant change is expected in Turkey's lentil exports during the 5-year period between2016-2020, a decrease in lentil production, and an increase in lentil consumption and imports.

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