

A Comprehensive Overview of Onion Production: Worldwide and Turkey

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Abstract: *The onion belongs to Allium section cepa, which consists of twelve species, most of which are used as the vegetable, spices, or medicinal plants. A region of especially high species diversity occurs in Turkey and in the Irano-Turanian floristic region. In this review, changes in the world's and Turkey's onion cultivation areas, production quantities, and yields were examined for last 21 years. Also, monthly producer prices were examined for covering the period 2007–2016. The values of Turkey were compared with Republic of Korea having highest yield, and China having highest quantities. In the conclusion section, it has tried to explain the causes of price fluctuations in the light of findings.*

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I. Introduction

The onion (*Allium cepa* L.) is an indispensable element of almost every culture as a vegetable. It consumed as raw or a component of meals in many different cultures around the world. Also, unlike many other vegetable species, consumption of onion is not limited to a particular season.

Academic studies on onions are quite difficult due to some features such as multiple flower structure, prolonged flowering period, long isolation distance for control of fertility, the strong effect of environmental factors on some morphological features, difficulty in maintaining genetic resources etc. In addition to these, at least two years are needed from seed sowing to seed harvesting. The onion bulbs harvested in the previous season should be stored under appropriate conditions and plantation should be established again in the second year for seed production¹.

The onion is a commonly used vegetable type in price / production modeling studies^{2, 3, 4, 5}. It was reported that cobweb theory is valid for onion production⁵. Accordingly, growers determine production strategies based on market prices that emerged in the previous season. Higher prices lead to higher production for the next season and lower prices lead to lower production for the next season. The marketing of onions and the formation of prices occur in free market conditions in Turkey. For this reason, onion prices and production show a very fluctuating course³. Whatever the reason, the fluctuations of the price of a product from year to year leads to the study of the mechanism called as cobweb theorem by economics⁶.

In this review, Turkey and world onion production quantities, yield, production area, export and import values were examined. For this aim, data from 21 years of 1996-2016 published by the United Nations Food and Agriculture Organization (FAO) were collected and interpreted⁷. The onion producer price changes of Turkey have been compiled to cover on a monthly basis for the last seven years. The IBM SPSS Statistics Ver. 22 software was used for data analysis. It is aimed that build a major resource for planning of Turkey's onion production in the light of this shared data. Also, it is tried to explain the fluctuations in onion prices.

When the data of the last 21 years are examined, a stable increase in quantities and harvesting area is observed ($R^2_{\text{quantities}}: 0.987$, $R^2_{\text{area}}: 0.984$, Figure 1). Worldwide total onion production was 40 695 848 tons in 1996, but by 2016 this figure has increased by 128.94% to 93 168 548 tons. Production quantities decreased in only three years (1997, 2009 and 2012) compared to the previous year, and increased between 1.43 and 11.63% in the other years. The situation in onion production areas also showed similar features. The world onion production area of 2 460 532 ha in 1996 reached 4 955 432 ha in 2016. Only in 2000, 2002 and 2009, there was a contraction in planting areas.

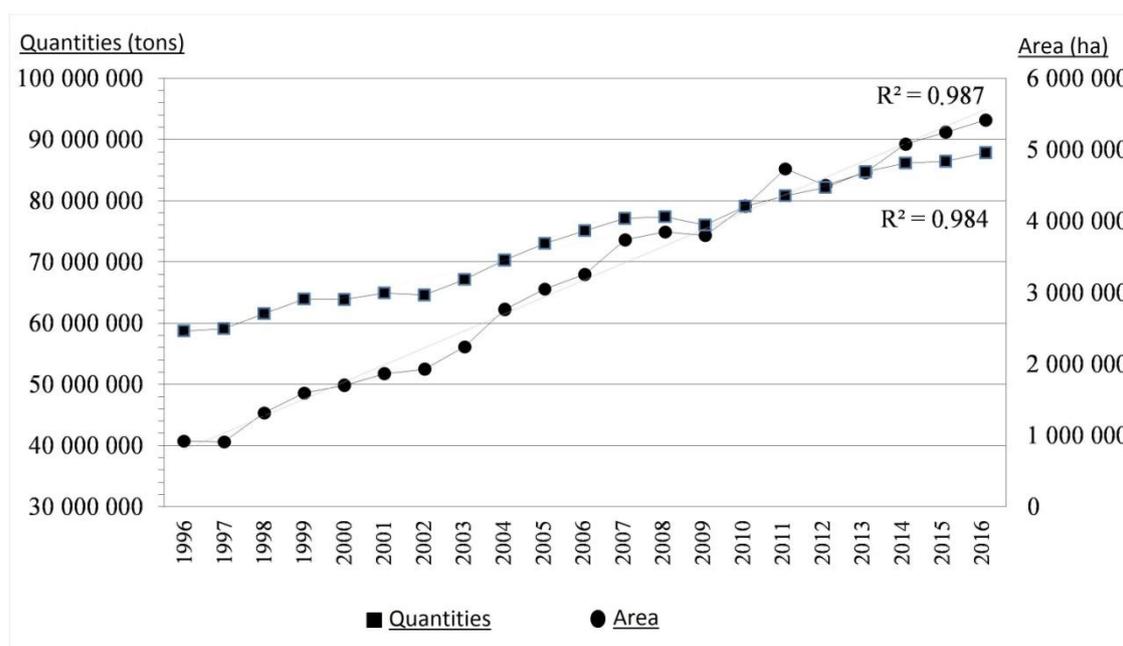


Figure 1. Changes of onion quantities and harvesting area between 1996 and 2016 (world total)

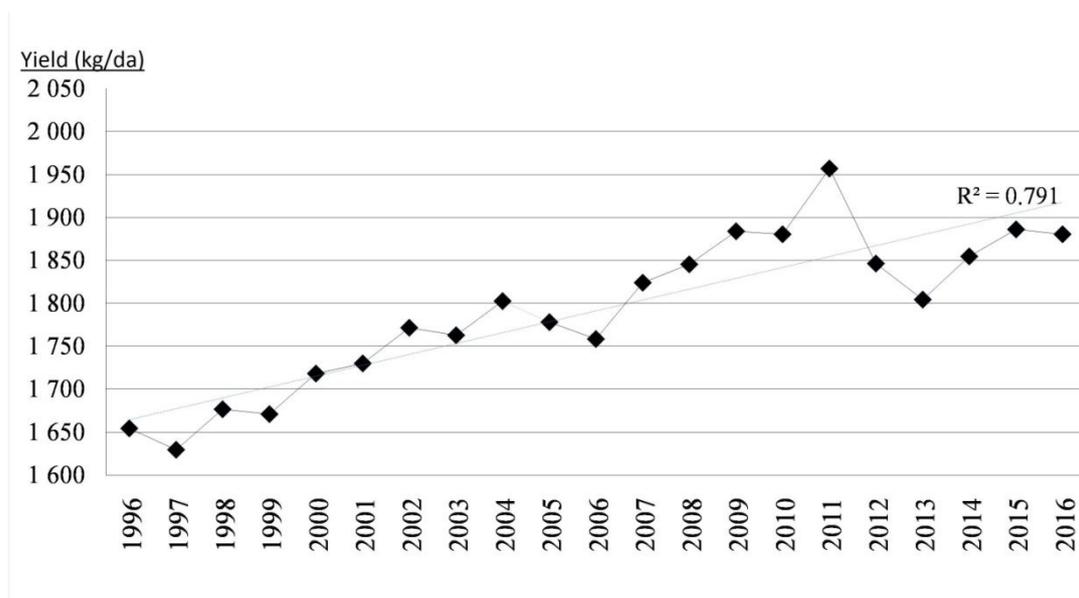


Figure 2. Changes of onion yields between 1996 and 2016 (world average)

When the yield figures of world onion cultivation are analyzed, it has been seen that fluctuations are experienced more frequently, unlike the quantities and harvesting area. Nine of the last 21 years have experienced a decrease in productivity (Figure 2).

While worldwide onion production quantities were analyzed on the basis of countries, data for the last 21 years were collected and then the average for each country calculated (Table 1). When we look at the first 30 countries for all three parameters, it can be said that economically the 20 largest countries of the world (G20, The Group of Twenty) are predominant in these lists.

Table 1. Mainly onion producer countries, according to the average of the past 21 years

Yield (kg/da)			Quantities (ton)		Area (da)	
1	Korea Rep.	6 190	China	18 190 997	India	9 003 386
2	USA	5 163	India	11 057 657	China	8 524 308
3	Taiwan	4 956	USA	3 255 948	Nigeria	2 542 936
4	Netherlands	4 911	Turkey	1 999 209	Bangladesh	1 364 440
5	Austria	4 812	Iran	1 751 511	Pakistan	1 179 802
6	Australia	4 784	Pakistan	1 591 255	Russia	1 009 929
7	Spain	4 769	Russia	1 463 415	Indonesia	1 006 201
8	Japan	4 755	Egypt	1 450 978	Vietnam	824 717
9	Chili	4 639	Sudan	1 333 072	Turkey	781 305
10	Germany	4 377	Brazil	1 297 058	Sudan	746 760
11	France	4 240	Mexico	1 194 185	Myanmar	720 663
12	UK	4 029	Japan	1 192 952	Brazil	691 635
13	Cyprus	3 827	Spain	1 096 122	Ukraine	688 498
14	Sweden	3 770	Korea Rep.	1 078 180	USA	634 210
15	Iran	3 287	Netherlands	1 071 135	Uganda	549 355
16	Egypt	3 070	Nigeria	929 469	Iran	545 305
17	Mexico	2 686	Indonesia	895 636	Egypt	507 227
18	Turkey	2 632	Myanmar	855 624	Mexico	456 311
19	China	2 140	Ukraine	776 507	Japan	251 906
20	Brazil	2 053	Bangladesh	682 879	Spain	234 947
21	Sudan	1 793	Germany	371 595	Netherlands	221 166
22	Russia	1 635	France	357 511	Korea Rep.	175 585
23	Pakistan	1 351	UK	355 268	UK	89 251
24	India	1 348	Chili	313 034	Germany	86 633
25	Ukraine	1 320	Vietnam	261 925	France	85 050
26	Myanmar	1 307	Australia	258 963	Chili	68 289
27	Indonesia	914	Uganda	216 465	Australia	55 023
28	Bangladesh	635	Austria	128 301	Austria	27 584
29	Nigeria	436	Taiwan	48 481	Sweden	10 421
30	Uganda	396	Sweden	36 066	Taiwan	9 966

Especially in terms of yield, eight of the top 10 rankings are on the G20 list. According to yields (average of 21 years), the first 30 countries were subjected to clustering analysis by Ward method according to Euclidean distances (Figure 3). In the cluster, two groups were formed. There are a total of 18 countries in Group A and are predominantly developed or developing countries. Turkey is located in the same subgroup with Iran, Mexico, and Egypt.

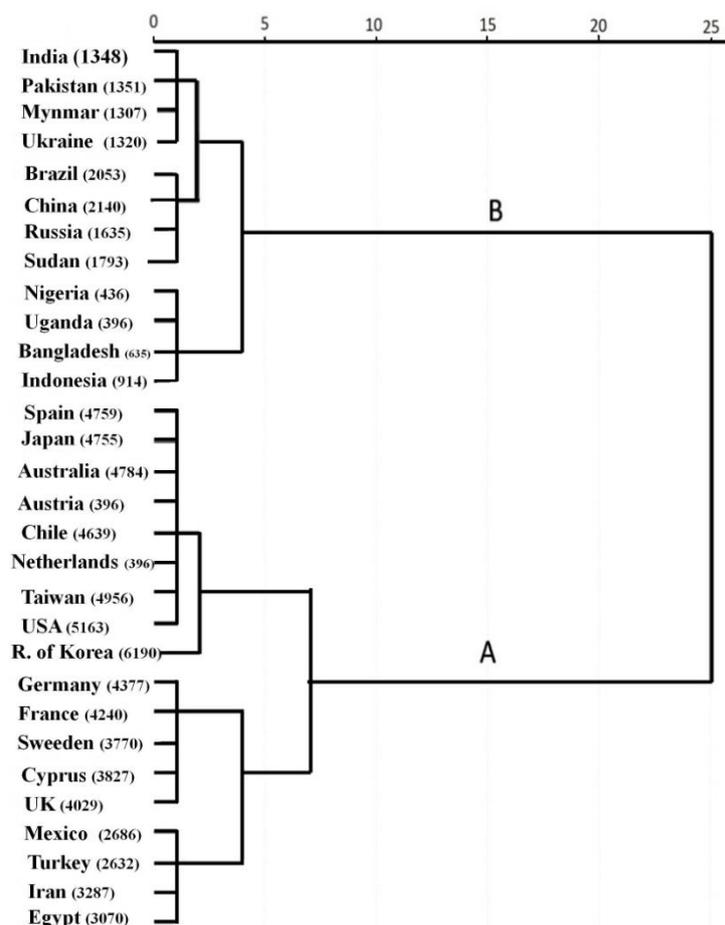


Figure 3. Grouping the first 30 countries in terms of yield

In terms of yield, the Republic of Korea, which has more than twice the value of Turkey, could only be in the 14th place in the amount of production (Figure 4). When the last 21 years' data on the onion production of this country are examined, it is understood that there are some fluctuations in the quantities and harvesting area on an annual basis, but in general the increase is observed for both parameters.

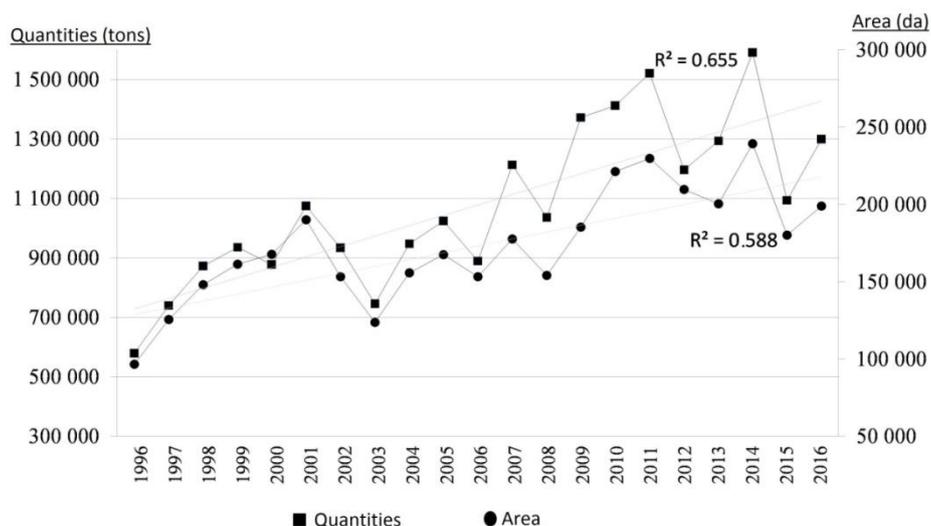


Figure 4. Changes of onion production quantities and harvesting area of Korea Republic between 1996-2016

When the annual changes in the yield of the Republic of Korea are analyzed, it seems that the output increased from 5 989 kg/da to 6 528 kg/da in 1996 to 2016, but this increase is not stable (Figure 5). This indicates that environmental factors are more effective in yield fluctuations, and those upper bounds for country conditions are approached as a result of breeding and agronomic studies.

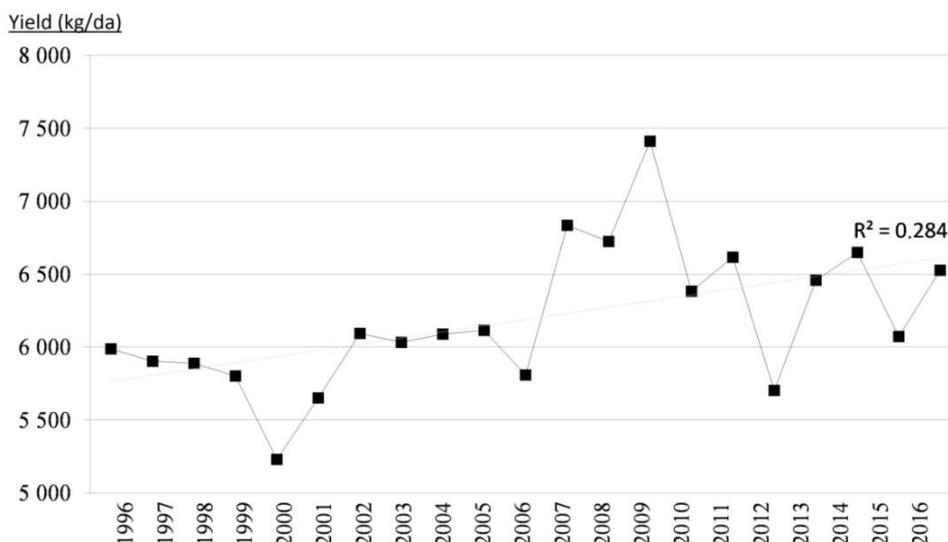


Figure 5. Changes of onion yield of Korea Republic between 1996-2016

With an average annual production quantity of 18 190 997 kg, China is the world's biggest onion producer. In the average of the last 21 years period, on average 27.12% of world annual onion production was carried out by China. When the changes in the production quantities are examined, an increase is observed in a linear manner (Figure 6). There has been an increase in all years except for 2008. This situation has also been observed in the area of harvesting ($R^2_{\text{area}}: 0.928$). In terms of yield, China displayed a quite stable aspect of the period under review. In this duration, the yield fluctuated in the range of 2-2.3 ton/da (Figure 7).

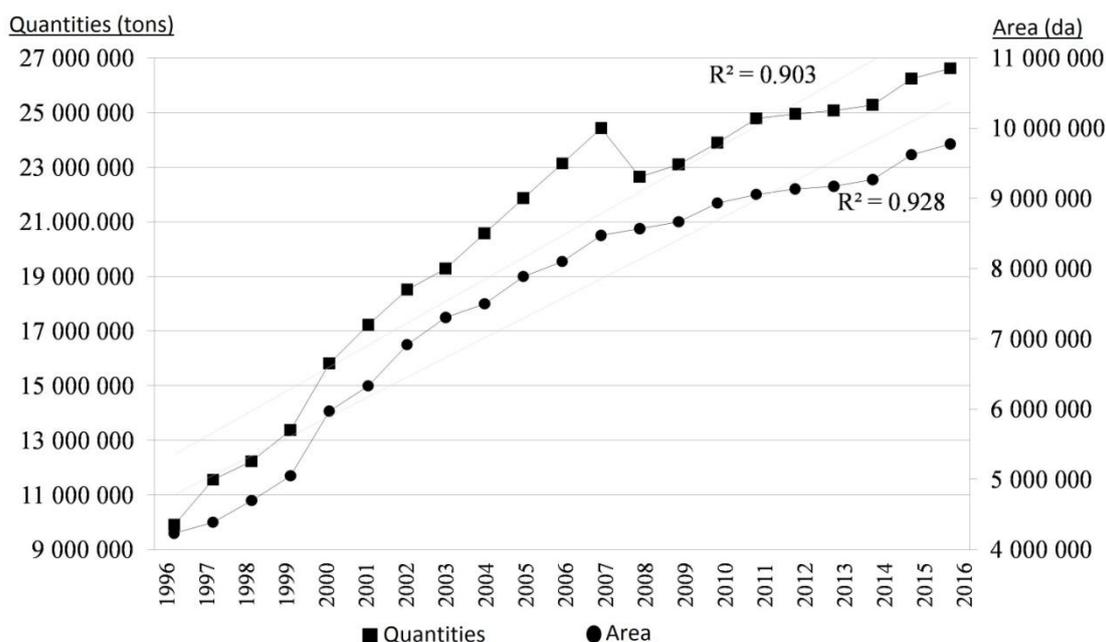


Figure 6. Changes of onion production quantities and harvesting area of China between 1996-2016

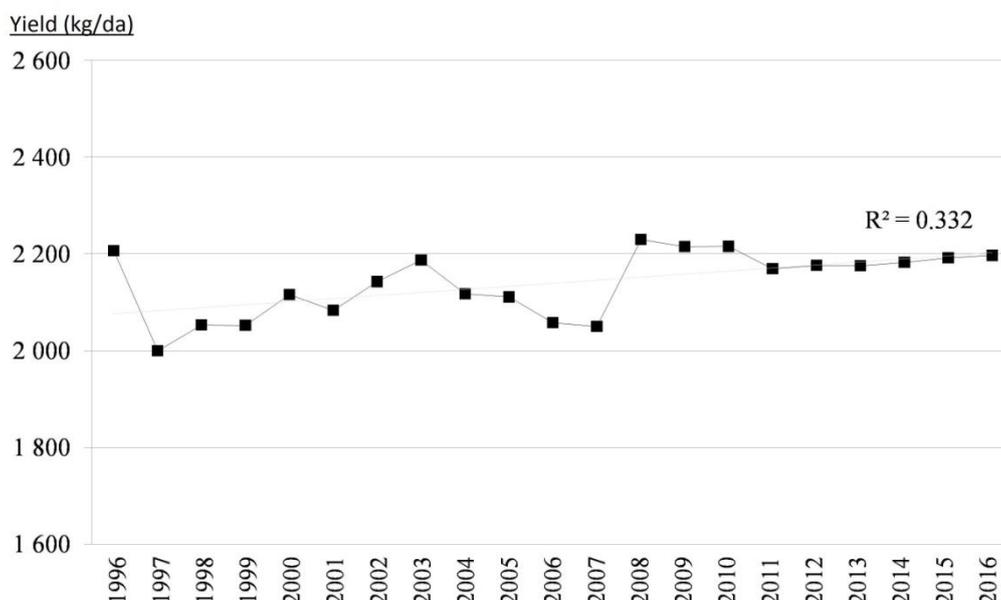


Figure 7. Changes of onion yield of China between 1996-2016

When the Turkey's onion production quantities and yields are examined, it is observed that both of them are decreased unlike the Republic of Korea, China and worldwide (Figure 8). Although Turkey's onion production increased very quickly between 1996-1999 period, followed by a dramatic decline was observed. The onion production quantities were the lowest in 2003 (1.75 million tons) and fluctuated in the following years. Although there was a relative increase in 2011 (2.14 million tons), there were decreases again in the next four years. In 2016, production of 2.12 million tons has exceeded the average of the past 21 years (1.99 million tons). The changes in the harvesting area do not show a certain consistency with respect to years ($R^2_{\text{area}}: 0.215$). Despite a steady increase from 1996 to 1999, a sharp decline was observed between 1999 to 2003. In the following years, a quite fluctuating trend was observed.

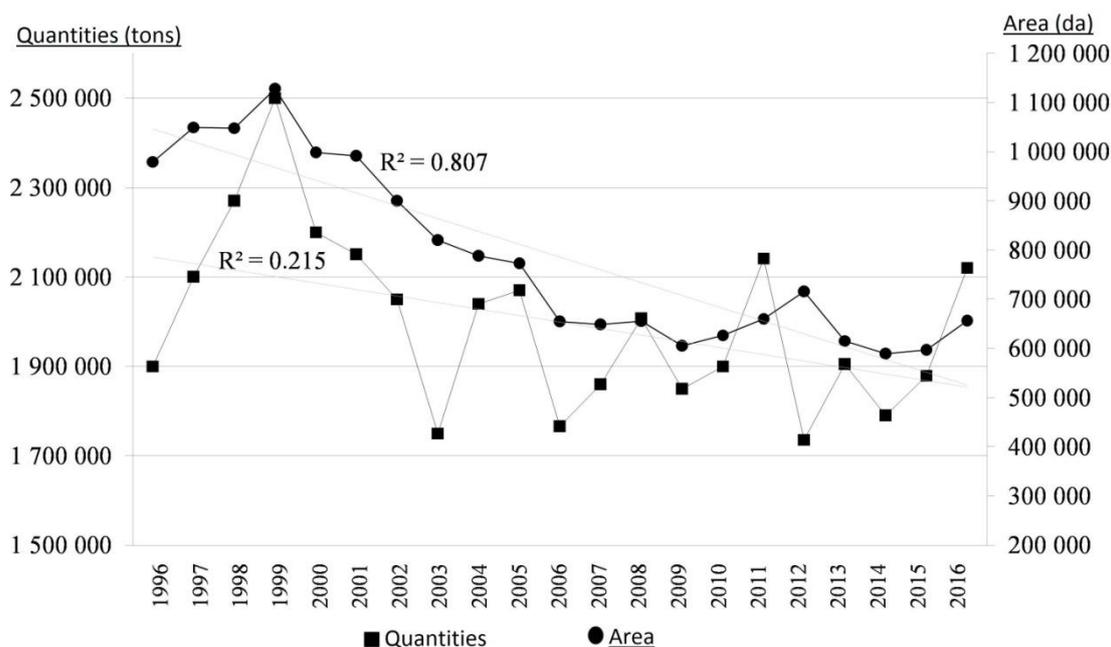


Figure 8. Changes of production quantities and harvesting area of Turkey between 1996-2016

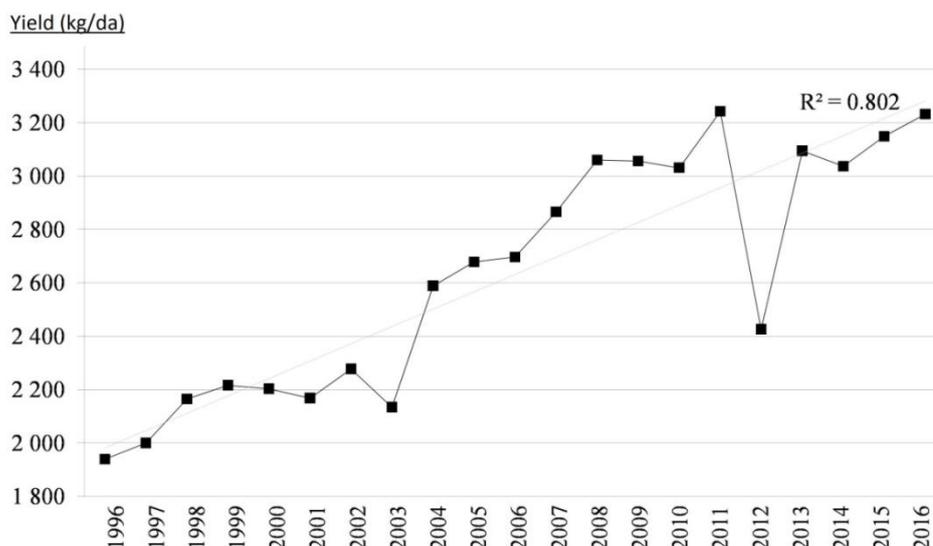


Figure 9. The changes of yield in Turkey between 1996-2016

Turkey's annual change graphics on the onion yield is in the opposite direction to the production quantities, and area harvesting. The yield increasing has been observed almost every year, except for the decrease in 2003 and 2012. It is assumed that these declines were due to environmental conditions.

The annual changes in yield, production quantity and harvested area are subject to correlation analysis. In this way the data of Turkey have been compared with the Republic of Korea with the highest average yield, China with the highest production quantities, India with the highest average harvested area, and worldwide. In all titles except Turkey, the statistically significant positive correlation has been identified between the amount of yield and production quantities. Similarly, statistically significant positive correlations were found between yield and production area for titles 'Worldwide', 'China' and 'India'. For Turkey, statistically significant negative correlation was found between yield and area (Table 2).

Table 2. The correlation analysis between yield, production quantities and harvested area for Worldwide, China, India, Republic of Korea and Turkey

Variables	Turkey	Worldwide	Rep. of Korea	China	India
Yield / Quantities	-0.287	0.906**	0.626**	0.569**	0.927**
Yield / Area	-0.892**	0.866**	0.353	0.485*	0.883**
Area / Quantities	0.681**	0.996**	0.950**	0.995**	0.992**

* $p > 0,05$, ** $p > 0,01$

When the 21-years data on global onion trade are examined, it is observed that the total export value has been continuously increased (R^2_{export} : 0.937, Table 3). World onion export quantities, which were 3.45 million tons in 1996, reached 7.30 million tons in 2016. Considering the average of the past 21 years, India is the largest exporter country with 982 172 tons (Table 4). The country is followed by the Netherlands with 858 881 tons and China with 474 064 tons. While India's onion exports in 1996 were only 215 766 tons, this figure increased steadily to 1 837 249 tons in 2016 (R^2 :0.989). In the same period, exports of the Netherlands increased from 434 673 tons to 1 326 576 tons (R^2 : 0.979).

Table 3. Onion export and import quantities by 21-year average

Years	Worldwide		Turkey	
	Export (tons)	Import (tons)	Export (tons)	Import (tons)
1996	3 446 750	3 161 980	195 304	42
1997	3 178 105	3 226 820	114 905	4 997
1998	3 573 006	3 485 173	144 222	352
1999	3 584 109	3 503 034	132 182	88
2000	3 398 896	3 421 095	85 712	402
2001	3 602 784	3 652 788	161 293	159
2002	4 258 983	4 002 820	138 866	228
2003	5 052 186	4 811 365	137 409	137
2004	5 073 572	4 697 295	74 319	72
2005	5 196 939	4 659 200	63 673	137
2006	5 859 501	5 174 042	128 729	47
2007	5 714 039	5 419 350	179 899	642
2008	6 277 867	5 918 437	210 936	279
2009	6 332 321	6 232 525	134 965	619
2010	6 897 299	6 580 533	95 639	443
2011	6 830 814	6 353 350	119 820	7 548
2012	6 534 224	6 314 227	140 768	365
2013	7 007 820	6 754 400	158 036	1 224
2014	6 935 588	6 791 075	224 991	-
2015	6 890 034	7 032 197	93 390	196
2016	7 299 372	7 260 763	105 910	20

In 1996, the top 5 countries of onion exports were ranked as Netherlands, India, USA, Argentina and Spain. Since 2003, India ranked first in this list. From 2014 onwards, China's rapid rise has begun. According to the 21-years average data, Turkey ranks 9th on the list of onion exporting. Exports which were 63 673 tons in 1996 increased steadily to 210 936 tons over the years ($R^2:0.939$). When the onion imports of the countries are examined, it is understood that the total value of 3 161 980 tons in 1996 reached 7 260 763 tons in 2016. According to the average data of the past 21 years, the largest onion importer of the world is Russia (407 493 tons), followed by Malaysia (366 982 tons) and USA (342 807 tons). Turkey's average annual imports are around 899 tons. When the annual change in the number of onion imports is examined, it is seen that 4 997 tons in 1997; 7 548 tons in 2011 and 1 224 tons in 2013 are noteworthy.

When the Turkey's, 7-years period (2010-2016) monthly changes of average produce prices have been analyzed, it is understood that prices are at the lowest level in September-December. A very hard rising has started since January and it continued until April.

Table 4. According to averages of 1996-2016, significant onion exporter and importer countries.

	Export		Import	
	Country	Quantities (ton)	Country	Quantities (ton)
1	India	982 712	Russia	407 493
2	Netherlands	858 881	Malaysia	366 982
3	China	474 064	USA	342 807
4	USA	316 761	United Kingdom	285 176
5	Mexico	305 797	Japan	263 785
6	Egypt	276 238	Bangladesh	255 513
7	Spain	233 258	Germany	251 245
8	Argentina	199 873	Saudi Arabia	230 269
9	Turkey	134 259	UAE	204 080
10	Poland	124 021	Canada	156 946
11	Iran	78 425	Sri Lanka	147 093
12	Peru	76 960	Belgium	135 666

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13	France	68 688	Netherlands	123 209
14	Kazakhstan	66 389	Belgium/Luxemburg	115 959
15	Niger	64 209	France	112 757
16	Pakistan	60 199	Pakistan	84 504
17	Yemen	57 625	Senegal	84 179
18	Germany	56 727	Vietnam	76 597
19	Belgium	55 779	Poland	56 467
20	Uzbekistan	53 467	Singapore	54 913
21	Canada	53 318	Italy	54 833
22	Malaysia	52 561	Mexico	54 425
23	Australia	52 085	Kuwait	52 924
24	Tajikistan	47 467	Colombia	52 019
25	Chile	46 989	Nepal	47 482
26	Italy	46 839	Czechia	46 200
27	Austria	43 726	Taiwan	43 192
28	Thailand	40 027	Amman	42 447
29	Kirgizstan	33 756	Spain	41 688
30	S. Africa	32 603	Thailand	39 324

Turkish Lira / ton

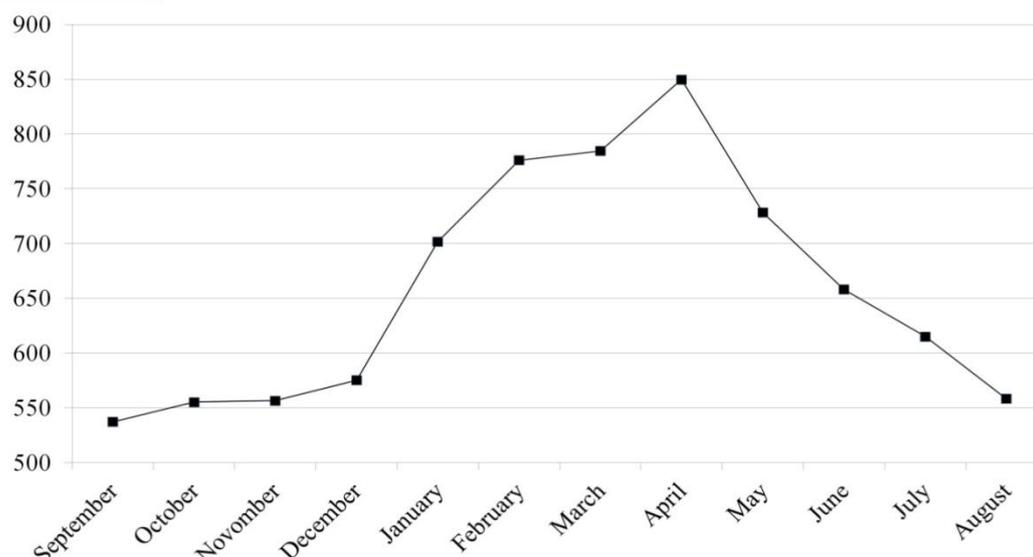


Figure 10. Monthly changes in onion producer prices according to the average of 2010-2016.

When annual onion producer prices are examined, it is understood that the it is at the highest point of the last 7 years with 887 Turkish Lira/ton in 2010, and this price shows a decreasing tendency in 2011 and 2012 (760 and 487 Turkish Lira/ton respectively). These prices have increased gradually since 2013. In 2016, the average producer price was recorded at 755 Turkish Lira/ton. It is understood that when all the data of this cycle are examined monthly basis, 3 different periods are highlighted. The highest producer prices level were recorded during the months February-March-April and May of 2010 (average Turkish Lira, 1 319.63 per ton). A similar situation occurred in the first four months of 2011 and reached an average value of 1 010.63 Turkish Lira/ton. Later, prices stabilized relatively, but in the first four months of 2016, the price again raised to 994.68 Turkish Lira/ton.

Table 5. Turkey onion producer prices between the years 2010-2016,

Months	2010	2011	2012	2013	2014	2015	2016
January	838.60	1 050.30	496.20	582.00	470.80	637.30	837.60
February	1 119.90	998.20	486.80	580.50	471.20	657.30	1 118.50
March	1 260.70	1 010.60	475.70	572.90	479.40	678.00	1 014.50

April	1 723.80	983.40	455.30	579.10	500.90	697.30	1 008.10
May	1 174.10	957.00	455.30	518.30	502.00	694.20	798.10
June	846.70	878.70	434.10	520.90	505.00	671.60	750.90
July	726.10	673.90	448.50	582.20	518.90	679.70	676.90
August	504.10	578.30	509.7	529.10	498.10	653.80	636.40
September	531.70	509.10	501.40	469.60	552.30	617.90	578.80
October	648.40	501.20	485.60	451.70	585.40	647.60	567.20
November	632.00	492.60	497.60	454.20	586.10	690.50	543.60
December	645.20	491.70	604.10	462.10	584.40	700.10	540.10

II. Conclusion

At the beginning of the summer of 2018, the consumer price of onion in Turkey has exceeded 6 Turkish Lira kg-1. As a result of this increase, it is shown that (1), intervention of speculators, (2) yield losses due to extreme climate conditions, (3) decrease in production areas, (4) low supply to the domestic market due to export.

Onion is a product that can be influenced by speculations all over the world. Indeed, the announcement of Bush's free trade agreement with Mexico in the 1990s led to serious fluctuations in onion prices in the US state of Texas⁸. Today, social media tools play an active role in the forming of onion prices (often speculative) as well as in many other issues⁹.

There is a steady increase in the quantities and harvesting area of onion in the world, depending on years. Even though there is a general increase in yield, there have been occasional declines. However, even in the years when yield declines were experienced (2006, 2012 and 2013), the amount of production continued to increase. In the Republic of Korea with the highest average yield, fluctuations are observed for all three values. However, production quantities and area values are increasing at low speeds. The increase in production volume and area in China is more pronounced and continuous than in other countries. However, the yield change over the last 21 years is quite stable. Turkey's image in the amount of production quantities and harvested area is in the opposite direction of the Republic of Korea, China, and Worldwide. Despite the overall increase in yield, the stability of the production has not been achieved.

When 7-year producer price fluctuations are analyzed on a monthly basis, the low prices during the May-December period are anticipated as a usual situation in free market conditions. New products are entering the market in May with the harvest of short day varieties. In August-September period, the supply reaches the highest level with the harvest of long day varieties. The stored product balances the demand till the end of the year, but from the beginning of the year (with the decrease of the product) the prices are starting to increase again. Contrary to this cycle, it is not possible to explain the huge price fluctuations experienced in June 2018 as "imbalance of supply-demand".

Turkey's onion yields were increased in general because of the development of new varieties with research studies, the introduction of hybrid varieties, and the increase of the awareness level of the farmer. However, the negative correlation between the rise in yield and the harvested area is highly suggestive.

As a result, in the formation of onion prices, the impact of speculation has always been and will continue. The factor that raises prices at an abnormal level is not the existence of speculation, but the lack of caution. Onion is a product that can be stored during the season. This feature allows public Institutions to avoid speculation by making purchases from the farmers. In outdoor cultivation, environmental factors are always a risk. However, in free market conditions, fluctuations in exports should not be described as surprise.

In light of data shared in this review, as regards the abnormal changes in onion prices, it is understood that the decrease in long-run harvesting areas and the inability to make the production plan is an important factor.

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