The economic dimension of production and acquired virtual water from the Saudi foreign trade for citrus

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Abstract

This research identifies the production efficiency of citrus cultivation and estimates the quantity and value of virtual water acquired from the Saudi citrus foreign trade during the 2005-2016 periods. It relied on primary data collected through a questionnaire form that was distributed to a sample of citrus farmers in Riyadh. The most important findings of this study

are: (1) citrus production reached 44.87 thousand tons in 2015 ; (2) Among priority areas for citrus cultivation, Tabuk region was top-ranked, followed by Riyadh, Sharqia, Qassim, and Madinah ; (3) in 2015, the import price of citrus exceeds the average cost of the unit produced by 190 riyals / ton, if the irrigation cost of water is included ; (4) the re-export of citrus was not in the interest of the Saudi economy during the 2014-2016 period because the import price exceeded the export price, ; and (5) the net virtual water value increased from 238.53 million SR in 2005 to 333.84 million SR in 2016 The study recommends the need to expand the production of citrus, especially in the priority areas in citrus cultivation, and this can leads to savings of up to 415.4 million SR for the Saudi economy.

Keywords: Citrus. Virtual water. Production costs. Foreign trade.

1. Introduction:

Citrus is one of the most important fruit crops and is of great economic importance in international trade. Citrus fruits are available throughout the year, which raises the issues of transportability, handling and storage. Despite the economic importance of citrus, the cultivated area in Saudi Arabia decreased from 4.64 thousand hectares in 1990 to 4.41 thousand hectares in 2015 representing 2.91% of the total area of fruit. (General Authority for Statistics, 2015).

Due to the inability of local production to meet local consumption needs, the quantity of Saudi imports of citrus increased from 452.32 thousand tons in 2005 to 673.41 thousand tons in 2016. The average import prices of citrus fruits increased from 1641.2 SR / ton in 2005 to 1961.9 SR / ton in 2016. With the increase in import prices of citrus, is it better for the KSA to expand production or continue to rely on imports to meet domestic consumption needs?

The objective of the research was to identify the economics of citrus production and virtual water acquired during the Saudi citrus trade citrus by studying the following:

- Studying the current situation and determining the priority citrus production regions in Saudi Arabia;
- 2 - Estimation of the quantity and value of water used in the production of citrus in Saudi Arabia;
- Studying the discrepancy between the price of imports and the average unit cost of producing citrus and estimating the value of the savings for the Saudi economy when expanding citrus production to meet the local consumption needs;

- Estimating the value of the gains and losses incurred by the Saudi economy from the foreign trade in citrus;
- Estimating the quantity and value of virtual water acquired from the foreign trade of citrus.

2. Previous Studies

Some studies have examined the economic dimension of citrus production and export. Dhehibi (2010) assessed the water use efficiency of citrus cultivation in Tunisia. The study showed that technical efficiency ranged from 12.82% to 90.96%, with an average of 67.73%. This means that citrus production can be increased by 32.3% without increasing the amount of resources and technology used. Sharif (2014) studied the economics of the production and export of Egyptian citrus.

This study shows that citrus produces a profitable return for producers, and citrus is a non-traditional export crop with high added value. Gehajah et al. (2014) discussed the reality of investment in citrus cultivation in Syria during the period 2007-2011. This study showed that investment in citrus added value of $ 1.17 billion.

The citrus sector also contributed to balancing the balance of payments, with net cash flows of citrus amounting to $ 140 million in 2011. Finally, Amran (2016) studied the behavioral aspects of citrus farming in the province of Qalyubiya. This study shows that about 44.16% of citrus farmers have high guidance or self-knowledge. There is also a positive correlation between the degree of knowledge of citrus farming and the cultivated area, as well as the number of years of experience.

It is clear from the results of the previous studies that some of them were interested in studying the value added by investment in citrus cultivation, in addition to measuring the technical efficiency of water use in citrus production.

Therefore, this study differs from the previous studies in that it focuses on determining priority areas in citrus cultivation and estimating the gains and losses incurred by the Saudi economy. In addition, it estimates the quantity and value of pure virtual water acquired from the foreign trade of citrus.

3. Methodology of the study

This study was based on the distribution of citrus production areas by different production categories for calculating the range and the number of categories using the following power law by Thomas and Pawel (2006): $2.5 \times \sqrt[4]{n}$. The priority of regions in citrus production was determined by the Scoring Technique, which is based on several criteria; the most important of them are the following:

- Water needs of the ground unit, where priority is given to areas with lower water requirements. This standard achieves the goal of rationalizing water consumption and achieving water security for the KSA;

- Average productivity per hectare, which reflects the efficiency of crop production in different regions. Priority is given to areas with higher productivity. This standard achieves the goal of maximizing citrus production;

- Water use efficiency expressed by the average productivity of the water unit. Priority is given to areas that use water with higher productivity. This standard achieves the goal of optimizing the utilization of water resources and reducing their overuse;

- The relative importance of the cultivated area of the crop in each production area. This criterion reflects the comparative advantage, the productive and environmental characteristics, and the importance of the crop from the point of view of the cultivators;

- The relative importance of cropland in different productive areas. This criterion reflects the volume or capacity efficiency of productive areas.

A gradient of productive areas between 0 and 100 was used. The results for the criteria —calculated at the district level were converted to absolute scales—according to which priority was given to citrus production (Blank and Tarquin, 1989).

The study also relied on a set of economic equations, the most important of which are the following:

- Quantity of water used in production = Area cultivated $\times$ Water needs of the ground unit (hectare);

- Value of water used in production = quantity of water used in production × cost of water unit;

- The amount of savings in the case of expansion of the production equivalent to t the net imports = (import price - the average cost of production unit) × (quantity imported - the amount re-exported abroad);

- Value of gains and losses for re-export = (export price - import price) × Re-exported quantity to abroad;

- Net quantity of virtual water = (quantity imported - quantity re - exported abroad) × Average share of the unit produced water;

- Net virtual water value = Net virtual water quantity × Water unit cost.

Finally, this study relied on the secondary data presented in: (1) the detailed results of the agricultural census for the year 2015 conducted by the General Organization for Statistics, (2) the Bulletin of Import Statistics issued by the General Authority for Statistics, (3) For different crops (Alamoud et al., 2010). The study also relied on preliminary data collected after preparing of a questionnaire form and d5istributing it to citrus farmers in Riyadh. The sample size was 250 individuals, which represents 5.6% of the total number of citrus farmers in Riyadh in 2015.

4. Results and discussion

4.1. The current status of citrus production in Saudi Arabia:

To study the current status of citrus production in the KSA, it is clear from the data in Table (1) that the area under citrus cultivation was 4.41 thousand hectares, and the local production of citrus was 44,870 tons in 2015. Citrus production is concentrated in several areas, including Madinah (25.92%), Tabuk (21.51%), Riyadh (12.81%),

Eastern Province (10.40%), Hail (8.45%), Qassim (8.34%) and Najran (7.69%). The relative importance of citrus production in the above mentioned areas is 95.14%, while the relative importance of citrus production in the remaining regions is not more than 4.86%.

Table 1: Area and production of citrus in different regions in the KSA in 2015

Region	Area (ha)	%	Production (thousand tons)	%
Riyadh	691	15.67	5.75	12.81
Eastern Region	402	9.11	4.67	10.40

Qassim	460	10.43	3.74	8.34
Al-Jawf	95	2.15	0.58	1.29
Hail	396	8.98	3.79	8.45
Tabuk	687	15.57	9.65	21.51
Makkah	129	2.92	1.04	2.31
Madina El Monawara	1072	24.30	11.63	25.92
Jazan	45	1.02	0.20	0.44
Asir	37	0.84	0.37	0.82
Najran	397	9.00	3.45	7.69
Kingdom	4411	100	44.87	100

Source: Calculated from data obtained from General Organization for Statistics (2015)

4.2. The disparity in citrus productivity between regions

Productivity is a measure of the efficiency of converting agricultural resources into a final output, that is, the ability to convert inputs to outputs according to specific specifications and at a certain cost over a specified period of time. The productivity measures the effect of one of the components of production on the final product and was calculated by dividing the total citrus production by the total cultivated area in each region.The data in Table 2 show that citrus productivity ranged from a minimum of 4.37 tonnes / ha in the Jazan region to a maximum of 14.05 tonnes / ha in Tabuk region with an average of 10.17 tonnes / ha in 2015.

The index was used to determine the variation in citrus productivity between regions. The productivity index can be expressed as follows:

Productivity Index = (Comparative Productivity ÷ Base Area Productivity) × 100

It is clear that most of the regions increase their productivity from the Jazan region at a rate ranging between a minimum of 39.1% for Al Jouf and a higher of 221.5% for the Tabuk region. In the case of comparing the productivity of the regions with the average productivity of citrus fruits in the Kingdom, it is clear from the calculation of the index that the productivity of the Eastern Province, Tabuk and Madinah exceeds the productivity of citrus in the Kingdom at 14.2%, 38.2% and 6.7%, respectively. The productivity of the other regions also decreased from the productivity of citrus in the Kingdom at rates ranging between a minimum of 2.0% for Asir and a high of 57.0% for the Jazan region in 2015. The variation in citrus productivity between the regions is due to differences in the fertility of agricultural lands and the quality of water used in irrigation , As well as variations in temperature, humidity, rainfall, and farmers' experience of farm operations for citrus trees.

Table 2: The amount of variation in citrus productivity for different regions in the Kingdom of Saudi Arabia in 2015.

region	Yield (tons / ha)	The productivity index, considering that the productivity of the Jazan region= 100	Rate of change in productivity %	The productivity index, considering that the productivity of the kingdom = 100	Rate of change in productivity %
Riyadh	8.32	190.4	90.4	81.8	18.2-
Eastern	11.61	265.7	165.7	114.2	14.2
Qassim	8.14	186.3	86.3	80.0	20.0-
Al-Jawf	6.08	139.1	39.1	59.8	40.2-
Hail	9.58	219.2	119.2	94.2	5.80-
Tabuk	14.05	321.5	221.5	138.2	38.2
Makkah	8.05	184.2	84.2	79.2	20.8-
Madina	10.85	248.3	148.3	106.7	6.7
Jazan	4.37	100	-	43.0	57.0-
Asir	9.97	228.1	128.1	98.0	2.0-
Najran	8.69	198.9	98.9	85.4	14.6-
kingdom	10.17	232.7	132.7	100	-

Source: Compiled and calculated from the data in Table (1).

In the distribution of citrus production areas to different categories, it is clear from the data in Table (3) that the low productive category areas (less than 6.50 tons / ha) are in Al Jawf and Jazan regions, which account for 3.17% and 1.73% of the acreage, respectively. Riyadh, Qassim, Hail, Makkah, Asir, and Najran are in the intermediate productivity category (6.50 to less than 10.75 tons / ha).

In the intermediate productive category, the percentage of cultivated area and production of citrus was 47.83% and 40.44%, respectively. Finally, the Eastern Province, Tabuk, and Madinah are located in the productive category (10.75 tons / ha and more). In the high productive category, the percentage of cultivated area and production of citrus was 48.99% and 57.84%, respectively.

Table 3: Distribution of citrus production areas to different productivity categories.

Productivity Category	Region	Area (ha)	Production (Thousand tons)	Relative importance %	
				Area	Production
Low:					
Less than 6.50 tons	Al-Jawf and Jazan	140	0.77	3.17	1.73
Medium:					

6.50 to less than 10.75 tons	Riyadh, Qassim, Hail, Makkah, Asir and Najran	2110	18.14	47.83	40.44
High:					
10.75 tons and more	Eastern, Tabuk and Madina	2161	25.95	48.99	57.84
Total		4411	44.87	100	100

Source: Compiled and calculated from the data in Table (2).

4.3. Priority areas in citrus production:

The priority areas for citrus production were determined by five criteria: water needs of the ground unit, average hectare productivity, water use efficiency, relative importance of citrus area, and relative importance of crop area in that region. A composite standard was used to combine the results of the criteria referred to by the Scoring Technique.

Table 4: Average productivity, water needs, water efficiency, relative importance of each citrus area, and cropland area for different regions in 2015.

Region	Yield (tons / ha)	Ranking	Water needs (m³ / ha)	Ranking	Water use efficiency (kg / m³)	Ranking	% of citrus area	Ranking	% of cropland area	Ranking
Riyadh	8.32	7	7798	4	1.068	5	15.67	2	27.4	1
Eastern	11.61	2	7864	5	1.476	2	9.11	5	7.20	5
Qassim	8.14	8	7198	1	1.131	3	10.43	4	13.8	3
Al-Jawf	6.08	10	7734	3	0.786	9	2.15	8	19.9	2
Hail	9.58	5	10380	8	0.923	6	8.98	7	11.1	4
Tabuk	14.05	1	7560	2	1.858	1	15.57	3	4.3	8
Makkah	8.05	9	11735	11	0.686	10	2.92	9	5.34	7
Madina	10.85	3	10080	7	1.076	4	24.30	1	2.31	9
Jazan	4.37	11	11464	9	0.381	11	1.02	10	5.55	6
Asir	9.97	4	11706	10	0.852	8	0.84	11	2.20	10
Najran	8.69	6	10010	6	0.868	7	9.00	6	0.51	11

Source: compiled and calculated from:
General Organization for Statistics (2015) and Alamoud et al. (2010).

It is clear from the data in Tables4 and 5 that as regards the priority productive areas for citrus cultivation based on the results of the combined criteria and the points obtained by each region, Tabuk region is first, followed by Riyadh, Sharqia and Qassim in second place; in the third place are the region of Hail, Al-Jawf, Najran, Asir, Makkah and Jazan.

Table 5: Results of criteria for determining the priority of regions in the production of citrus in Saudi Arabia.

Region	productivity Ground unit	Water needs	Water use efficiency	% of % citrus area	% of cropland area	Total Points	Arrangement Areas
Riyadh	40	70	60	90	100	360	2
Eastern	90	60	90	60	60	360	2
Qassim	30	100	80	70	80	360	2
Al-Jawf	10	80	20	30	90	230	5
Hail	60	30	50	40	70	250	4
Tabuk	100	90	100	80	30	400	1
Makkah	20	**0**	10	20	40	90	8
Madina	80	40	70	100	20	310	3
Jazan	0	20	**0**	10	50	80	9
Asir	70	10	30	**0**	10	120	7
Najran	50	50	40	50	0	190	6

Source: Compiled and calculated from the data in Table (4).

4.4. Estimation of the quantity and value of water used in citrus production:

In light of the current status of cultivated area and the water demand for citrus, the average cost of extracting groundwater is 0.578 SR / m^3 at a 10% discount rate (Nashwan et al., 2016). The data in Table 6 shows that the amount of water used in citrus production ranged from a minimum of 0.43 million m^3, at a cost of 0.25 million SR in the Asir region, to a maximum of 10.81 million m^3, worth 6.25 million SR in the area of Medina.

Table 6: Estimation of the quantity and value of water used in the production of citrus in Saudi

Region	Area (ha)	Production value (in million SR)	Water needs (m^3 / ha)	Quantity of water in (million m$^{3)}$	Value of water (million SR)	Percentage of water value to production value
Riyadh	691	17.43	7798	5.39	3.11	17.86
Eastern	402	14.16	7864	3.16	1.83	12.90
Qassim	460	11.34	7198	3.31	1.91	16.88
Al-Jawf	95	1.76	7734	0.73	0.42	24.15
Hail	396	11.49	10380	4.11	2.38	20.68
Tabuk	687	29.26	7560	5.19	3.00	10.26
Makkah	129	3.15	11735	1.51	0.87	27.75
Madina	1072	35.26	10080	10.81	6.25	17.71
Jazan	45	0.61	11464	0.52	0.30	49.17

Asir	37	1.12	11706	0.43	0.25	22.32
Najran	397	10.46	10010	3.97	2.30	21.96
The kingdom	4411	136.05	-	39.14	22.62	16.63

Source: Compiled and calculated from Alamoud et al. (2010) and Nashwan et al. (2016).

In the light of the average farm price of 3032 SR / ton in 2015, it is clear that the value of water used for citrus production to production value of citrus ranged from a minimum of 10.26% for the Tabuk region to a high of 49.17% for the Jazan region. In general, the quantity of water used in citrus production was 39.14 million m^3, with a value of 22.62 million SR. The value of water used to produce citrus fruit to the value of citrus production was 16.63% in 2015.

4.5. The difference between the import price and the average unit cost of citrus fruit:

The total production costs include fixed costs (depreciation and permanent labor costs), as well as variable costs, including temporary labor wages, cost of production inputs (chemical fertilizers, pesticides, organic fertilizers, and seeds), fuel, oil and grease, electricity, communications, drinking water, rent of machinery and equipment, maintenance costs, and cost of spare parts. In light of the average water requirements of citrus of 9.41 m^3 / ha and the unit cost of water unit of 0.578 SR / m^3, the cost of irrigation water is estimated at 5,440 riyal/ ha (Nashwan, et al., 2016).

The data in Tables 7 and 8 show that: (1) the average production costs of citrus in 2015 was 12,280 SR / ha, without including the irrigation cost of water. In view of the average productivity of 10.17 tons / ha, the average cost per unit produced was 1,210 SR / ton. It is clear that the average unit import price of citrus (1,930 thousand SR / ton) exceeds the average unit cost of production (720 SR / ton), that is, the ratio of the import price to the unit cost of production in 2015 is 159.5% ; (2) if the irrigation cost of water is included, the average production cost of citrus in 2015 is 17,720 thousand SR / ha; in view of productivity improvement, the average cost of the unit produced was 1.74 thousand SR / ton. In comparing the cost of the unit produced with the average import price of citrus, it is clear that the import price exceeds the average cost of the produced unit by 190 SR / ton, that is, the ratio of the import price to the unit production cost in 2015 is 110.9% in 2015, (3) in light of the difference between the import price and the cost per unit produced and the net imports of

citrus (imports − re-exports) of 576.95 thousand tons in 2015, the expansion of citrus production to meet the local consumption needs is necessary.

Table 7: Structure of production costs of citrus in Riyadh in 2015.

Fixed costs	Value (SR / ha)	Variable costs	Value (SR / ha)
Depreciation:		Operating costs	3753.0
Buildings and facilities	411.3	Costs of production inputs	2388.8
Water sources	510.2	Variable costs	6141.8
Mechanisms and devices	857.6		
Total Depreciation	1779.1		
Permanent employment *	4356.4		
Total fixed costs	6135.5		
Total			12277.3

Source: Compiled and calculated from questionnaire forms collected in 2015.

It would lead to savings to the Saudi economy of 109.63 million SR if the irrigation cost of water is included, and this increases to 415.4 million SR if it is not.

Table 8: Comparison between the import price and the average cost of the citrus producing unit in 2015.

Statement	Do not include the cost of water	Include the cost of water
Production costs (in SR / ha)	12.28	17.72
The irrigation cost of water (in thousands SR/ha)	-	5.44
Average productivity (ton / ha)	10.17	10.17
Average cost per ton of production (in thousands SR)	1.21	1.74
Average prices of citrus imports per thousand (SR / ton)	1.93	1.93
The difference between the import price and the average unit cost of production (in SR / ton)	720	190
Percentage of import price for production costs (%)	159.5	110.9
Net imports (in thousand tons)	576.95	576.95
The amount of savings for the Saudi economy (in million SR)	415.40	109.62

Source: Compiled and calculated from the data in Table (7) and General Organization for Statistics (2015)

4.6. Value of gains and losses incurred by the Saudi economy from foreign trade of citrus:

The country pursues the policy of import and re-export of citrus to benefit from price differences. It is clear from the data provided in Tables 9and 10 that the quantity of Saudi imports of citrus increased from 452,320 tons with a value of 742.36 million SR in 2005 to 673,410 tons with a value of 1321.19 million SR in 2016.

Table 9: Development of quantity and value of imports and re-exports of citrus during the 2005-2016 period.

Year	Imports			Re-export		
	quantity (thousand tons)	value (million SR)	price (SR / ton)	quantity (thousand tons)	value (million SR)	price (SR / ton)
2005	452.32	742.36	1641.2	6.17	10.72	1737.4
2006	462.30	560.76	1213.0	9.87	18.40	1864.2
2007	409.22	585.02	1429.6	13.01	39.01	2998.5
2008	428.99	855.78	1994.9	12.18	40.44	3320.2
2009	469.84	884.39	1882.3	16.90	52.00	3076.9
2010	492.01	1008.57	2049.9	21.58	59.00	2734.0
2011	532.74	1078.71	2024.8	9.74	27.44	2817.2
2012	567.47	1092.24	1924.8	17.70	40.58	2292.7
2013	575.60	1112.40	1932.6	26.18	60.48	2310.2
2014	614.15	1194.70	1945.3	24.05	41.91	1742.6
2015	615.32	1186.01	1927.5	38.37	65.00	1694.0
2016	673.41	1321.19	1961.6	49.00	75.00	1530.6
Average	524.45	968.51	1827.3	20.40	44.17	2343.2

Source: General Organization for Statistics, Bulletin of Import Statistics, 2005-2016.

The volume of re-exports increased from 6,170 tons with a value of 10.72 million SR in 2005 to 49000 tons valued at 75 million SR in 2016. Due to the export price of citrus being higher than the import price, the re-export policy has achieved a gain of 102.64 million SR for the Saudi economy during the 2005-2013 period. However, the import price of citrus exceeds the export price of citrus during the 2014-2016 period. Therefore, the re-export of citrus is not in the interest of the Saudi economy, which has incurred losses of 34.95 million SR during the last three years.

Table 10: Value of gains and losses, the proportion of exports to imports, and the quantity and value of Saudi net imports of citrus during the period 2005-2016.

Year	The difference between the export price and the import price SR / ton	Value of gains and losses for re-export (in million SR)	%Ratio of exports to imports			Net imports	
			the quantity	the value	price	the quantity (thousand tons)	the value (million SR)
2005	96.2	0.59	1.36	1.44	105.86	446.15	731.64
2006	651.2	6.43	2.13	3.28	153.69	452.43	542.36
2007	1568.9	20.41	3.18	6.67	209.74	396.21	546.01
2008	1325.3	16.14	2.84	4.73	166.43	416.81	815.34
2009	1194.6	20.19	3.60	5.88	163.46	452.94	832.39
2010	684.1	14.76	4.39	5.85	133.37	470.43	949.57
2011	792.4	7.72	1.83	2.54	139.13	523.00	1051.27
2012	367.9	6.51	3.12	3.72	119.11	549.77	1051.66
2013	377.6	9.89	4.55	5.44	119.54	549.42	1051.92
2014	202.7-	4.87-	3.92	3.51	89.58	590.10	1152.79
2015	233.5-	8.96-	6.24	5.48	87.89	576.95	1121.01
2016	431.0-	21.12-	7.28	5.68	78.02	624.41	1246.19
Average	-	-	3.70	4.52	130.49	504.05	924.35

Source: Compiled and calculated from the data in Table (9).

4.7. Quantity and value of virtual water acquired from Saudi foreign trade for citrus:

Foreign trade of agricultural commodities includes the export and import of virtual water in the production of exported and imported quantities. By importing and re-exporting citrus, the KSA gets pure virtual water. It is clear from the data in Table (11) that in the light of the net imports and the water needs of the productive units, the net amount of virtual water gained increased from 412.69 million m^3 in 2005 to 577.58 million m^3 in 2016.

Table 11: Quantity and value of virtual water and its relation to the value of Saudi imports of citrus during the 2005-2016 period.

Year	Average share of water produced unit (thousand m^3/ ton)	Net virtual water		Percentage of the value of virtual water to the value of imports	Cumulative Net Water Quantity (million m^3)
		the quantity (million m3)	the value (million SR)		
2005	0.925	412.69	238.53	32.60	412.69
2006	0.925	418.50	241.89	44.60	831.19
2007	0.925	366.49	211.83	38.80	1197.68
2008	0.925	385.55	222.85	27.33	1583.23
2009	0.925	418.97	242.16	29.09	2002.20
2010	0.925	435.15	251.52	26.49	2437.35
2011	0.925	483.78	279.62	26.60	2921.13
2012	0.925	508.54	293.93	27.95	3429.67
2013	0.925	508.21	293.75	27.92	3937.88
2014	0.925	545.84	315.50	27.37	4483.72

2015	0.925	533.68	308.47	27.52	5017.40
2016	0.925	577.58	333.84	26.79	5594.98
Year	0.925	466.25	269.49	29.15	-

Source: Compiled and calculated from the data in Table (10).

In light of the average cost of groundwater extraction of 0.578 SR / m^3 (Nashwan et al., 2016), the value of net virtual water increased from 238.53 million SR, representing 32.6% of the net value of Saudi citrus imports in 2005, to 333.84 million SR, representing 26.79% of the net value of Saudi imports of citrus in 2016. In calculating the net quantity of accumulated virtual water for citrus, it is clear that the total net quantity of water acquired was 5594.98 million m^3 at the end of the 2005-2016 period.

5. Conclusions and Recommendations:

In 2015, citrus production reached 44.87 thousand tons, while consumption reached 621.82 thousand tons, which represents 7.22% self-sufficiency in citrus. Due to insufficient production to meet local consumption needs, the state was forced to expand imports. By comparing the import price of citrus and the cost of the produced unit, it was found that the import price exceeds the cost of the unit produced by 190 SR / ton, if the irrigation cost of water is included.

Therefore, the expansion of citrus production can save the Saudi economy 109.63 million SR. This can increase to 415.4 million SR if the irrigation cost of water is not considered. The KSA has also adopted a policy of importing citrus for re-export to benefit from the difference in prices. Comparing the import price with the export price, it was found that this policy is beneficial to the Saudi economy and achieved savings of 102.64 million SR during the 2005-2013 period.

However, the price of imports exceeded the export price during the 2014-2016 period; thus, the policy of re-export led to losses of 34.95 million SR during the last three years and is no longer in the interest of the Saudi economy. In light of the results of this study, the following steps are recommended: (1) expansion of production, especially in priority areas for citrus cultivation; (2) applying the optimal foreign trade pattern to protect the Saudi economy from losses incurred in case the import price exceeds the export price.

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