

THE ANALYSIS OF THE MAIN STATISTICAL INDICATORS WHICH CHARACTERIZE THE AGRICULTURE'S EVOLUTION IN THE VEGETAL SECTOR OF THE REPUBLIC OF IRAQ

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Abstract

Agriculture in Iraq has gone through many changes in the last decade, its revival has constituted a very important subject for debates. Agriculture is still an important sector since the agricultural sector does provide an opportunity for Iraq to improve the country's economy, and more critically, to increase the resilience of conflict affected rural populations, by increasing their productivity. The focus of this study is on the main crops of Iraq that are very instable in terms of surface and production, affecting also the prices and producers' confidence. A review of the cultivated crops, total and average productions was made for the period 2000-2014, with the help of the main statistical indicators that analyze the evolution, variation and growth. This study is divided into an introductory section, research methods, results and discussion in which data are interpreted, and end with the conclusions and recommendations.

Key words: evolution, agriculture, field crops, fruits, vegetables, Iraq

INTRODUCTION

The present research is situated in the field of agriculture, focusing on evaluating the evolution in the period 2000-2014 of the main agricultural crops that are highly important for the economic development in Iraq. Arable land in Iraq numbers nearly 24 million acres, more than half of which is planted each year, and plant crops (cereal crops in particular) represent two-thirds of agricultural production, while animal production represents one-third [4].

In Iraq, the agriculture is a key factor for the economy, and although a considerable portion of its agricultural lands are irrigated, it still depends highly on rain fed agriculture. The potentially suitable land for agricultural production is not more than 27% of the total area of the country with about 8 million ha which almost 67% of the cultivable area is. Besides this, due to some limitations like shortage of irrigation water in summer, soil salinity, drought and an unstable political situation it is estimated that the average area ranges from 3 to 4 million hectares [10].

The contribution of agriculture to GDP has

been declining in the last decade from 9 percent in 2002 to 3.6 percent in 2009, following the problems caused by the war, the social unrest and institutional and economic issues.

Agriculture is mostly practiced on small farming units and it is a low input–low output system. Crop yields are low by any comparative standards as farmers tend to minimize costs concerned with land preparation, planting, weeding and harvesting [11].

After years of war and social unrest, Iraq is facing a number of challenges. The poor performance of the agricultural sector and lack of employment perspectives drive migration to the urban areas, generating pressure on service delivery and increasing urban poverty.

Population growth combined with the need to produce more food from a limited and shrinking resource base of land and water have resulted in farming systems that tend to maximize short-term returns at the expense of long-term sustainability. Water losses in irrigation schemes, all over Iraq, are substantial. The recent intensification of

violence in Iraq coincides with wheat planting. If farmers are displaced, or unable to venture to their fields, this will have implications for medium-term food security. Agriculture-based livelihoods also face severe constraints across the value chain [7].

MATERIALS AND METHODS

This study involves the use of theory and statistical data. The theory may or may not be made explicit in the design of the research, although it will usually be made explicit in presentation of the findings and conclusions. In the paper the following indicators have been used: arithmetic mean, coefficient of variation, average annual growth rate, and statistical indicators.

The formulas used for to calculate these indicators, are:

$$\text{For the arithmetic mean} = \bar{x} = \frac{\sum xi}{n}$$

where \bar{x} = the arithmetical mean, xi = the average production values for a number of years (i); n= number of years taken into account

The research method followed the following steps, beginning with scientific databases research of the relevant articles concerning organic agriculture in Iraq and marketing of the main agricultural products grown organically in Iraq, followed by an analysis and selection of the relevant data and the last step was extraction and summarization of the results based on interpretation and evaluation of data.

RESULTS AND DISCUSSIONS

In the Arab countries, the share of agriculture in the national GDP is around 6.7% in average for the period 2000 to 2012 [10] and the agricultural sector in Iraq represents the second largest industry of the non-oil economy, contributing 9.7% to GDP in 2013 [5]. Recently, the agricultural sector has been identified by the Government of Iraq and the Kurdistan Regional Government (KRG) as a strategic area of focus to be prioritized.

The selling of agricultural equipment started opening to private sector, while the

government still maintained hegemony over importing and selling agricultural machinery and the government remained the main importer and seller of agricultural machinery until 1993 when a new law for the Ministry of Agriculture was issued, which pointed out that the main activities of the government should be addressed to agricultural research, services and extension [2].

In 2003, the new government and administration identified that such issues as mechanization-related problems and agricultural issues were mainly affecting the medium and small producers in Iraq [3]. Three years later, in 2006, three USDA agriculture advisors were assigned to the Iraqi Ministry of Agriculture to build its capacity in agricultural extension, agricultural strategic planning, and food safety and inspection. USDA provided also a public affairs specialist to be part of the U.S. embassy's public affairs team [12]. Iraqi imports had a value of almost \$3 billion in food annually, and Iraq was the No. 2 buyer of U.S. hard red winter wheat in marketing year 2005-2006 [World Bank, 2006] [14]. In addition, Iraq was the No. 1 buyer of U.S. long grain milled rice in 2005. In the late 1980s, it was the top market for rice and one of the top 10 wheat export markets. USAID started helping Iraqi farmers improve production technologies for wheat, barley, rice, and maize [12].

The evolution of the surfaces occupied by the main crops in Iraq

The major portion of the agricultural land in Iraq is cultivated with field crops. Wheat and barley are the most important crops. Wheat is the most important staple food crop in Iraq and Barley is mainly used for animal feed. The large increase of wheat grown area after 1991 is likely due to a national policy to increase food production in Iraq, possibly induced by international economic sanctions. Other crops of significance and major importance are pulses that include lentils, chickpeas, broad beans, oil seed crops such as cotton, sesame, sunflower [6].

The analysis begins with the evolution of surfaces that are cultivated with grain cereals, beans and other main crops. Form the first table it can be observed an increase of the

surface cultivated with wheat, with high variation between the years, 28.2%, and an annual growth rate of 4.11%. In the year 2014 the wheat registered 2,109.5 thousand ha compared to 1,200 thousand ha in 2000. The barley crop is also cultivated on large areas, and its surface has increased in the last years,

having high variations on years. The highest decreases can be observed at the chick peas crop, from 85.4 thousand ha has dropped with 28% per year at just 0.9 thousand ha in year 2014. The beans and sunflower are also two crops that have suffered important decreases in surface [1].

Table 1. The evolution of the surfaces for the main field crops in Iraq, during 2000-2014

Indicator	MU	2000	2005	2010	2014	Mean	St. Dev.	Coefficient of variation	The annual growth rate
		Th. ha	Th. ha	Th. ha	Th. ha	Th. ha	Th. ha	%	%
Wheat	Th. ha	1,200.0	2,549.8	1,383.3	2,109.5	1,519	429	28.2	4.11
Barley	Th. ha	1,110.0	1,063.3	1,005.8	1,145.8	923	284	30.8	0.23
Beans, dry	Th. ha	9.0	5.0	0.9	1.2	3.7	3.1	84.9	-13.40
Beans, green	Th. ha	2.4	1.3	0.9	1.2	1.5	0.6	40.6	-4.83
Broad beans, horse beans, dry	Th. ha	6.5	4.5	5.1	1.2	3.8	1.6	42.5	-11.32
Chick peas	Th. ha	85.4	11.8	1.0	0.9	50	70	140.3	-28.02
Cow peas, dry	Th. ha	0.6	0.4	0.3	0.2	0.4	0.1	29.5	-6.77
Lentils	Th. ha	2.8	4.5	0.1	0.6	2	3	122.5	-10.83
Maize	Th. ha	72.8	173.8	113.1	84.6	130	38	29.4	1.08
Potatoes	Th. ha	38.8	51.0	13.0	25.7	37	11	30.3	-2.88
Rice, paddy	Th. ha	100.0	107.0	48.0	78.9	85	27	31.7	-1.67
Sugar beet	Th. ha	0.3	0.0	1.2	2.7	1.1	0.9	82.9	71.84
Sugar cane	Th. ha	5.0	0.0	0.6	0.5	1.3	2.3	168.5	19.13
Seed cotton	Th. ha	19.8	27.0	20.6	15.5	22	12	54.7	-1.72
Sunflower seed	Th. ha	6.0	15.8	5.8	0.8	7.2	4.4	61.4	-13.07
Tobacco, unmanufactured	Th. ha	2.4	2.4	2.5	2.6	2.3	0.3	12.5	0.55

Source: FAOSTAT, 2014, Value of Agricultural Production, <http://www.fao.org/faostat/en/#data/QV>[9]

Important increases in surface are observed at sugar beet, from 0.3 thousand ha in 2000 to 2.7 thousand ha in 2014, the sugar cane decreasing from 5 to 0.5 thousand ha.

Almost all of the crops have high variation between the cultivated surfaces over the period, which represents a high instability on the market and for producers.

The cultivated area of vegetables is estimated at about 9% (450,000 ha) of the total cultivated area and about 6% (300,000 ha) is covered by permanent fruit trees.

Vegetables and fruits provide good supplementary and nutritive food in daily diet and they also fetch attractive price for the

producers.

Vegetables are grown all year round in Iraq. Similarly fruit trees are grown throughout Iraq as the climate is considered highly suitable for various fruits.

Analyzing the second table, the surfaces for tomatoes and vegetables have decreased, with high variations on years and high annual rates between 2% and 5.53%.

The tomatoes have a mean of 60 thousand ha, with a high coefficient of variation of 26.5% and standard deviation of 16 thousand ha. In the year 2014 it registered only 34.8 thousand ha cultivated.

Table 2. The evolution of the surfaces for the main vegetable crops in Iraq, during 2000-2014

Indicator	MU	2000	2005	2010	2014	Mean	St. Dev.	Coefficient of variation	The annual growth rate
		Th. ha	Th. ha	Th. ha	Th. ha	Th. ha	Th. ha	%	%
Tomatoes	Th. ha	77.3	67.0	53.2	34.8	60	16	26.5	-5.53
Vegetables, fresh nes	Th. ha	30.0	27.6	22.8	19.4	25	3	13.2	-3.07
Vegetables, leguminous nes	Th. ha	18.5	33.8	17.9	13.9	21	6	28.1	-2.01

Source: FAOSTAT, 2017, GIEWS - Global Information and Early Warning System,[7]

The fruits production it's a highly important part in the agriculture of Iraq, and the Table 3

presents the data of the evolution of these crops.

Table 3. The evolution of the surfaces for the main permanent crops in Iraq, during 2000-2014

Indicator	MU	2000	2005	2010	2014	Mean	St. Dev.	Coefficient of variation	The annual growth rate
		Th. ha	Th. ha	Th. ha	Th. ha	Th. ha	Th. ha	%	%
Apples	Th. ha	9.0	10.8	30.3	66.2	24	21	85.4	15.32
Apricots	Th. ha	4.6	5.1	4.9	5.2	5	0	9.1	0.82
Dates	Th. ha	110.0	50.0	123.0	242.6	118	49	41.6	5.81
Olives	Th. ha	2.0	0.9	4.7	4.5	3	2	54.9	5.93
Oranges	Th. ha	28.0	26.5	37.1	59.6	35	12	33.1	5.54
Tangerines, mandarins, clementines, satsumas	Th. ha	3.0	1.2	0.7	0.8	2	1	56.5	-8.83

Source: FAOSTAT, 2014, Value of Agricultural Production, [http://www.fao.org/faostat/en/#data/QV\[9\]](http://www.fao.org/faostat/en/#data/QV[9])

-The apples have increased in surfaces from 9 thousand ha to 66.2 thousand ha in year 2014, with a very high variation of 85.4% and 15.34% yearly increase.

-Dates are also very significant for the export of Iraq, the year 2014 registering a surface of 242.6 thousand ha, more than double compared to the first year and almost five time more than the surface from year 2005. Iraq is considered to be the largest producer of date palm fruit in the world.

-Increases in surface have also the olives and the oranges with high variations on years and the Tangerines, mandarins, clementines and

satsumas have decreased continuously to a surface of 0.8 thousand ha in 2014.

The evolution of the total productions of the main crops in Iraq

The next three tables analyses the evolution of the total production mainly influenced by the changes in the cultivated surface, as it was shown in the previous tables, has had high variations on years.

The wheat, the most cultivated crop in Iraq, has increased from 384 tons in year 2000 to 5,055 tons in year 2014, with a variation of 50%, and a very high standard deviation of 1,182 thousand tons (Table 4).

Table 4. The evolution of the total productions for the main field crops in Iraq

Indicator	MU	2000	2005	2010	2014	Mean	St. Dev.	Coefficient of variation	The annual growth rate
		Th. to	Th. to	Th. to	Th. to	Th. to	Th. to	%	%
Wheat	Th. to	384	2,228	2,749	5,055	2,358	1,182	50.1	20.21
Barley	Th. to	400	754	1,137	1,278	803	258	32.1	8.66
Beans, dry	Th. to	8.9	8.4	4.1	7.2	6.8	2.5	37.5	-1.48
Beans, green	Th. to	8.0	7.0	5.6	7.2	7.6	2.3	30.9	-0.73
Broad beans, horse beans, dry	Th. to	3.0	4.0	11.3	0.6	8.0	4.3	54.2	-10.96
Chick peas	Th. to	48.9	13.0	0.8	0.8	28.5	38.7	135.9	-25.28
Cow peas, dry	Th. to	0.8	0.6	0.9	1.2	0.8	0.3	33.9	3.26
Lentils	Th. to	2.0	4.0	0.2	0.9	2.5	4.2	166.6	-5.80
Maize	Th. to	55	401	267	289	341	173	50.5	12.59
Potatoes	Th. to	545	808	205	402	582	215	36.9	-2.15
Rice, paddy	Th. to	60	309	156	403	258	121	46.8	14.57
Sugar beet	Th. to	7.5	0.1	10.7	7.9	8.6	6.9	79.4	49.25
Sugar cane	Th. to	65.0	0.0	12.5	8.7	17	26	149.4	12.29
Seed cotton	Th. to	33.0	29.0	45.3	38.0	38	19	49.2	1.01
Sunflower seed	Th. to	7.5	24.0	7.5	1.8	12	8	65.3	-9.61
Tobacco, unmanufactured	Th. to	2.3	2.3	2.3	2.3	2.3	0.1	4.5	0.16

Source:FAOSTAT,2017, GIEWS - Global Information and Early Warning System,[8]

The barley production has increased also, from 400 thousand tons to 1,278 thousand tons in year 2014, also with high variations on

years. The beans have decreased in productions and together with the chick peas have the most important downward trend.

Overall, all the productions have important variations on years, with high standard deviations and also high annual growth rate, these fluctuations being main influenced by the variations in surfaces.

The tomatoes increased their production until year 2010, when it was registered a total production of 1,013.2 thousand tons and decreased up to 770.6 thousand tons, with a mean of 934 thousand tons and a very high

standard deviation of 253 thousand tons.

The fresh vegetables have a continuous decrease over the years, with a rate of -3.64% per year and the leguminous vegetables increased their production up to 195 thousand tons in year 2005, and 108.2 thousand tons in year 2014 compared to year 2000 when the total production was 75 thousand tons (Table 5).

Table 5. The evolution of the total productions for the main vegetable crops in Iraq

Indicator	MU	2000	2005	2010	2014	Mean	St. Dev.	Coefficient of variation	The annual growth rate
		Th. to	Th. to	Th. to	Th. to	Th. to	Th. to	%	%
Tomatoes	Th. to	989.0	939.0	1,013.2	770.6	934	253	27.0	-1.77
Vegetables, fresh nes	Th. to	140.0	129.2	103.8	83.3	113	16	14.0	-3.64
Vegetables, leguminous nes	Th. to	75.0	195.0	140.5	108.2	136	45	33.0	2.65

Source:FAOSTAT,2017, GIEWS - Global Information and Early Warning System,[7]

The fruits production has increased at apricots and olives and decreased with high rates at citrus and dates.

The apples production is in year 2014 at 63.4 thousand tons, almost the same with year 2000, but with high variation over the years, and a slight decrease rate of 0.29%.

The dates decrease from 932 thousand tons to

662 thousand tons in year 2014, with a decrease of 2.41% per year and a high standard deviation of 187 thousand tons.

The production of oranges is more than a half smaller in year 2014 compared with year 2000, the coefficient of variation being very high for this category, 63.9%, but also for olives and tangerines and etc (Table 6).

Table 6. The evolution of the total productions for the main permanent crops in Iraq

Indicator	MU	2000	2005	2010	2014	Mean	St. Dev.	Coefficient of variation	The annual growth rate
		Th. to	Th. to	Th. to	Th. to	Th. to	Th. to	%	%
Apples	Th. to	66.0	25.0	39.6	63.4	47	16	34.8	-0.29
Apricots	Th. to	6.0	11.7	15.7	16.1	12	4	32.8	7.28
Dates	Th. to	932	404	568	662	630	187	29.7	-2.41
Olives	Th. to	6.0	3.0	15.1	24.8	11	8	70.2	10.66
Oranges	Th. to	270.0	79.0	97.9	115.6	144	92	63.9	-5.88
Tangerines, mandarins, clementines, satsumas	Th. to	37.0	27.0	3.7	4.7	18	15	85.5	-13.74

Source: FAOSTAT, 2014, Value of Agricultural Production, <http://www.fao.org/faostat/en/#data/QV>[9]

The evolution of the average productions/ha of the main crops in Iraq

The other responsible for the increase of the total production is the average production, as it will be demonstrated in the next three tables has very high variations over the years.

The wheat production has increased from 320 kg/ha to 2,396 kg/ha with an average of 1,542 kg/ha and a standard deviation of 620 kg/ha.

The barley production has achieved an average of 1,115 kg/ha in the year 2014, starting also with 360 kg/ha in 2000.

The chick peas have variations between 572

kg/ha and 1,106kg/ha, the production of sugar beet has a very high decrease from 22,727 kg/ha to 2,995 kg/ha in 2014 and the maize also increased in production up to 3,420 kg/ha (Table 7).

An important increase is observed at the tomatoes production, from 12,802 kg/ha to 22,129 kg/ha, i.e. a growth rate of 3.99%.

Also the leguminous vegetables almost doubled their production from 4,054 kg/ha to 7,775 kg/ha, with an average of 6,486 kg/ha and a growth rate of 4.76% per year (Table 8).

Table 7. The evolution of the average productions for the main field crops in Iraq

Indicator	MU	2000	2005	2010	2014	Mean	St. Dev.	Coefficient of variation	The annual growth rate
		kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	%	%
Wheat	kg/ha	320	873	1,987	2,396	1,542	620	40.2	15.47
Barley	kg/ha	360	709	1,130	1,115	932	323	34.7	8.41
Beans, dry	kg/ha	988	1,698	4,355	6,019	3,083	1,991	64.6	13.78
Beans, green	kg/ha	3,333	5,600	5,977	6,019	5,380	958	17.8	4.31
Broad beans, horse beans, dry	kg/ha	461	888	2223	488	2,306	1,417	61.4	0.41
Chick peas	kg/ha	572	1,106	839	967	747	332	44.4	3.82
Cow peas, dry	kg/ha	1,357	1,425	2,774	5,671	2,567	1,734	67.5	10.75
Lentils	kg/ha	727	888	1,520	1,565	1,163	344	29.5	5.63
Maize	kg/ha	756	2,307	2,358	3,420	2,523	752	29.8	11.38
Potatoes	kg/ha	14,064	15,843	15,717	1,5626	1,5315	2,228	14.5	0.76
Rice, paddy	kg/ha	600	2,887	3,248	5,104	3,098	1,168	37.7	16.52
Sugar beet	kg/ha	22,727	17,500	9,124	2,995	11,799	6,548	55.5	-13.14
Sugar cane	kg/ha	13,000		20,000	15,993	17,198	4,380	25.5	-5.74
Seed cotton	kg/ha	1,670	1,074	2,201	2,451	1,867	476	25.5	2.78
Sunflower seed	kg/ha	1,250	1,523	1,304	2,156	1,744	369	21.2	3.97
Tobacco, unmanufactured	kg/ha	937	937	941	888	1047	199	19.0	-0.38

Source: FAOSTAT, 2014, Value of Agricultural Production, [http://www.fao.org/faostat/en/#data/QV\[9\]](http://www.fao.org/faostat/en/#data/QV[9])

Table 8. The evolution of the average productions for the main vegetable crops in Iraq

Indicator	MU	2000	2005	2010	2014	Mean	St. Dev.	Coefficient of variation	The annual growth rate
		kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	%	%
Tomatoes	kg/ha	12,802	14,014	19,046	22,129	15,633	2,863	18.3	3.99
Vegetables, fresh nes	kg/ha	4,666	4,682	4,545	4,298	4,506	199	4.4	-0.59
Vegetables, leguminous nes	kg/ha	4,054	5,777	7,853	7,775	6,486	1,532	23.6	4.76

Source: FAOSTAT, 2014, Value of Agricultural Production, [http://www.fao.org/faostat/en/#data/QV\[9\]](http://www.fao.org/faostat/en/#data/QV[9])

It is concerning how the apples production has decreased, a high dropdown from 7,333 kg/ha to 956 kg/ha in year 2014. Also the dates have high decreases in the average production, with

a downward trend by -7.77% rate, the olives production has increased up to 5,527 kg/ha and the citrus have important decreases with very high variations over the year (Table 9).

Table 9. The evolution of the average productions for the main permanent crops in Iraq

Indicator	MU	2000	2005	2010	2014	Mean	St. Dev.	Coefficient of variation	The annual growth rate
		kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	kg/ha	%	%
Apples	kg/ha	7,333	2,325	1,307	956	3,083	2,208	71.6	-13.54
Apricots	kg/ha	1,300	2,300	3,240	3,100	2,555	714	27.9	6.40
Dates	kg/ha	8,472	8,080	4,615	2,730	5,922	2,230	37.7	-7.77
Olives	kg/ha	3,000	3,233	3,215	5,527	3,646	790	21.7	4.46
Oranges	kg/ha	9,642	2,981	2,638	1,39	4,669	3,829	82.0	-10.82
Tangerines, mandarins, clementines, satsumas	kg/ha	12,333	22,500	5,175	5,680	9,250	6,117	66.1	-5.39

Source: FAOSTAT, 2014, Value of Agricultural Production, [http://www.fao.org/faostat/en/#data/QV\[9\]](http://www.fao.org/faostat/en/#data/QV[9])

Date palm is the most popular fruit in Iraq, which is grown in the central and southern part of the country.

A New York Times article [13] describes that Iraq produced 75% of the world's supply of dates, growing 629 different varieties.

In recent years, Iraq has lost its position on the world market, and production (281,000 tons) was in 2008 approximately half of production levels in the 1980's. The article states that the number of date palm trees has

fallen from 33 million in the mid 50's to 9 million in 2008.

CONCLUSIONS

The agricultural sector confronts enormous challenges to investment and growth. Settlement of unresolved land and water rights issues, renovation of Iraq's irrigation infrastructure, development of a coordinated national program of de-salinization, as well as

the rebuilding of infrastructure for handling, storing, and distributing agricultural inputs and outputs will all likely be needed to fully restore producer's confidence in increasing the cultivated surfaces and average productions.

-The agricultural sector in Iraq represents the second largest industry of the non-oil economy, contributing 4.2% to GDP in 2013.

-Overall, all the productions have important variations on years, with high standard deviations and also high annual growth rate, these fluctuations being main influenced by the variations in surfaces.

-The large increase of wheat grown area after 1991 is likely due to a national policy to increase food production in Iraq, possibly induced by international economic sanctions.

-A New York Times article describes that Iraq produced 75% of the world's supply of dates, growing 629 different varieties.

-In recent years, Iraq has lost its position on the world market, and production (281,000 tons) was in 2008 approximately half of production levels in the 1980's.

-Recently, the agricultural sector has been identified by the Government of Iraq and the Kurdistan Regional Government (KRG) as a strategic area of focus to be prioritized.

-In 2006, three USDA agriculture advisors were assigned to the Iraqi Ministry of Agriculture to build its capacity in agricultural extension, agricultural strategic planning, and food safety and inspection.

-USDA provided also a public affairs specialist to be part of the U.S. embassy's public affairs team.

-Through the Agriculture Reconstruction and Development Program for Iraq (ARDI), USAID has helped the development of agriculture.

-As a result and recommendation, a revision of effective policies with a new framework approach, such public-private partnership, will have to be considered to reap expected benefits in terms of agricultural growth.

-The instability of land use and agricultural production is due to politic instability mainly and it is definitely an important issue that must be stabilized and prioritized.

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