Monitoring-based analysis of agriculture in Iraq

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Abstract. The paper deals with change in area and structure of Iraq agricultural lands. It revealed the main reasons for the change: crisis (war, sanctions, etc.); economic (swamp and lake drainage, melioration, etc.); weather condition. Land-use intensification as a reason for reduction of agricultural land areas was not proved. The area of cultivated lands proved to correlate significantly with the level of precipitation, wheat productivity –with the average temperature in Iraq.

1. Introduction

The agriculture lands are one of the main factors of production in all countries [1]. They have special legal status and are subjected to special protection aimed at maintaining the area, improving soil fertility [2] and supporting adequate cadastral value [3]. However, since 1985, there has been reduction of agricultural land areas in many countries regardless their natural, demographic and economic conditions [4].

The experts identify two reasons: crisis, which is conditioned by political and social-economic reforms, as well as wars, and intensification, which is connected with the development of technologies aimed at increasing crop fertility.

The aim of this work is to study the causes of change in the agriculture land areas in the Republic of Iraq. Thus, to achieve the goal the following tasks were completed:

- The change in agricultural land areas over the period of 35 years was studied;
- The main reasons for changes were revealed;
- The correlation of area, fertility, gross product of the key agricultural crops with the meteorological conditions was defined.

2. Objects and methods of research

Agricultural lands of Iraq were chosen as an object of study, since this country is agrarian, and characterized by different climatic characteristics, social-political conditions, and features of agriculture (ameliorative, bogar) [5]. The following characteristics were used as the criteria of their condition: crop yield, gross product, total area and areas for different crops (rice, watermelon, tomatoes, cucumber, grapes, dates, chickpeas, barley, wheat, corn, clover, etc.).

Iraq is located between 29°15' N. lat. and 38°15' N. lat., 38°45' and 48°45', has a total area of 438,320 km^2, is bordered by Iran in the East, Turkey in the North, Syria and Jordan in the West, Saudi Arabia and Kuwait in the South and the Persian Gulf in the South-East. The main rivers are the Tigris and the Euphrates, which are widely used for irrigation of crops (figure 1). They flow through the great Mesopotamian plain, surrounded by mountains rising 3,550 m above the sea level on the North and East, and desert areas in the South and West occupying more than 40% of the territory [6].

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Figure 1. Agricultural lands in the valley of the Tigris river on the north of Iraq (a); plantation of the date palms (photo of A Alshaibi) (b)

The climate of Iraq is mainly continental, subtropical in the North and mediterranean in the North-East. The average temperature in winter is + 16°C during daytime and 2°C at night; in summer, the daytime temperature is 43°C and 26°C at the night. Rainfalls are very unevenly distributed over the country, as well as over the years (figure 2) and seasons: in most regions – mainly in winter months, in the mountains - from November to April; from < 100 mm in the South and South-West to 1000 mm per year in the North and North-East. Significant differences in the amount and distribution of rainfalls increase the risk in rain-fed agriculture [6]. Values of precipitations and annual temperatures in the period from 1980 to 2011 are shown in the figure 1.

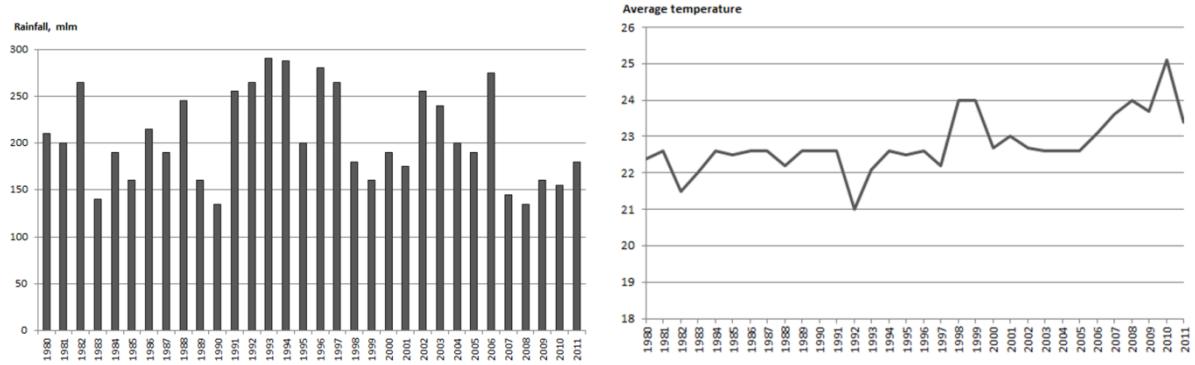

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Figure 2. Values of precipitations (a, mm) and annual temperatures (b, ^{o}C)

Agricultural lands occupy about 20% of total land surface in Iraq. About half of them are located in the North-Eastern plains and mountain valleys with sufficient rainfalls. The other part of the lands occupies the valleys of the Tigris and Euphrates rivers. Due to scarce rainfalls, the rivers supply water to irrigate fields with crops wheat and barley in winter and rice, corn, dates, cotton, vegetables and fruits in summer (figure 2). Alfalfa and other legumes are grown for cattle [7]. The list of crops with

low harvest area consists of cotton (seeds), okra, clover, fresh vegetables, legumes, apples, potatoes, beans, onions, grapes, peas, pumpkin, and sesame seeds.

Cultivation of drought-resistant technical fodder and grain crops on bogar (using moisture of spring rains in the areas inconvenient in terms of irrigation) is widespread In Iraq. Changes in water availability, installation of drainage systems and reclamation of saline lands, the introduction of new varieties of crops, scientific advances in agronomic practices and other agricultural technologies also influence the efficiency of agricultural production.

To solve the tasks, the abstract-logical, monographic and correlation methods were used.

3. Results and discussion

Analysis of statistical data showed that the area of cultivated land in Iraq experiences significant changes [7, 8]; for example, the cultivated area reduced fourfold during the period 1993-2000 (figure 3a). The ratio of cultivated areas for summer crops also changed (figure 3b). The period 1990-2010 is characterized by the following changes: the reduction in the areas of land occupied by rice crops and the growth of the areas occupied by corn and figs (the main export crop).

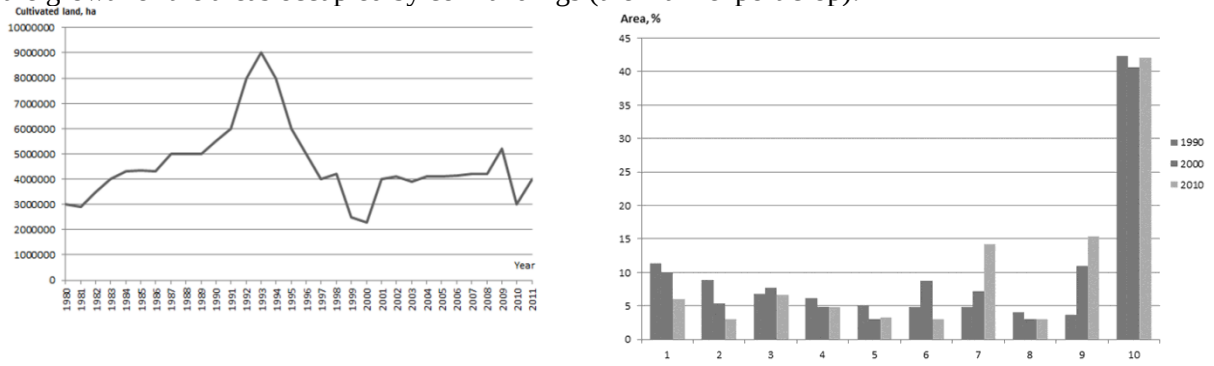

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Figure 3. Change of areas of cultivated lands (a) and percent ratio of summer crops areas in 1990, 2000 and 2010 (b). Descriptions: 1 – rice, 2 – watermelon, 3 tomatoes, 4 cucumbers, 5 – grape, 6 – nut, 7 – corn, 8 – clover for silage, 9 – dates, 10 – other cultures

It is notable that a steady rise of cropland area began in the early 80s, then, there was a sharp increase in cultivated areas in the early 90s followed by a sharp fall after 2003. In our opinion the reason for these changes is the implementation of large-scale governmental ameliorative projects aimed at draining wetlands and lakes and using new areas for agriculture. These projects were supported by income from petroleum export (the early 80s). In response to Iraq's invasion of Kuwait in 1990 the United States and other countries launched a military operation, which resulted in destruction of dams, power stations, irrigational facilities and pump stations. The economic sanctions against Iraq made the situation worse, destroying the life support system of the country. To prevent hunger, the population used actively all available land resources for growing crops. After the Iraq war (2003) the labor resources migrated to the cities, agricultural production decreased almost twice, and the cultivated areas decreased [9].

Moreover, winters were dry from 2004 to 2010 [9], which along with the destroyed ameliorative systems had negative impact on the effectiveness of agricultural production. We studied the correlation of agricultural land areas, general product and productivity of rice barley and wheat with temperature and rainfalls. The authors revealed that the areas of cultivated lands have significant correlation with the level of precipitation (significance level is 0.05, correlation coefficient is 0.45), which may be explained by the use of naturally wet areas for rice growing; the increase in rice production is also registered in the years rich in rainfalls. The significant correlation of wheat productivity with the average temperature in Iraq was identified (significance level is 0.05, correlation coefficient is 0.42). The same correlation for rice and barley was not identified. Figure 4 shows a chart of wheat productivity change over 30 years [7].

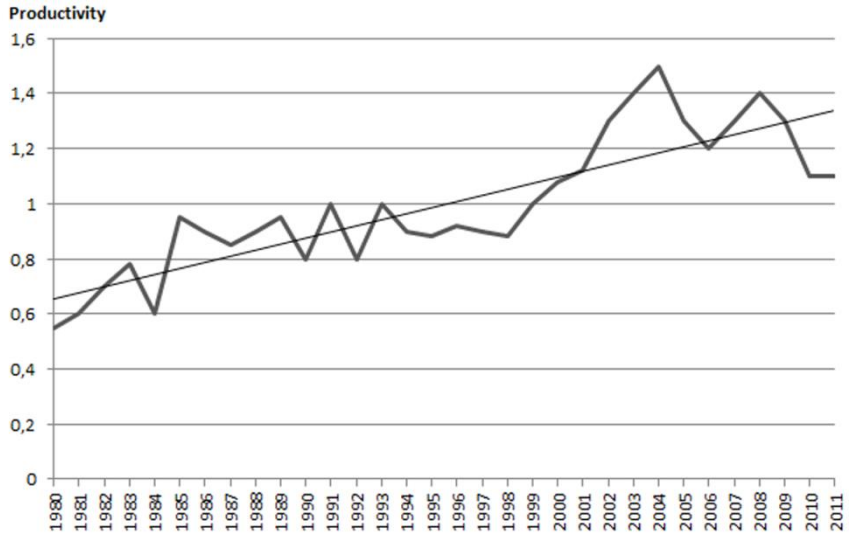

Figure 4. Productivity of wheat (tons/year)

4. Conclusion

The research resulted in the following conclusion:

1. Significant changes in areas and structure of agricultural lands in Iraq are conditioned by crisis (wars, sanctions etc.); economics – implementation of large-scale governmental projects (drainage of the wetlands and lakes, amelioration etc.); and weather conditions. Land-use intensification as a reason for reduction of agricultural land areas was not proved.

2. The area of cultivated lands has great correlation with level of precipitation (significance level 0.05, correlation coefficient 0.45) which may be explained by the use of additional naturally wet areas for rice growing. The wheat productivity, a drought-resistant plant, is correlated with the average temperature in Iraq (significance level 0.05, correlation coefficient 0.42).

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