Iraq Salinity Project **Technical Report 8**

Report B2.1 Historical agricultural production data in Iraq

Reporters:

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With contributions of component B members

The Iraq Salinity Project is an initiative of Government of Iraq, Ministries of Agriculture, Water Resources, Higher Education, Environment, and Science and Technology, and an international research team led by ICARDA – the International Center for Agricultural Research in the Dry Areas, in partnership with the University of Western Australia, the Commonwealth Scientific and Industrial Research organization (CSIRO) of Australia, the International Water Management Institute (IWMI), Sri Lanka, and the International Center for Biosaline Agriculture (ICBA), Dubai, United Arab Emirates.

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This technical report series captures and documents the work in progress of the Iraq Salinity Project, in its seven research themes, working at the regional, farm and irrigation system scales. Technical reports feed into the *Iraq Salinity Assessment*, a synthesis and solutions to solving the problem: Situation Analysis (Report 1); Approaches and Solutions (Report 2) and Investment Options (Report 2).

Key words: southern Iraq, central Iraq, spatial distribution, remote sensing, irrigation, salinity mapping.

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With contributions of
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This report is part of a series analyzing historic and current agricultural production in Iraq. The aim of this analysis is to identify the areas in the Mesopotamian plain where changes in agricultural production have occurred, either through rising water and soil salinity, or due to a reduced availability of (irrigation) water.

Report B2.1 uses databases with historical crop production data and analyzes agricultural production data for the Mesopotamian plain, separately from the Iraqi national production data.

1. Introduction

Agricultural production in Iraq is divided into rain fed agriculture, mainly in the North of the country, and irrigated agriculture, mainly in the Mesopotamian plain centered around the Tigris and Euphrates rivers. The most important rain fed crops in the North are wheat and barley, both grown during the winter months, accounting for 1/3rd of the nation's cereal production (FAS website, 2003). The same winter crops are grown in the irrigated Mesopotamian plain. Main irrigated summer crops are rice, corn, dates, cotton, vegetables and fruits (FAS website, 2003). Forage crops like alfalfa and other legumes are grown for livestock in addition to barley.

Iraqi agricultural production has been affected by several socio-economic and political events in the last century. At the same time, variations in water availability, installation of drainage systems and reclamation of saline lands, as well as the introduction of new crop varieties, advances in agronomic practices and other agricultural technologies affect the ability to produce. This report reviews the historical trends in Iraqi agriculture, with special emphasis on the irrigated agriculture in the Mesopotamian plain.

2. Method

Data sources used are the USDA-PSD database, the FAO FAOSTAT database, and data provided from the ministry of Agriculture, Iraq.

USDA – Production, Supply and Distribution Database
The agricultural production data for Iraq can be extracted from an on-line database maintained by the United States Department of Agriculture. A summary of results for Iraq agricultural production is reported here. The extraction of data focuses on harvested area, yield, productivity (yield per harvested area) and the contribution to forages for a specific crop. The data are obtained from several sources, as described on the website:

The international portion of the data is updated with input from agricultural attachés stationed at U.S. embassies around the world, Foreign Agricultural Service (FAS) commodity analysts, and country and commodity analysts with Economic Research Service (ERS). The U.S. domestic component is updated with input from analysts in FAS, ERS, the National Agricultural Statistical Service, and FSA. Interagency work on the database is carried out under the aegis of the WAOB.

FAOSTAT

The UN-Food and Agricultural Organization (FAO) has been collecting cropping data worldwide and publishes these data from the FAOSTAT database. Data are obtained from member states through the national statistical offices.

Ministry of Agriculture, Government of Iraq

The Ministry of Agriculture in Iraq collects data on cropping systems in Iraq. These data have been obtained through the interaction within the current Iraq salinity management project.

3. Agriculture at the national level

Based on the available reports from the databases described above, three major classes can be distinguished: Total area of cultivated winter cereals, total area of irrigated winter cereals (an extraction of the previous data set, indicating the area of winter cereals that is relying on irrigation water) and summer crops, indicating the irrigated summer area. Figure 1 shows the variations of each class between the years 1960 and 2010. Note that the three databases report different values (comparison between the reports is made later in the chapter). This results in an artifact that shows a larger irrigated area than total cultivated area for winter cereals in 1971.

From 1980 to 2005, the irrigated winter cereal area compares well with the total irrigated summer crop area (except 1992-1993, when winter cereal area is larger than the irrigated summer crop area). After 2005, the irrigated summer area is smaller than the irrigated winter cereal area.

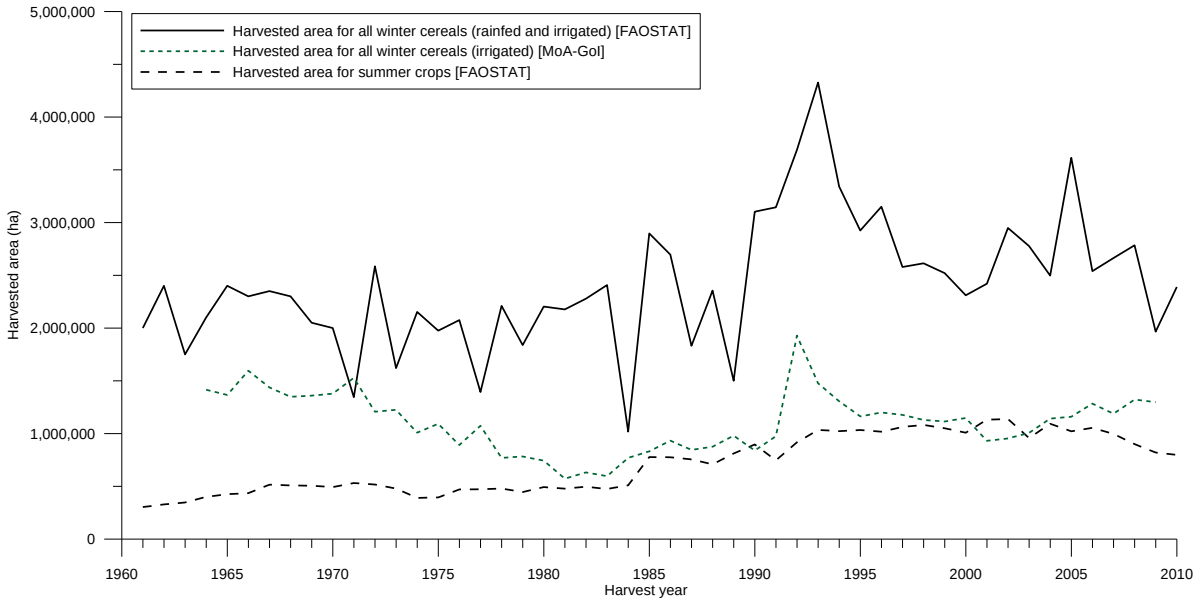

Figure 1: Harvested area for winter and summer crops in Iraq (irrigated and non-irrigated areas) [based on FAOSTAT extracted data] and irrigated winter cereals [based on data provided by MoA-GoI].

Note that from 1985, the FAOSTAT database reports on more crops than before, including dates and oranges. This explains the sudden increase in reported summer area, and is an artifact of available data instead of a sudden increase in agricultural area.

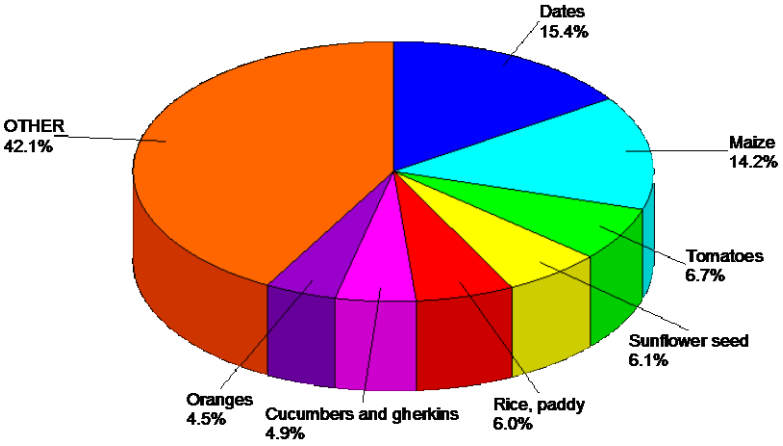

Figure 2: Summer crops covering more than 4% of the area harvested in 2010 [based on FAOSTAT extracted data]

Figure 2 shows the percentages of harvested crop area in summer 2010 as obtained from the FAOSTAT data set. Harvested crop area is an indication of the type of crops that can be identified using remote sensing (more so than crop production). The total harvested area in the summer of 2010, according to the FAOSTAT database, was 798,000 ha.

The group labeled "Other" in Figure 2 contains all crops covering less than 3% of the total cultivated area in the summer. This group includes watermelon (2.6%), seed cotton (2.6%), okra (2.4%), clover for forage (2.3%), fresh vegetables (2.3%), leguminous vegetables (2.2%) and eggplant (2.1%). In the list of crops with less than 2% of the total harvested area in the summer are apples, potatoes, string beans, dry onions, grapes, chick peas, pumpkins and sesame seed. Other crops cover less than 1% each of the total harvested area.

Note that the percentage of tomatoes, sunflower seed, cucumbers and gherkins and oranges are higher than expected, and that cotton covers only 2.6% (less than expected) of the total harvested land in summer 2010.

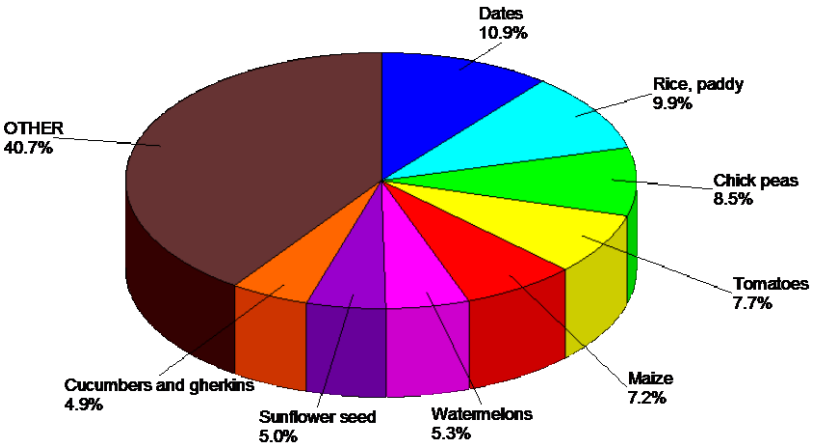

Figure 3: Crops covering more than 4% of the area harvested in 2000 [based on FAOSTAT extracted data]

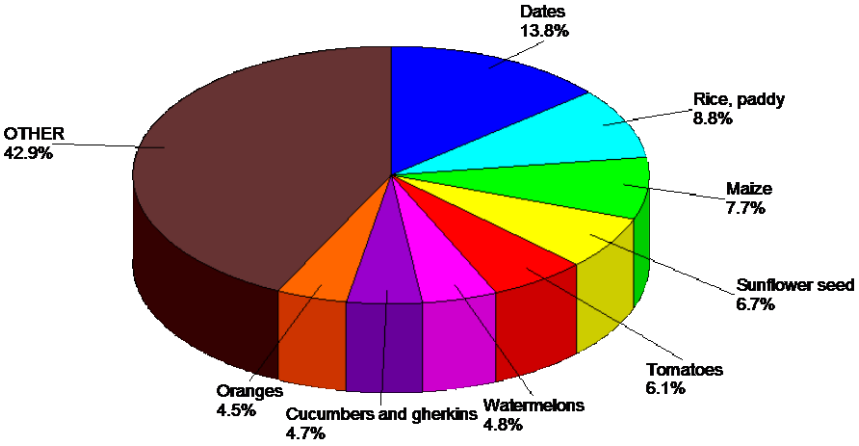

Figure 4: Crops covering more than 4% of the area harvested in 1990 [based on FAOSTAT extracted data]

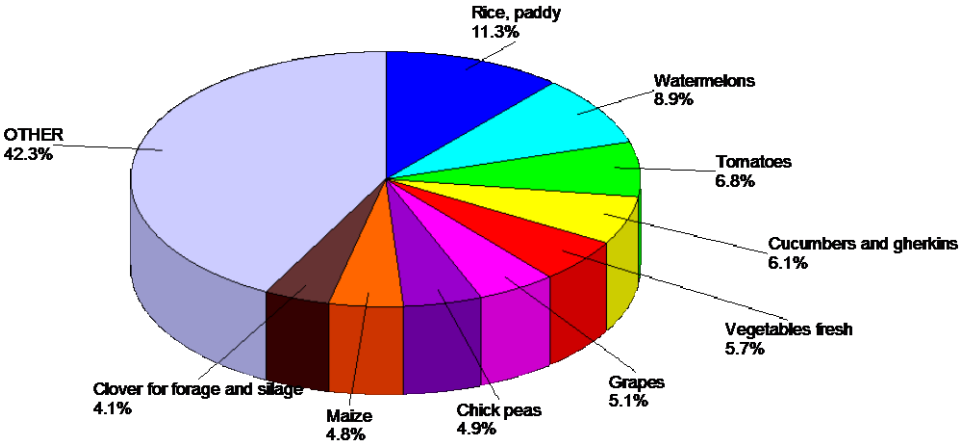

Figure 5: Crops covering more than 4% of the area harvested in 1980 [based on FAOSTAT extracted data]

Note that date and orange production area is not reported in the FAOSTAT database in 1980. The percentages shown in Figure 5 are based on only reported statistics, and are not fully comparable with previous figures. It is likely that dates would have grown on a similar area as in following years (10-15% of the total harvested area). This would reduce the reported percentages for the crops listed in Figure 5.

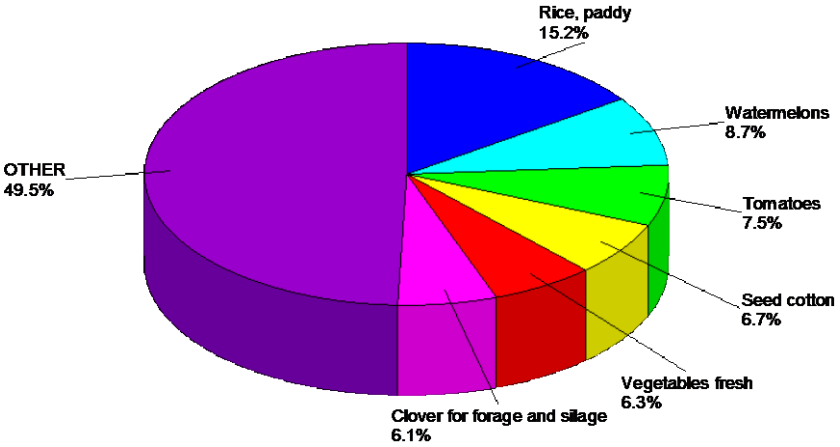

Figure 6: Crops covering more than 4% of the area harvested in 1970 [based on FAOSTAT extracted data]

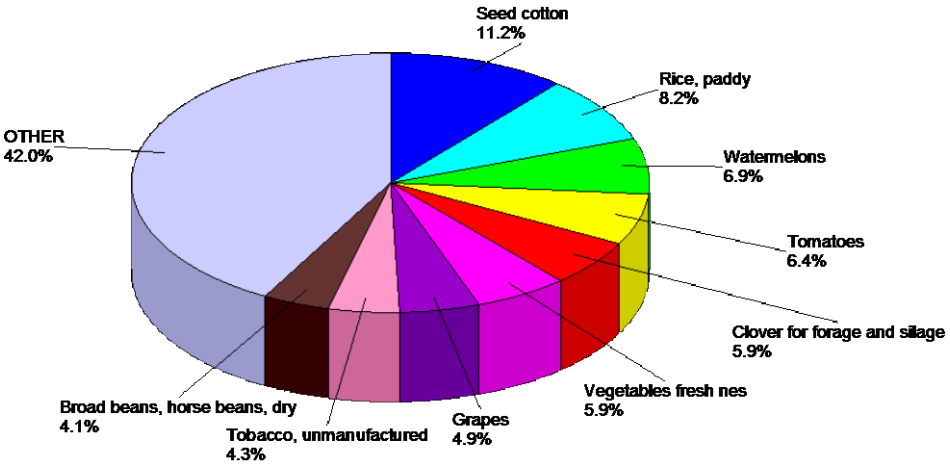

Figure 7: Crops covering more than 4% of the area harvested in 1961 [based on FAOSTAT extracted data]

The list of crops in the past 5 decennia shows cotton only twice as an important crop (based on area harvested), namely in 1961 and 1970 (Figure 7 and Figure 6). From the 1980's onward it is not occupying more than 4% of total harvested area, according to the FAOSTAT database.

Chickpeas are mentioned in the list. Part of the chickpea cultivation is as a rain fed winter crop in the Northern provinces. It may not be part of the summer crop in the irrigated areas.

4. Winter crops

4.1 Wheat

The growing season for wheat in Iraq is commonly between October-November and March-April. Remote sensing images for February-March should show the crop at its maximum NDVI.

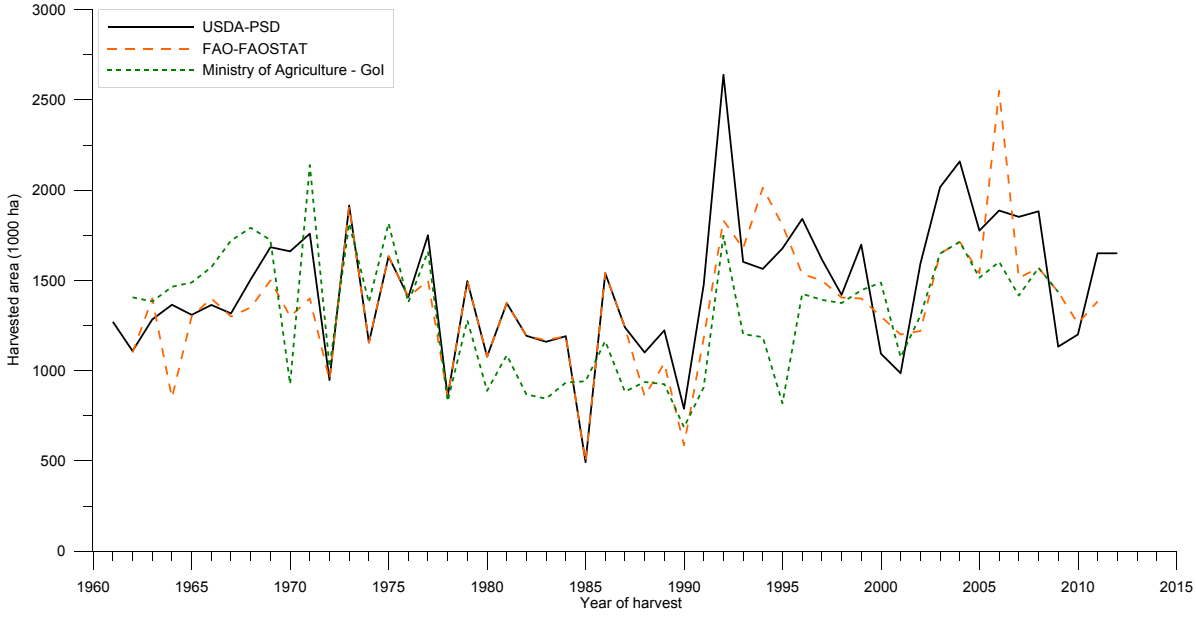

Figure 8: Harvested area for wheat (rain fed and irrigated) based on USDA-PSD and FAOSTAT extracted data, and MoA-GoI provided data.

Figure 8 shows the total harvested area of wheat over the past 50 years. Three data sets were used, and each shows similar trends. An estimate of the separation of

irrigated area and rain fed area was made by Bishay (2003), assuming that the three Northern governorates (Ninewa, Dahuk and Erbil) are mainly rainfed wheat. Taking the 14-year average cropped area, a total area of 1,417,000 ha of wheat was grown, of which 469,000 ha in the Northern governorates. This would indicate that at least 33% of the wheat area is rain fed, and thus it is likely that 67% of the wheat is at least partially irrigated. For 2011, this would indicate an area of 1.1 million ha of irrigated wheat, of which a majority would be grown in the Mesopotamian plain.

Data provided by the Ministry of Agriculture, GoI show that the average contribution of the rain fed cultivated area to the overall area has a 49% average over the past 20 years. The most recent year (2008) shows a 41% contribution of rain fed agriculture to the overall cultivated area (Table 1). The total area of wheat in irrigated conditions is given as 852,000 ha in 2008.

Table 1: Cultivated wheat per governorate based on MoA-GoI supplied data

Region	1962	1980	2008
Total wheat grown area	1,406,090	1,085,675	1,435,291
Northern rain fed	860,888 (61%)	848,675 (78%)	583,167 (41%)
- Niniwa	618,800	727,200	411,290
- Kirkuk	242,088	121,475	171,877
Central irrigated	438,177 (31%)	191,300 (18%)	518,379 (36%)
- Salan Al Din	0	65,525	77,226
- Anbar	43,500	8,575	53,466
- Baghdad	142,700	5,650	61,607
- Diyala	115,891	58,175	86,107
- Karbala	3,093	100	2,618
- Babil	23,263	15,775	74,914
- Wasit	109,730	37,500	162,442
Southern irrigated	107,025 (8%)	45,700 (4%)	333,745 (23%)
- Qadissiya	4,936	15,275	109,238
- Najaf	0	150	48,768
- Missan	30,930	10,000	82,332
- Muthana	15,640	4,975	12,644
- Thi-Qar	53,580	14,100	63,907
- Basrah	1,939	1,200	16,856

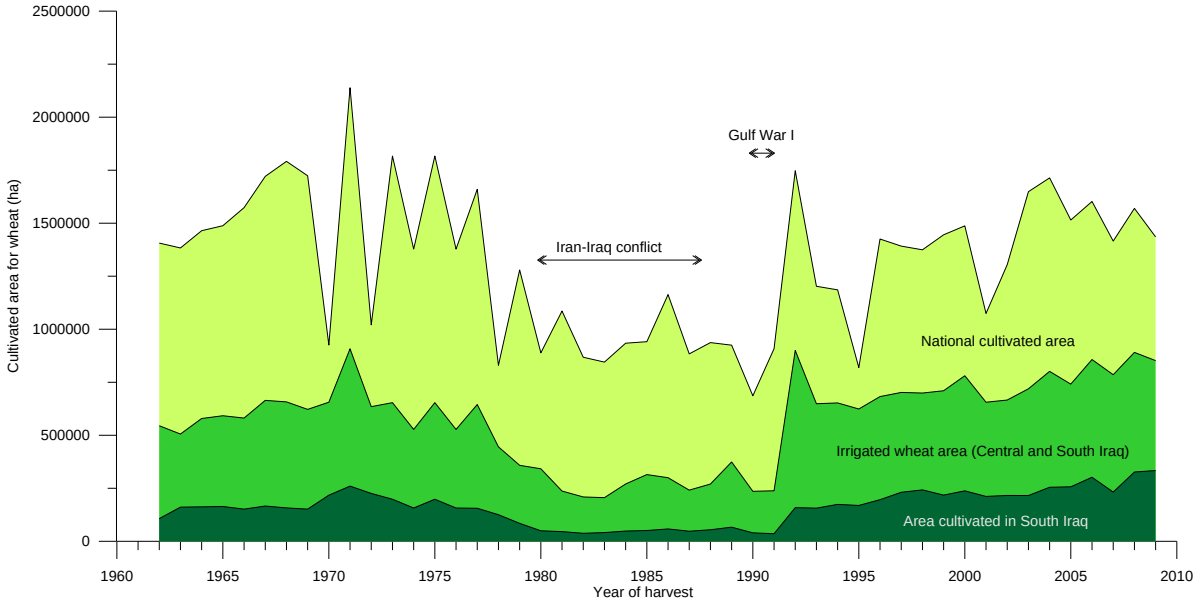

Figure 9: Harvested area for wheat based on MoA-GoI provided data.

Figure 9 shows the harvested wheat areas for different regions within Iraq. From 1992 the irrigated wheat in the south of Iraq has slowly increased, while the area in central Iraq has remained constant. Rain fed wheat fluctuates, most likely based on the amount of rain available during the season.

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. The period from 1980 to 1988 shows a decrease of wheat grown, most significant in the irrigated areas. This is likely due to the international conflict between Iran and Iraq, which for large part took place around the borders on the east side of the Mesopotamian plain. A smaller available labor force for the irrigated agriculture may have affected the area of wheat cultivated and harvested.

With the exception of the period between 1980 and 1990, the area under irrigated wheat has steadily expanded, largely due to increases in the southern irrigated parts in the Mesopotamian plain.

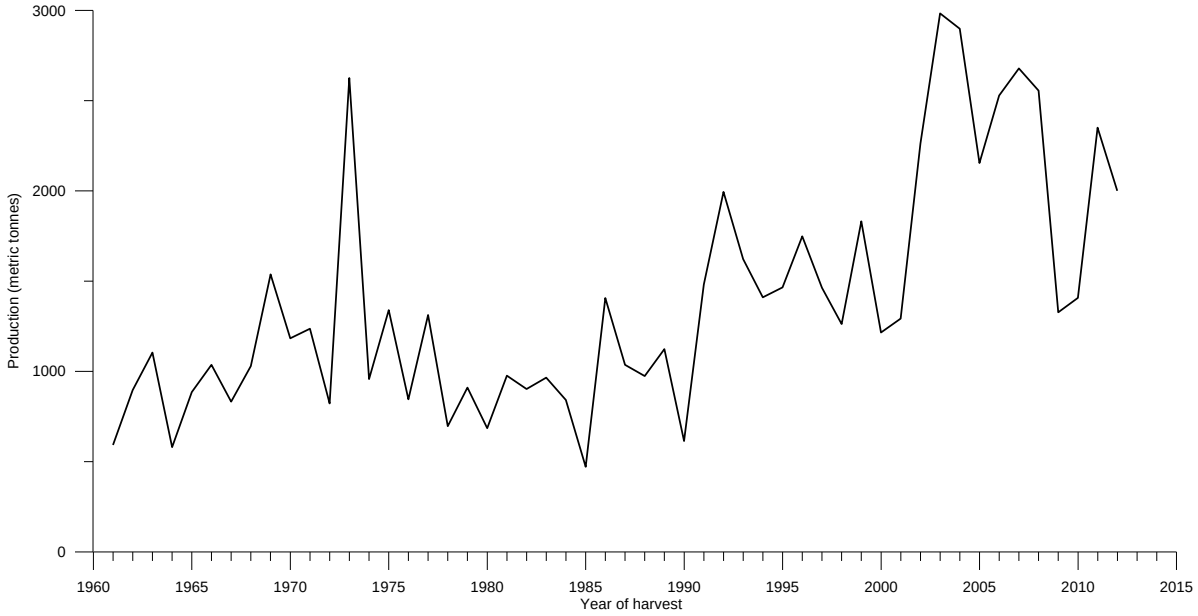

Figure 10: Production of wheat (rain fed and irrigated) in Iraq [from USDA-PSD]

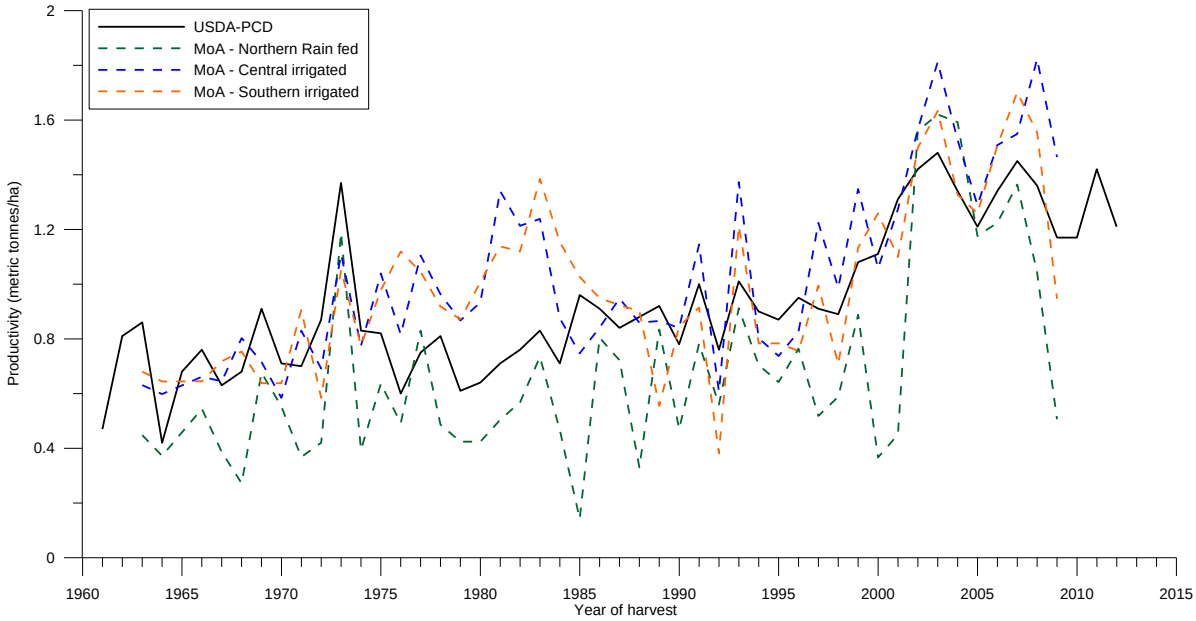

Figure 11: Productivity of wheat in Iraq.

Figure 10 shows an increase of wheat production over time, with a high variability from year to year. The variability is likely due to variable climatic growing conditions in the rainfed areas. The average productivity of wheat (Figure 11: USDA-PCD) also rises steadily, and fluctuates in the last 10 years between 1.2 and 1.5 ton/ha. This compares to wheat productivity of 0.9-2.1 ton/ha in Australia, 2.7-3.9 ton/ha in Italy, 5.6-6.6 ton/ha in Egypt and 1.6-2.3 ton/ha in the Russian Federation.

The data provided by the Ministry of Agriculture allow a separate analysis for the rainfed and irrigated wheat. The Northern area has a lower productivity of wheat per hectare than the irrigated areas in Central and South Iraq.

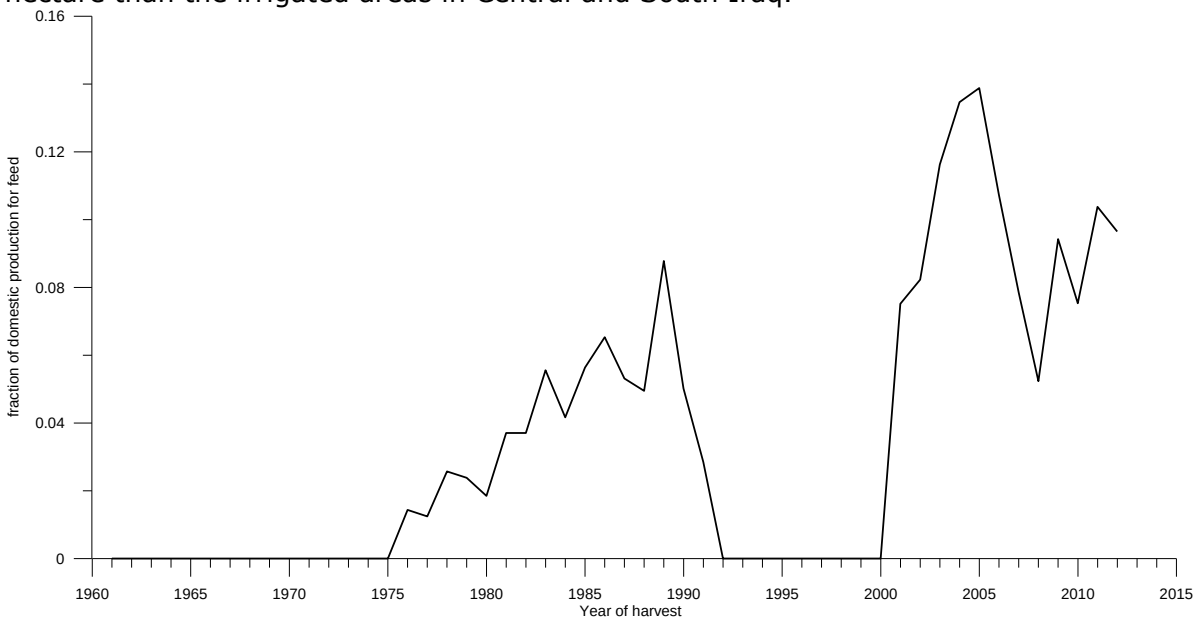

Figure 12: Ratio of wheat used for fodder in Iraq [from USDA-PSD]

Most of the wheat grown in Iraq is used for human consumption. However, data from the USDA-PSD indicate that in recent years wheat is used more for fodder than before. Figure 12 shows an increasing trend starting in 1975, with a drop in the years of low wheat production, rising again from 2000 onwards to 6-14% of total production used as fodder.

4.2 Barley

The growing season for barley is similar as wheat in Iraq and is commonly grown between October-November and March-April. Remote sensing images for February-March should show the crop at its maximum NDVI. Note that, since most barley is used as fodder, barley is commonly harvested before full grain production. This allows earlier harvesting than wheat, which could be used to distinguish barley from wheat in remote sensing analysis.

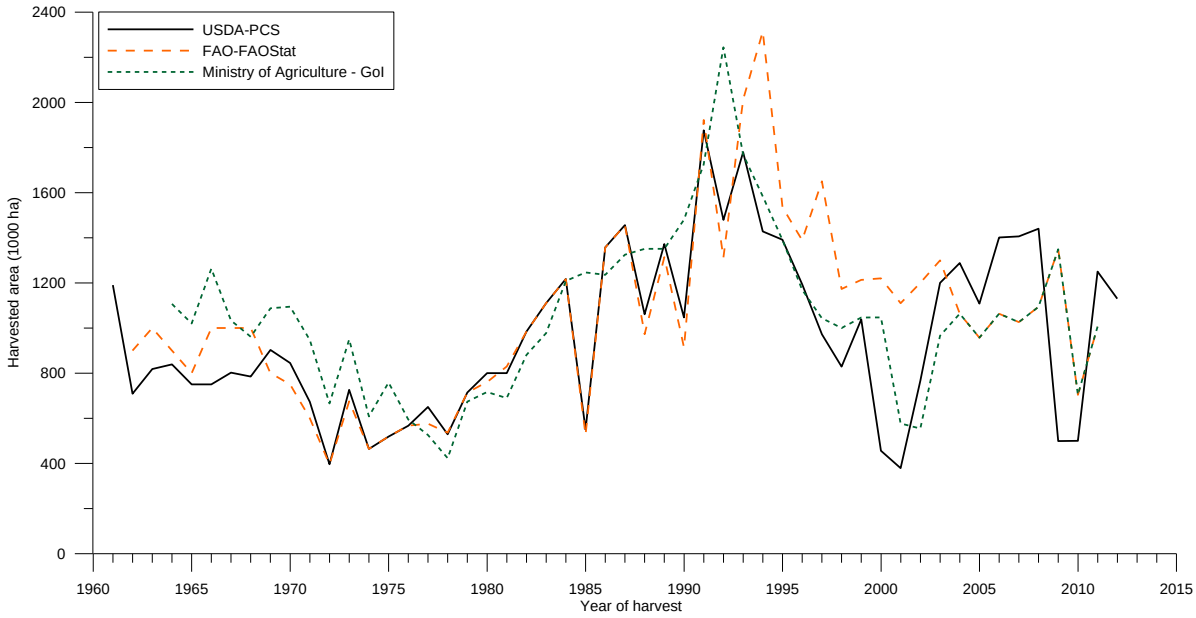

Figure 13: Harvested area for barley (rain fed and irrigated) based on USDA-PSD and FAOSTAT extracted data, and MoA-GoI provided data.

The total area of barley harvested in Iraq in the past 50 years is shown in Figure 13. The data show a constant increase in harvested area from 1979 to mid-1990. The harvested area then dropped off to levels comparable to the 1960-1970 era (based on MoA dataset). The drop of harvested area between 1980-1990 that was clearly present in the wheat dataset is not visible in the data for barley. This may be related to barley being a fodder crop, thus cultivation and harvest time is less critical than a crop grown for cereal production for human consumption.

Note that the FAO dataset corresponds fully with the Ministry of Agriculture dataset from harvest year 2004 until the latest available data.

Wheat harvested area for the same time period fluctuates mainly between 1,000,000 and 2,000,000 ha, while barley harvested area fluctuates between 400,000 and 2,200,000 ha.

Similar to the analysis for wheat, the production of barley can be separated into three regions; Northern, Central and Southern Iraq. It can be assumed that production in Central and Southern Iraq are irrigated crops (due to low rainfall), while most of the production in Northern Iraq will be mainly based on rainfall. Figure 14 shows that the largest year-to-year variation in production is occurring in the northern governorates, likely related to variations in rainfall. The harvested area of barley in central Iraq has been steadily decreasing (the thickness of the middle green band). Wheat production in central Iraq remained constant for the past 20 years (Figure 9), indicating and overall reduction in cultivated land in the winter in Central Iraq. While wheat cultivation

increases in Southern Iraq, the barley cultivated area does not appear to expand largely in the past 20 years. The largest growth in barley cultivated area can be found in the period 1980-1990 in the northern governorates.

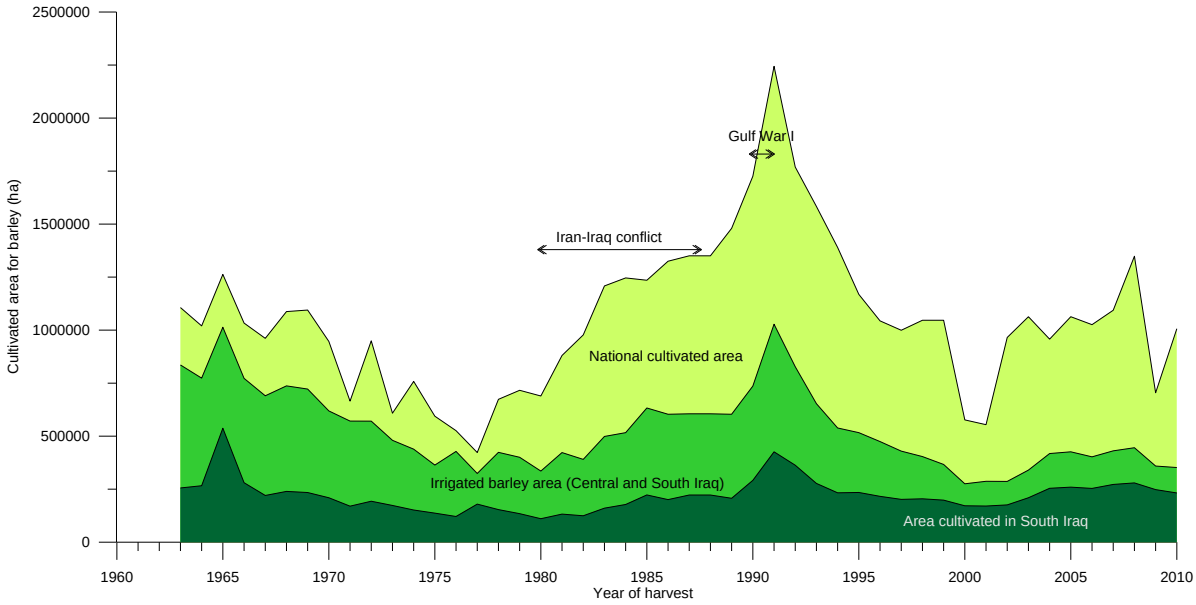

Figure 14: Harvested area for barley based on MoA-GoI provided data.

The average percentage of total irrigated barley cultivated area remains steady at 60% of the total cultivated barley area in the years 1990-2010.

The production of barley (Figure 15) shows large fluctuations over time, most likely related to water availability. The productivity of barley (Figure 16) appears to have a downward trend, possibly due to a decrease of land suitability or the selection of less suitable areas for barley (more soil salinity)

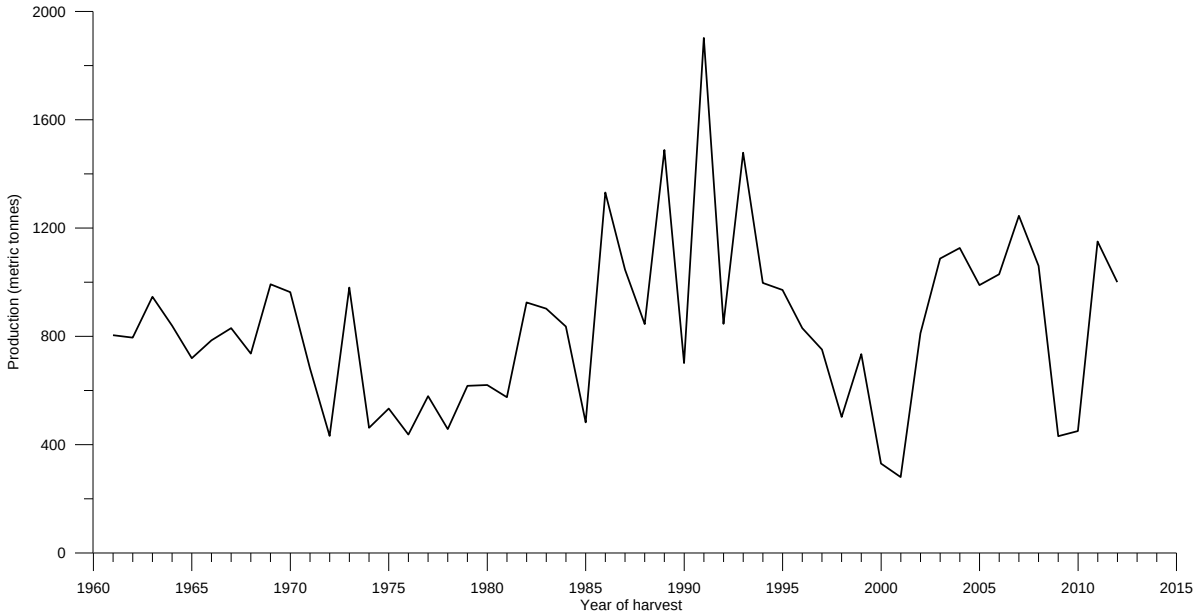

Figure 15: Production of barley in Iraq.

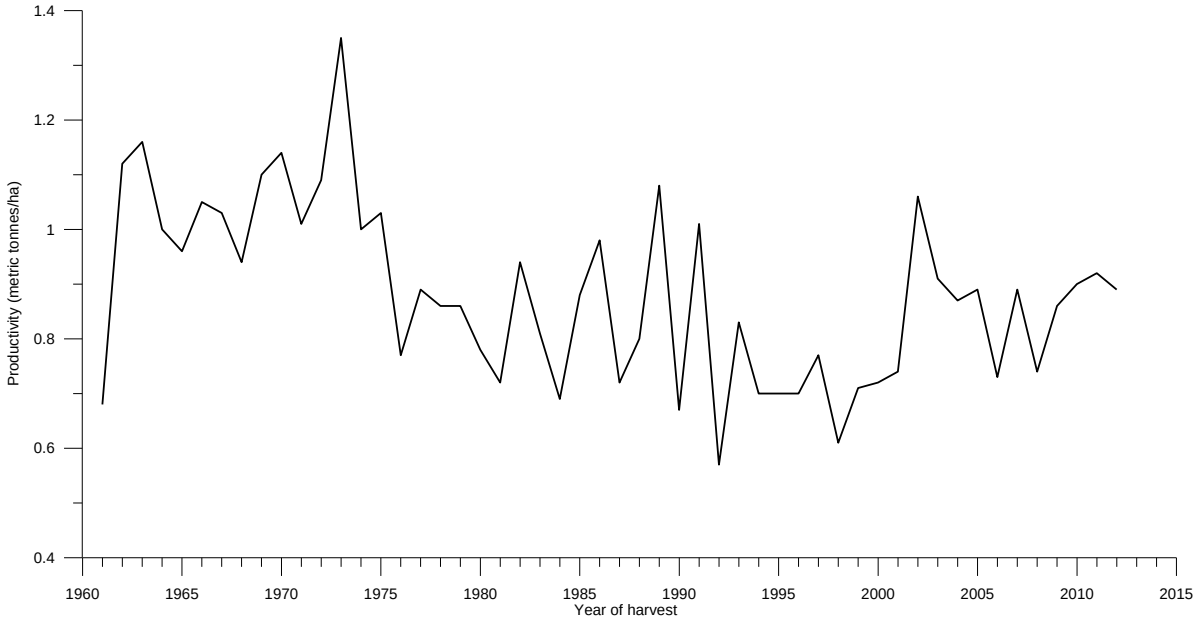

Figure 16: Productivity of barley in Iraq

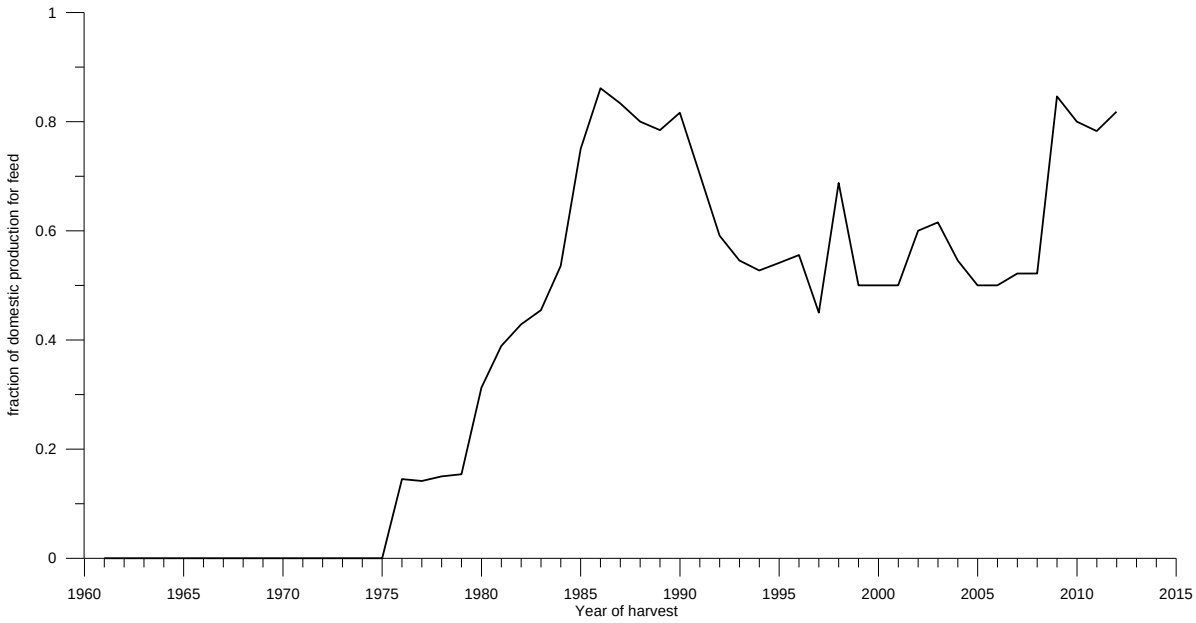

Figure 17: Ratio of barley used for fodder in Iraq [from USDA-PSD]

Where the ratio of wheat production used for fodder is low in Iraq, the ratio of barley used for fodder is high. Figure 17 shows the variation of the barley ratio used for fodder, indicating that since 1985 this is always more than 60%. Since 2010 the percentage of barley used for fodder has been over 80%.

4.3 Winter cereals

The total harvested area for cereals (wheat and barley) for Iraq for the three data sources used is shown in Figure 18. The total area is presented as a data check, and to identify the total arable non-covered agricultural land area, using the knowledge that wheat and barley are the main two winter crops in Iraq.

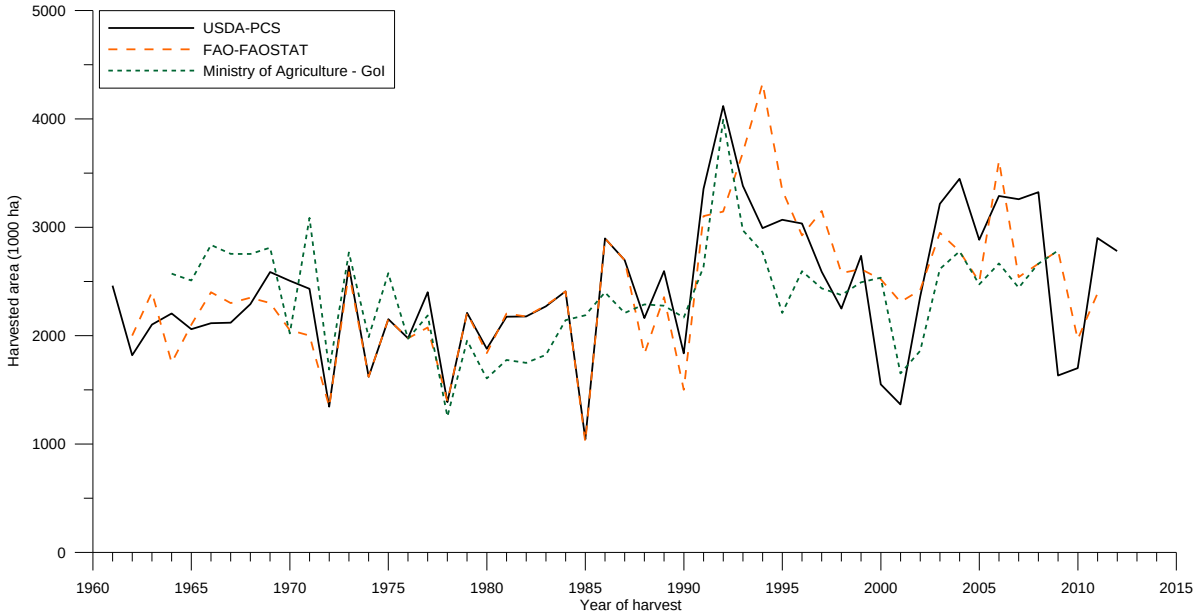

Figure 18: Total harvested area of winter cereals in Iraq.

From 1960-1990, the harvested area varies most years between 2 and 3 million ha, with three years (using USDA-PCS data) between 1 and 1.5 million ha. After 1990, some years show values up to 4 million ha, while several years have areas harvested in the range of 2.5 - 3 million ha.

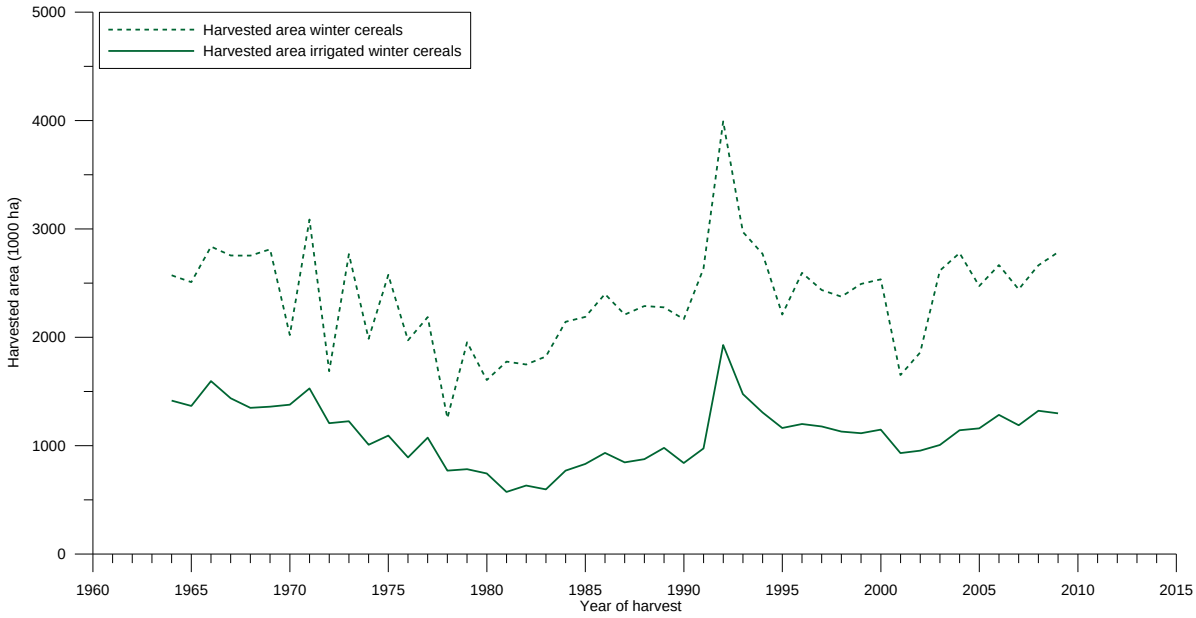

Figure 19: Total harvested area and total irrigated harvested area of winter cereals in Iraq [based on MoA-GoI data]

A separation of irrigated and rain dependent winter cereals shows that from 1965 to 1982 a constant decline of winter cereals can be observed. From 1982 to 2009, a constant increase of irrigated winter cereals can be seen, with a peak in 1992. Total irrigated cereal area in 2009 is similar to areas grown under winter cereals in 1970, and reaches 1.3 million ha.

5. Summer crops

It can be assumed that summer crops are irrigated, as atmospheric water demand for cultivated crops exceeds the available rainfall during the summer. Most of the summer crop areas will therefore be cultivated in central and southern Iraq. A selected number of crops will be discussed in this chapter, based on the size of the cultivated areas (Figure 2), and crops of major importance in the past. Only data from USDA and FAO are available for the analysis of summer crops.

5.1 Dates

Reporting for the harvested area of dates has started in 1985. Before 1985 dates were grown commercially, but earlier data are not available in the FAOSTAT database. No other data sources report on the cultivated area of dates. Production data are available from 1961 onwards in the FAOSTAT database.

Date palms will show up in remote sensing images are year-round green areas. Most of the date production appears to occur close to the Euphrates and Tigris river. In southern Iraq, several palm plantations used to be irrigated using tidal irrigation (using the rising tide of the Gulf to increase the level of river water near the mouth to let water enter the high density open irrigation channels and provide water to the plantation). Harvest period is around the end of July until early August.

A New York Times article (Williams, 2009) 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 (based on numbers from the Ministry of Agriculture, GoI). It continues with the statement that a normal year production per tree varies between 65 and 80 kg, while the production per tree for an interviewed farmer varied between 15-45 kg in 2008-2009. Reasons for the lower production and productivity of date trees are given as a drought in 2008-2009, increase in diseases and pests, a lack of insecticides and fungicide application methods (few crop dusters) and an increase of salinity of the irrigation water.

The FAOSTAT data on harvested area (Figure 20) shows a large drop in area from 1997 to 2000, with a large drop in 2005. Areas of harvested dates appear to be rising in 2009-2010.

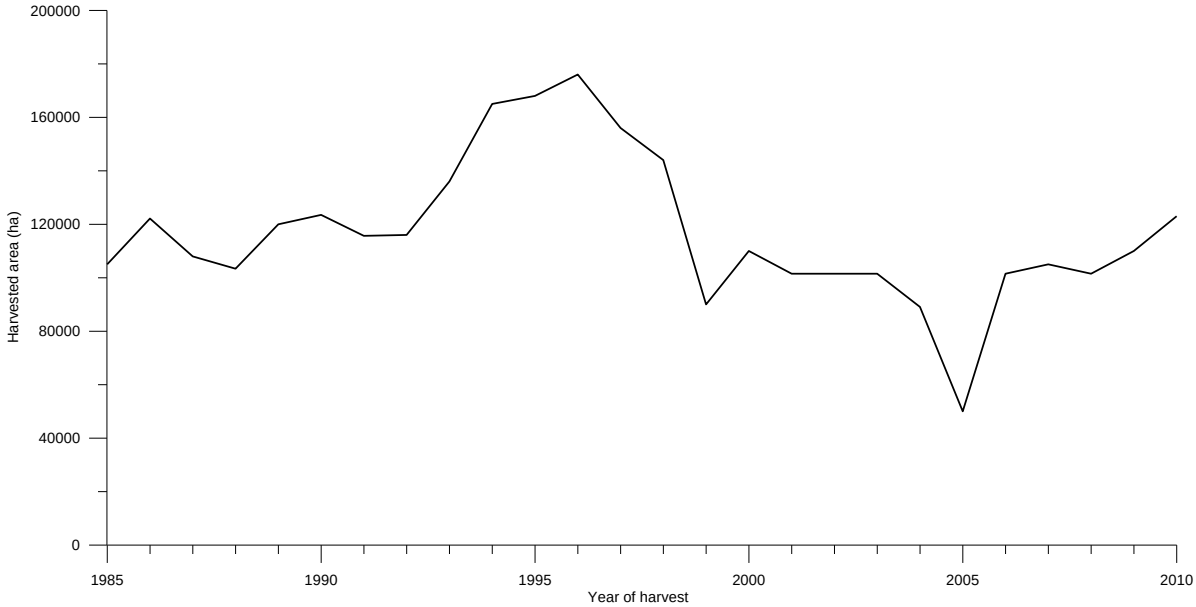

Figure 20: Cultivated area of dates in Iraq [based on FAO-FAOSTAT data].

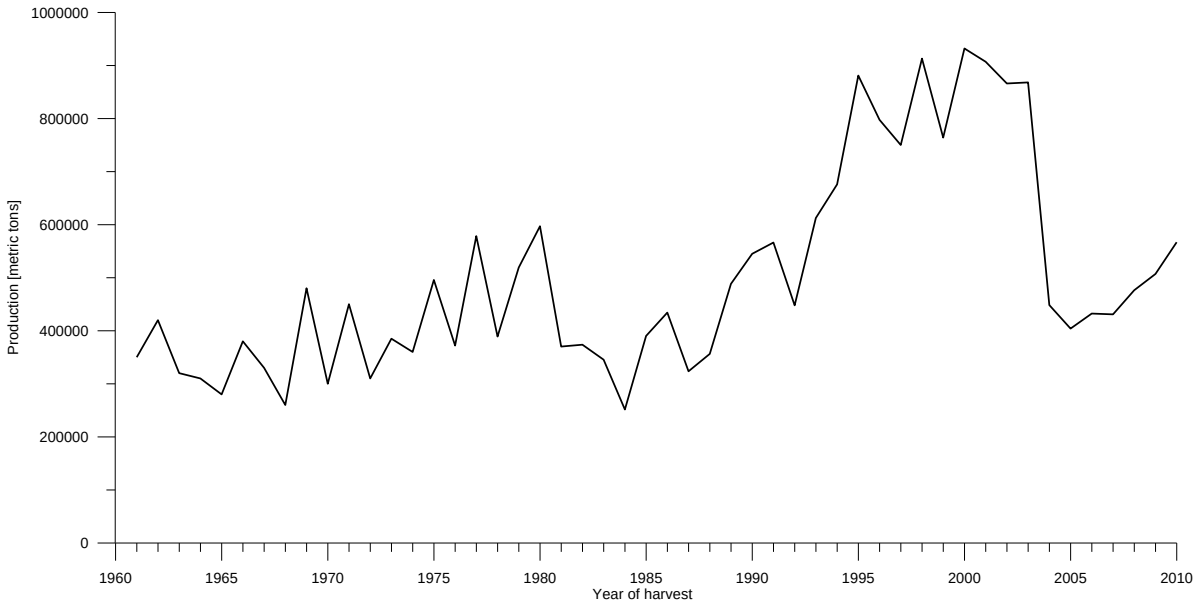

Figure 21: Date production in Iraq [based on FAO-FAOSTAT data]

The production of dates (Figure 21) shows a large increase between 1994 and 2003, with a large decrease (more than 50%) after 2003. The levels of 400,000 metric tons after 2003 are comparable with production levels before 1994. The large peak of production between 1994 and 2003 corresponds with an increase in harvested area (Figure 20).

Productivity per hectare (Figure 22) increased twofold in 1998-2003, possibly the result of increased inputs in date plantations. This period of increased productivity corresponds with a high production period, but lower values of "harvested area" reported in the database.

The production data for 2008 quoted by Williams (2009) are lower than the reported values in FAOSTAT. However, trends reported in the newspaper article can be found in the data: a decrease in productivity in recent years compared with the period 1994-2003, a decrease in harvested area, and a decrease in overall production.

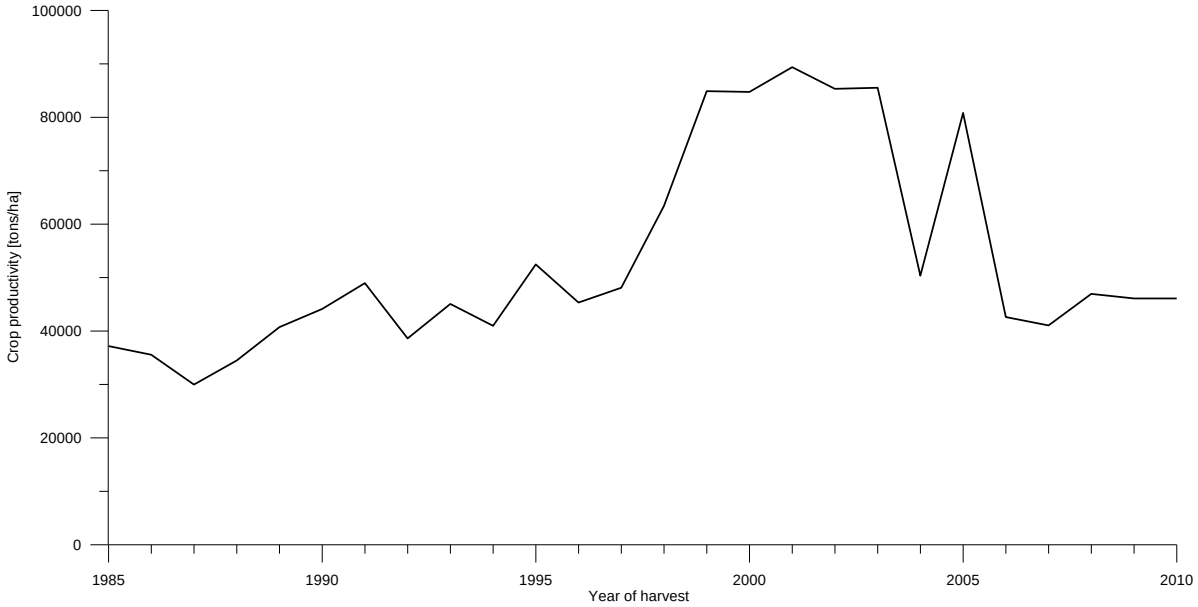

Figure 22: Productivity (tons/ha) for dates in Iraq [based on FAO-FAOSTAT data]

5.2 Maize

Maize is a C4-crop, and produces more biomass with less water than C3 crops. Usually, reflections from maize crops using remote sensing techniques are brighter than C3 crops. Maize is grown from early summer to autumn, with the harvest usually in October.

A report from USAID (http://reliefweb.int/node/432091) identifies difficulties with current varieties of maize and agricultural practices that limit the maize production. One of the activities employed by USAID is to introduce new hybrid maize varieties apparently producing 30% more yield than traditional Iraqi grown species.
One of the uses of maize in Iraq is identified as the poultry industry, apparently currently relying on imported wheat and maize.

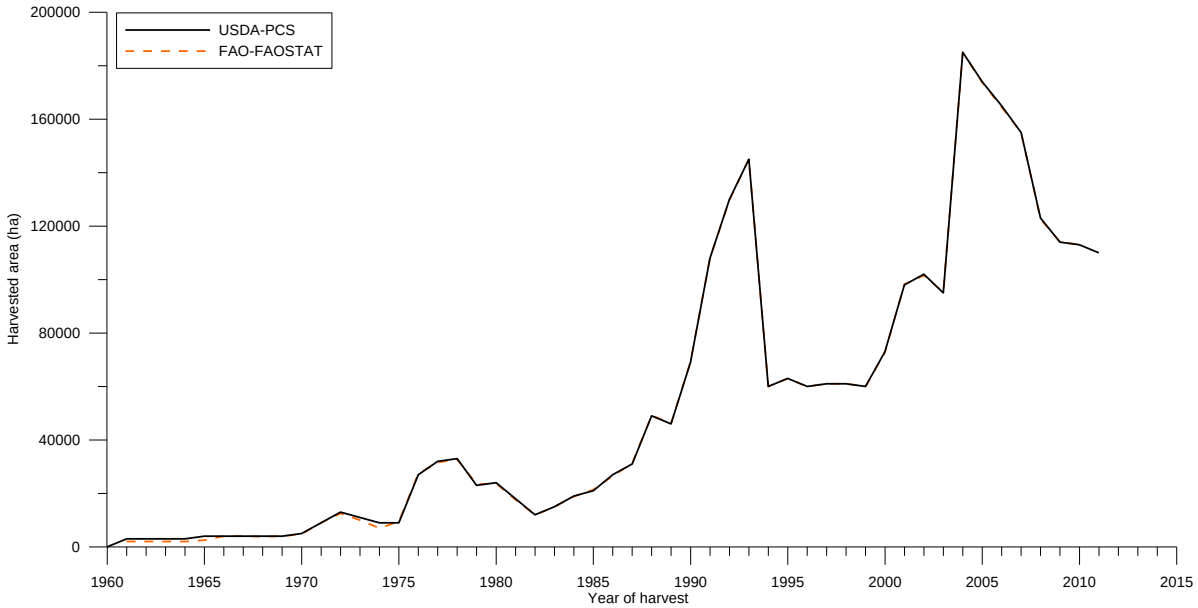

Figure 23: Harvested area for maize in Iraq.

Figure 23 shows the harvested area of maize. The data sets from USDA-PCS and FAOSTAT correspond. A clear drop in maize cultivated area is obvious from 1994 to 2004. This sudden drop appears policy related, rather than based on climate or agronomic influences.

Cereal policies for this period have been described by the FAO in annual reports:

In Iraq, the Government made it mandatory for farmers to sell their entire harvest of wheat and barley to the Government. The Government also raised procurement prices first in April 1994 by an average of 100 percent and again in June by another 133 percent for top quality wheat, 136 percent for other types of wheat, and by 167 percent for barley. (FAO, 1995)

Although the winter cereals do not directly compete for land and water resources with the summer cereals, the policy may have shifted resources away from the cultivation of maize. Note that despite this policy no major increase (inverse fluctuation from the maize) can be seen in the cultivation of wheat (Figure 8) and barley (Figure 13). The policy described in the report also shows the level of involvement of the Government of Iraq in the agricultural sector.

Figure 23 can also be interpreted as having two sudden peaks in production from 1991 to 1994 and from 2004 to 2008, both times following a moment of unstable conditions affecting Iraq. Overall, the harvested area of maize has increased over time.

The national production of maize (Figure 24) follows the trend of the harvested area. Both USDA and FAO databases are using the same data set. The similarity between production and harvested area results in a fairly constant productivity for maize, fluctuating between 2.0 and 2.5 ton/ha yield. This compares to productivity levels of 4.6-6.2 metric ton/ha in Australia, 8.6-9.5 ton/ha in Italy, and 6.9-8.4 ton/ha in Egypt.

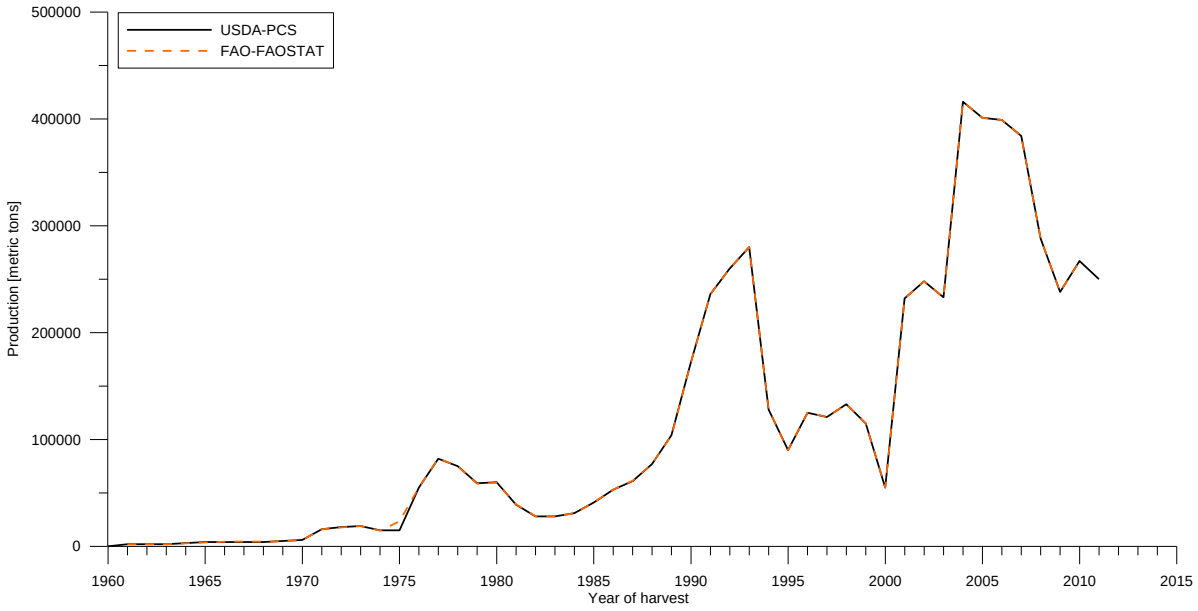

Figure 24: Maize production in Iraq.

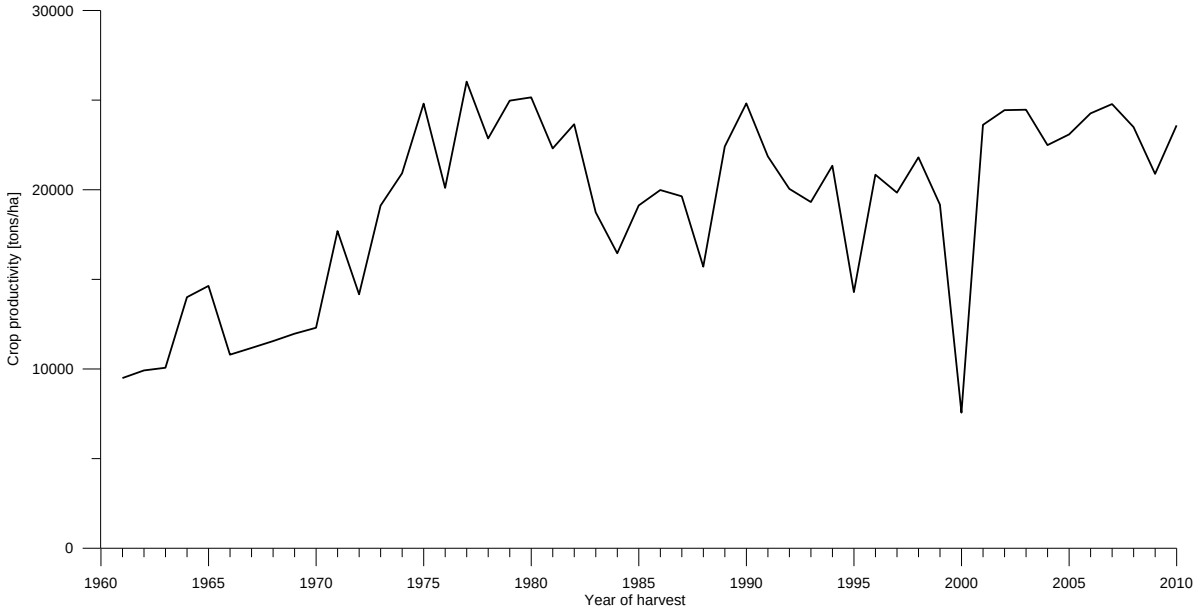

Figure 25: Maize productivity in Iraq.

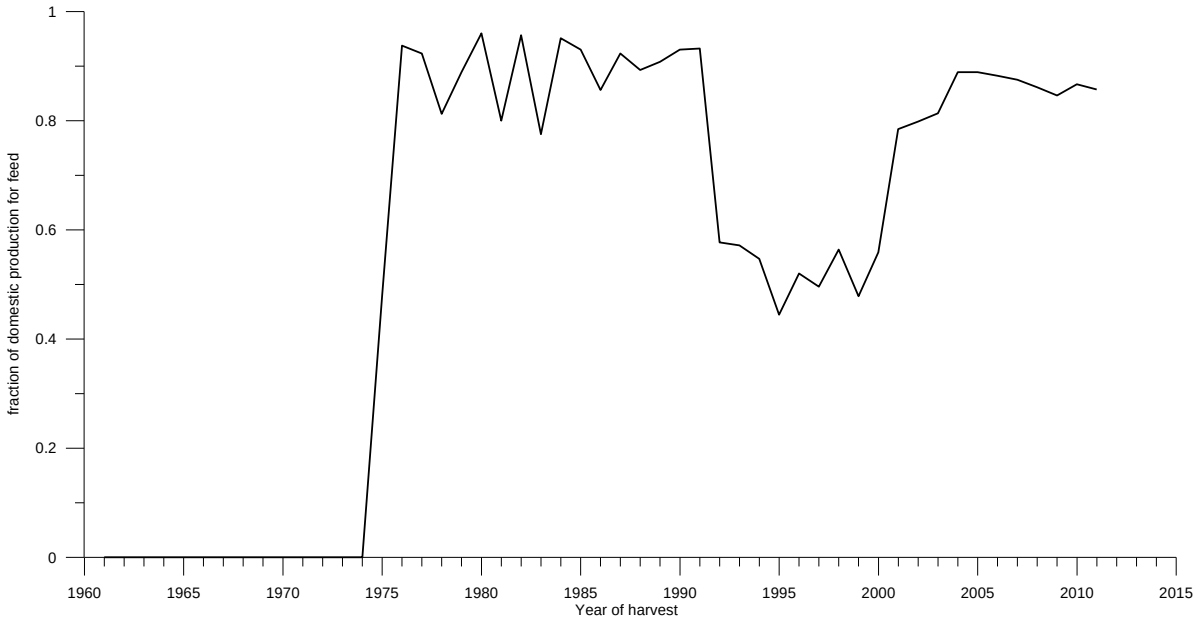

Figure 26: Ratio of maize used for feed and fodder in Iraq [from USDA-PSD]

Figure 26 shows that the ratio of production used for feed is usually over 80%, except in the years of lower production between 1992 and 2001. Maize cultivation for human consumption is thus only a small ratio of total cultivated maize.

5.3 Tomatoes

Tomatoes are grown in whole Iraq, both as open field and greenhouse crops. Two tomato paste factories were located in Iraq before 2007 (USAID, 2007), one in the north, and one near Baghdad, indicating two areas of importance for tomato production. Basrah governorate is also identified as an "efficient tomato cluster in Iraq" (USAID, 2007). The USAID study identifies tomato paste as a good alternative of excess production of fresh-market tomatoes.

Figure 27 shows the area reported to be harvested for tomatoes. A large increase in harvested area between 1994 and 2002 is shown, with a large dip in 2003. Harvested

area jumped again in 2004, but shows a decline for the most recent data. Figure 28 shows the production of tomatoes in Iraq. Note that the USAID (2007) report identifies a total overproduction in Basrah of fresh tomatoes for the market of 50,000 metric tons in a year. The average productivity of tomatoes has been steadily rising over time (Figure 29). Note that the USAID (2007) report identifies areas around Basrah with a yield of between 70 and 80 metric ton/ha, approximately 4 to 5 times higher than the national average. Productivity values for tomatoes in Australia (40-65 ton/ha), Egypt (38-40 ton/ha), Italy (51-57 ton/ha) and Russian Federation (15-19 ton/ha) show that productivity in Iraq (12-18 ton/ha) could possibly be improved through improved agronomic management.

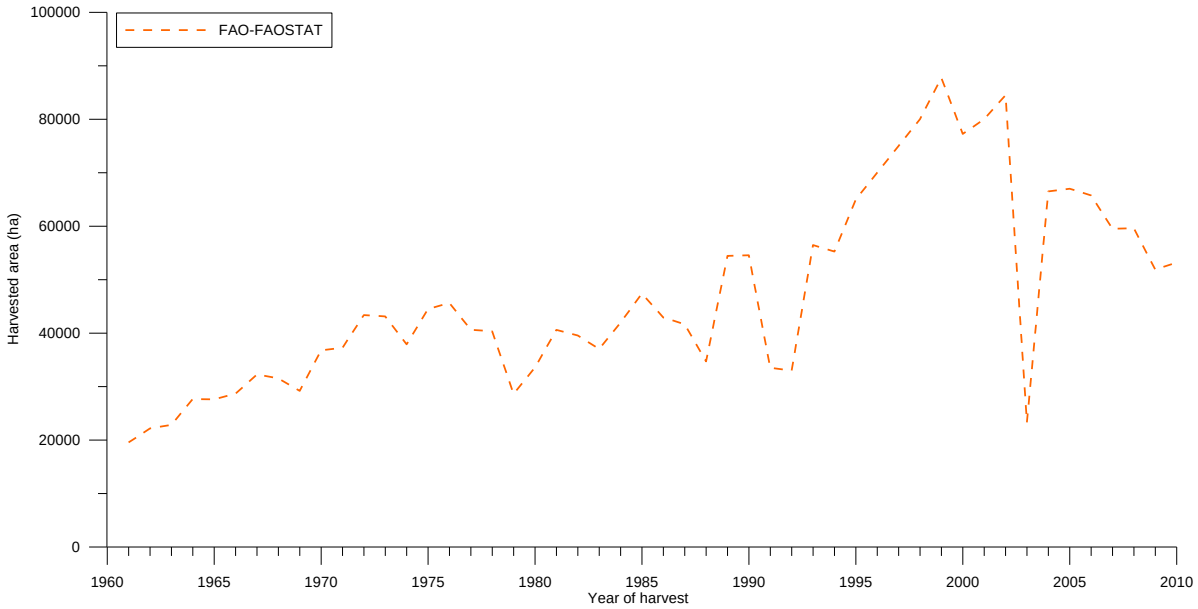

Figure 27: Harvested area of tomatoes in Iraq [based on FAO-FAOSTAT data]

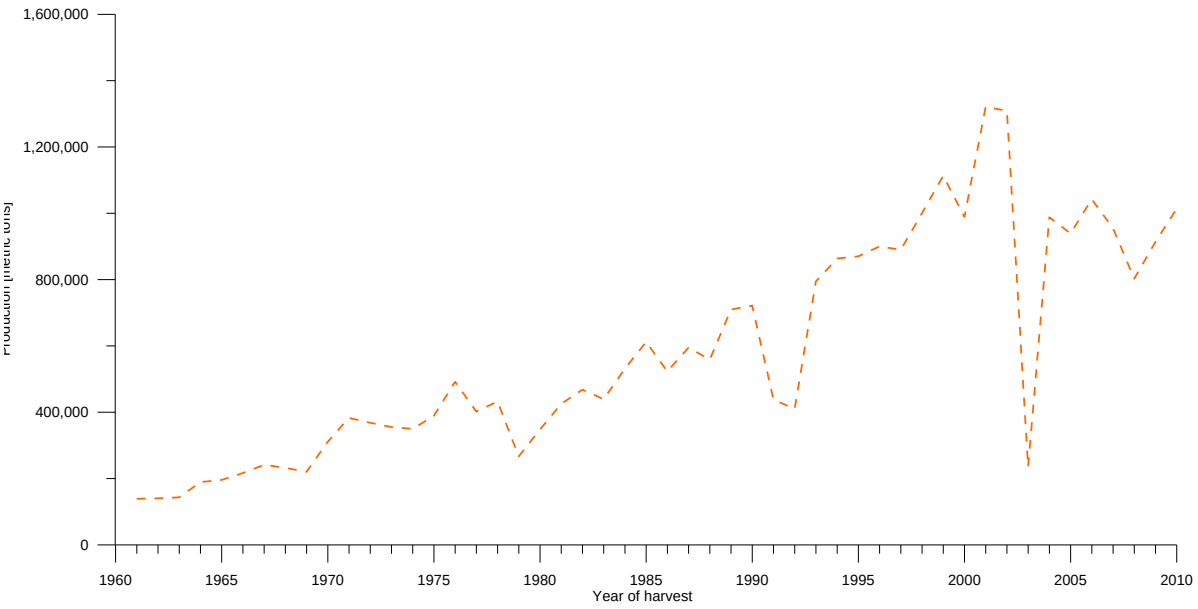

Figure 28: Tomato production in Iraq

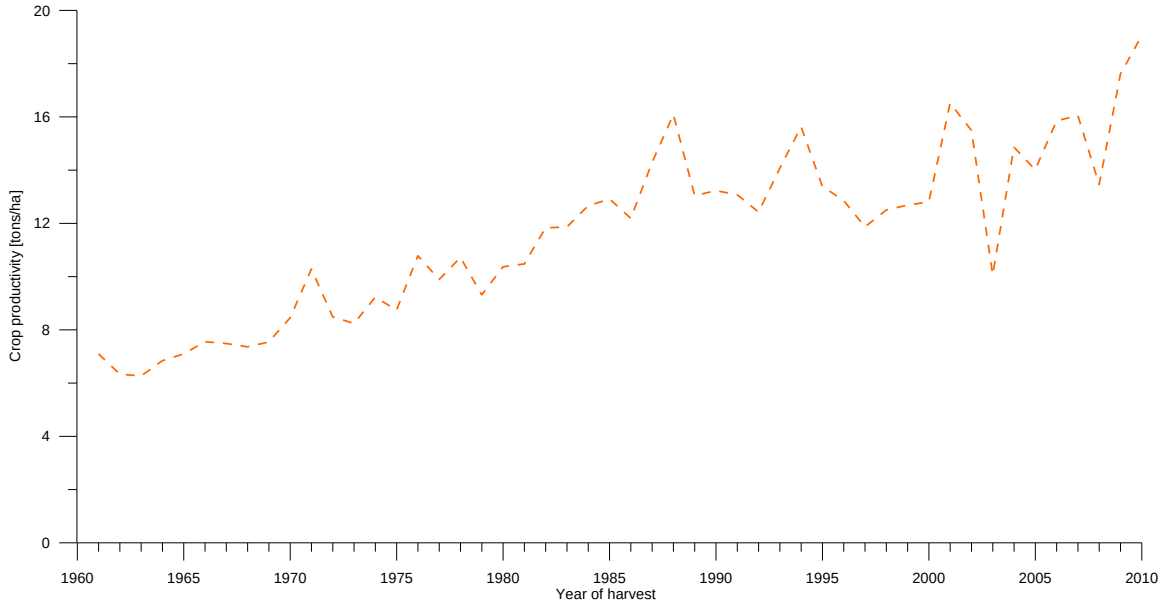

Figure 29: Productivity of tomatoes in Iraq

5.4 Rice

The production of rice in Iraq is mainly grown in four provinces in central and south Iraq, with a large concentration around Najaf. Rice varieties are long-grain aromatic types, considered in high demand in Iraq. The growing season of rice starts in July and ends in October-November.

Figure 30 shows the fluctuation of the harvested area of rice in Iraq. Especially the recent droughts in 2003, 2009, 2010 and 2011 show a large reduction in rice area. A news article (IRIN, 2009) reports that a lack of water and increases in soil salinity are the cause for this reduction.

Figure 30: Harvested area of rice in Iraq.

The production of rice (Figure 31) shows a similar variability as the harvested area. This results in a productivity of rice estimated between 2.5 and 3 ton/ha for most years.

Note that the productivity of rice appears to increase in the recent years, which corresponds to smaller areas of rice being harvested. The productivity for rice during 1993-1999 appears lower than in other years, and corresponds to a period of high production of rice. This may indicate that in dry years, only the most suitable areas are cultivated under rice, while in wetter years, less suitable lands are included in the production of rice.

Comparable productivity values for rice are 6.6 – 10.8 ton/ha in Australia, 9.4-10.1 ton/ha in Egypt, 5.8-6.6 ton/ha in Italy and 3.1-5.3 ton/ha in the Russian Federation.

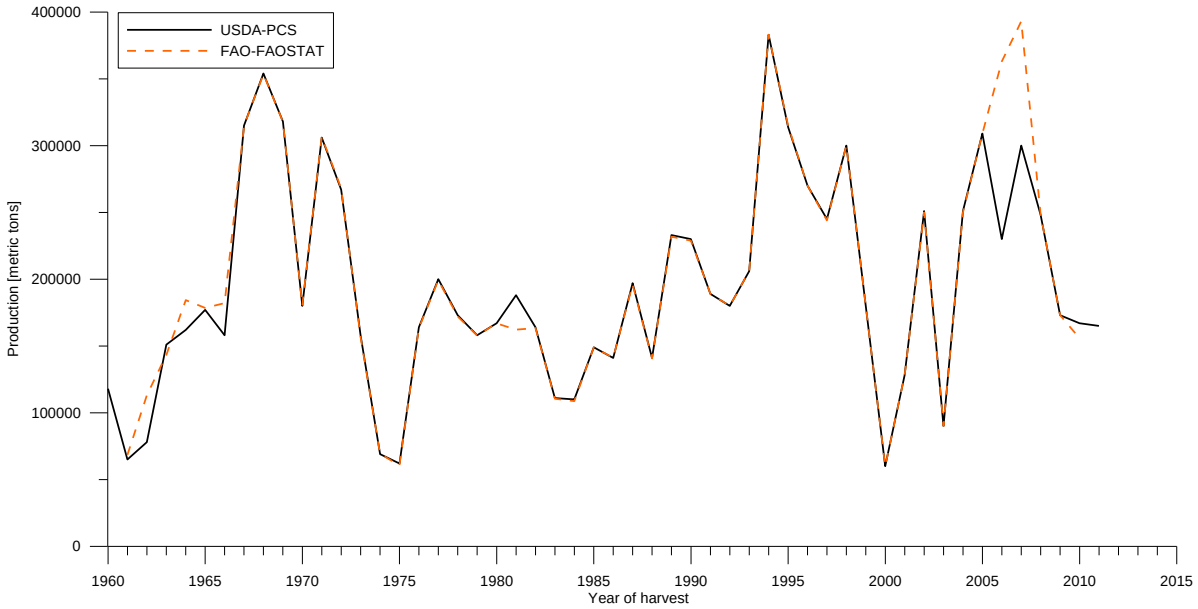

Figure 31: Rice (rough) production in Iraq

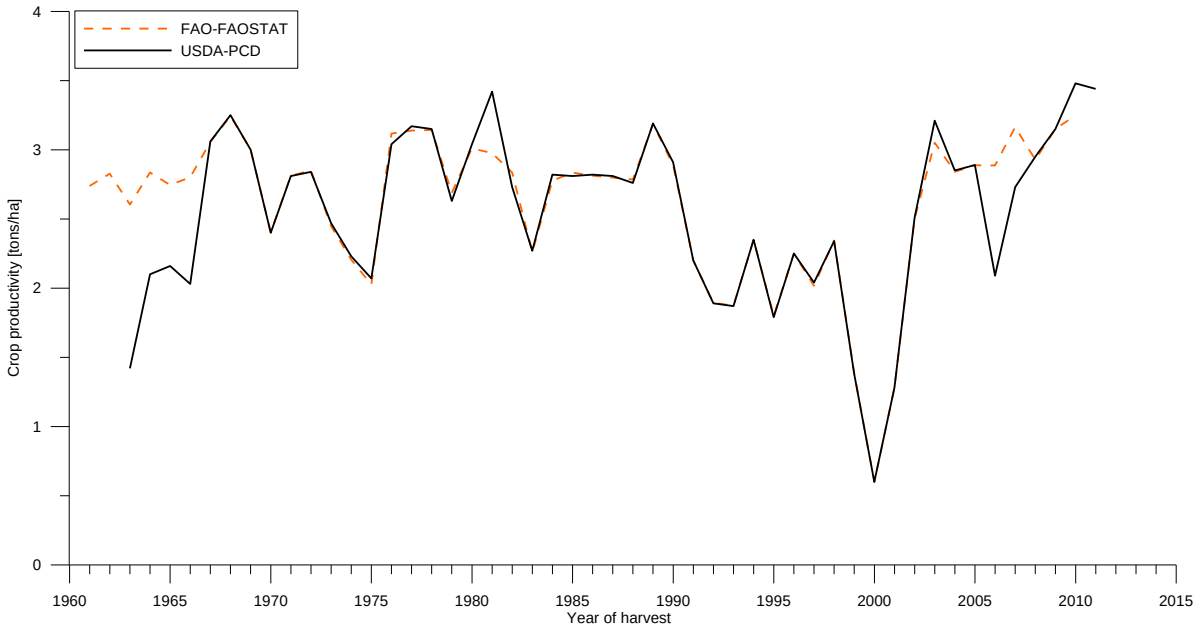

Figure 32: Productivity of rice in Iraq.

5.5 Cotton

Cotton is often mentioned as an important crop in Iraq. Although there have been periods where large areas of cotton were grown (Figure 33) it covers a relatively small area within the arable lands in Iraq, only twice mentioned as a crop covering more than 4% of cropped area (Figure 6 and Figure 7, in the 60's and 70's). The FAOStat database shows vegetables like cucumber and watermelon, and crops like sunflower in the same magnitude as cotton.

Haj (2010) describes how cotton production was introduced and encouraged during the British Mandate period (1914-1932). Government concessions to produce cotton were issued first in 1923 to the companies Eastern Irrigation Ltd and Diyala Cotton Plantation Co. To stimulate the production of cotton, a study was promised to develop Lake Habanyia and the Falluja Barrage to allow large scale cotton production. Due to the sharecropping (iqta) system used in the Mesopotamian plain, less incentive existed to make large investments in the land, and cotton did not reach the large scale production that was envisioned. Additional reasons for the lack of interest in cotton were that it was not a food crop, and required larger labour inputs. The economic crash in 1929 reduced world demand for cotton products and lowered the profits that cotton production was abandoned. Although production resumed I the 30's and 40's, it did not become a main export crop as envisioned during the British Mandate.

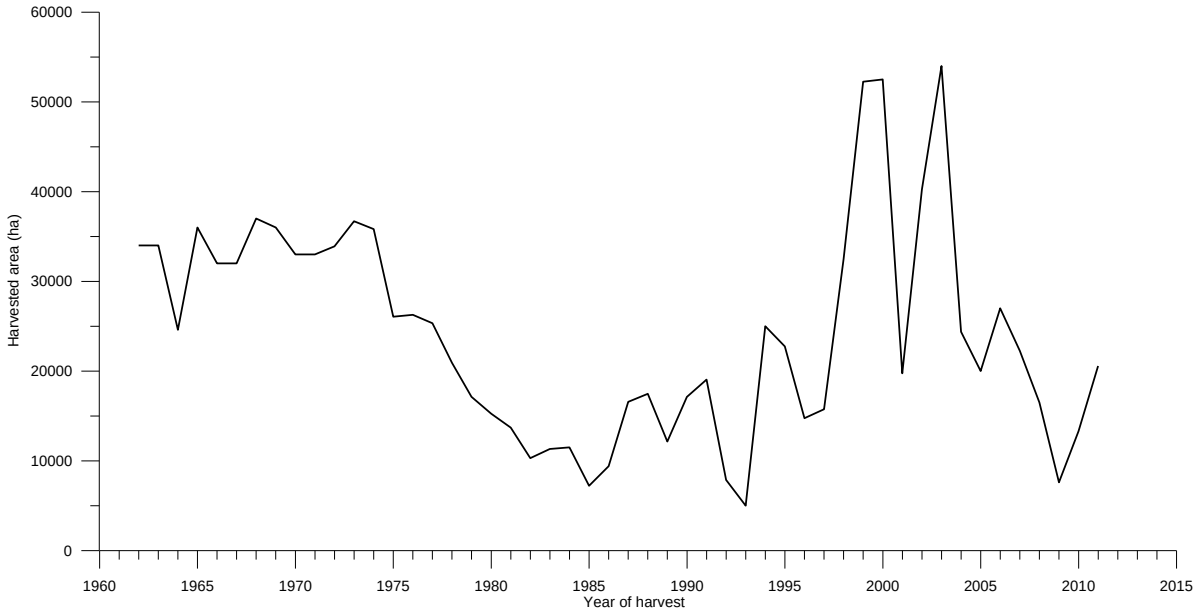

Figure 33: Harvested area of cotton in Iraq [FAO-FAOStat data]

5.6 Summer crops

A summary of the harvested area for summer crops is shown in Figure 34. A jump in summer crops can be observed in 1984 as the result of the reporting of dates and oranges. The 2003 drought appears to mainly have influenced rice and tomatoes. After 2007, a general decrease of harvested area can be observed. Crop classification of dates, maize, tomatoes and rice will result in a 25-33% area covered in Iraq.

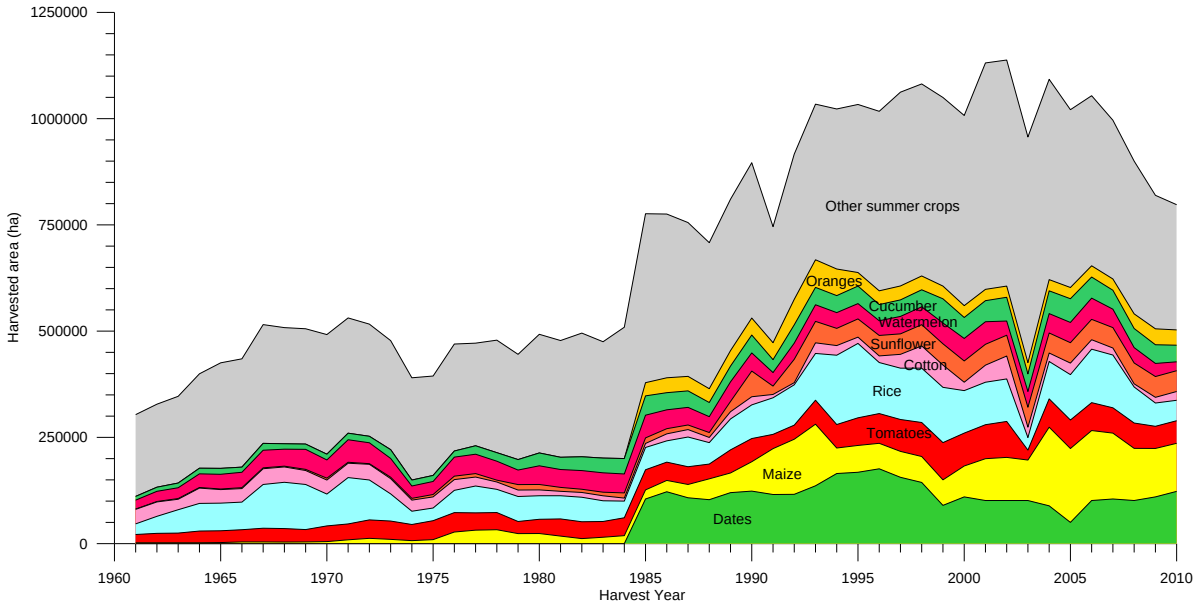

Figure 34: Harvested area for summer crops in Iraq

6. Crop productivity, irrigation and soil salinity

In the crop commodity based analysis, a relative low productivity was observed for Iraq compared to other agricultural systems. Haj (2010) identified this issue in her description of the development of expanding agriculture in Iraq, and notes that the sharecropping system (iqta) was partially the cause of expanding agriculture, without intensification. She notes for the period from 1940 to 1960:

"Although output under iqta increased in response to the demands of the market, this increase largely occurred through the expansion of cultivated areas and the intensification of peasant exploitation. Instead of maximizing production though capital investment to improve the productive level of both labor and land, the tribal landed class tended to increase production by opening new lands to sharecropping cultivation."

The development of further irrigation projects in the 1950's was not supported by some government advisors and the International Bank for Reconstruction and Development (IBRD)(Haj, 2010). Their advice was to improve productivity on existing land through land drainage as opposed to increasing cultivated land. With expansion of cultivated land, no incentive existed to improve and reclaim existing land, since cultivation could be shifted to new, less salinity impacted land. This resulted in approximately 30% of land abandoned due to soil salinity, and an estimated 20-50% decline in yield (Haj, 2010).

Land tenure systems have changed in Iraq, and population growth most likely explain the needs for larger areas of crop cultivations that in the early 1900's. However, the issue of relatively low productivity due to limited water resources, soil and water salinity still exist. Drainage and reclamation projects have been implemented from the 60's onwards, and resulted in improvement of conditions in several areas. Improvement of deteriorated drainage systems, and improved visions on regional assessment and implementation of water and salt management should result in more sustainable approaches towards water and salt management in the Mesopotamian plain in Iraq. This sustainable approach needs more than just advice on how to improve the soil and water conditions. We want to avoid comments made by Buringh (1960) about earlier soil studies:

"The results of the early soil investigations (1919-1925) are still important. It is surprising that the soil specialists of those days had a good idea of the soil problems, and of the way in which they could be solved. […] It is quite astonishing that the recommendations of these experts were not followed, and that even to-day the same can be said as 35 years ago."

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