

The Reality of the Cultivation and Production of Oil Crops and the Manufacture of Vegetable Oils in Iraq: a Review of Selected Applied Studies

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Review Article

Abstract: The problem of the food deficit and consequently the lack of self-sufficiency in the production and manufacture of various foodstuffs, including vegetable oils, is one of the main problems in Iraq, as agriculture in Iraq is still growing at rates that are not sufficient to secure the population's need for food, and this sector still suffers from many problems due to the circumstances that Iraq witnessed which in turn negatively affected the production and manufacturing reality of various foodstuffs, such as the manufacture of vegetable oils. Despite the increasing health and cultural awareness of the Iraqi consumer about the importance of using vegetable oils for cooking purposes, this sector or industry is still characterized by its weakness or absence at the present time, perhaps one of the most important reasons for this is the lack of production and the deterioration of the productivity of one hectare of the main sources of these oils represented in the oil field crops of all kinds due to the lack of areas allocated for their cultivation and the lack of adequate support from the requirements of their production, especially since some of them require many and expensive service operations, which led to the suspension of many vegetable oil factories from working at the present time.

Key Word: Oil crops; Vegetable oils; Areas and production; Manufacture; Iraq.

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I. Introduction

Agricultural activity performs a prominent and important role in the economic structure of the country through its effective contribution to the development of other economic activities by supplying those activities with the raw materials they need in their manufacturing operations, especially food ones¹. Most agricultural crops are a close link between the agricultural sector and the rest of the sectors that participate with it in economic activity, especially the industrial sector, as a result of most industries' dependence mainly on agricultural outputs as a basic raw input to them. Thus, it creates a demand for agricultural outputs as a result of an expansion in the manufacturing base and optimal exploitation of raw agricultural materials^{2,3,4}. Hence, it becomes clear that any economic activity, especially in developing countries, including Iraq, is characterized by the agricultural sector carrying out a major role in the formation of the outputs of these activities. The most prominent result is the inability of this sector to provide the needs of workers in other sectors with the necessary raw materials^{5,6}, which imposes on agriculture the need to raise production levels and productivity rates of various agricultural crops, especially industrial ones, to meet the continuous increase in the levels of increasing demand for food⁷.

Oil crops are one of the most important economic pillars in the economies of many countries of the world, especially the industrial and agricultural sectors⁸, and their importance comes to the agricultural sector in that they occupy large areas of the agricultural area, where they come in second place after grain crops^{9,10,11}, and because the seeds of these crops are included in the manufacturing industries of the industrial sector, where oil is extracted from it, which is used in direct or indirect feeding and in many industrial fields, in addition to the secondary products of the oil industry, which are the waste that enters the manufacture of concentrated feeds of livestock^{12,13}. Therefore, the world's interest in the production of oil crops has increased, especially since there is a continuous population increase with the rise in per capita income levels in the developed peoples and some peoples of under developing countries, including Iraq, which caused an increase in the global need for vegetable oils¹⁴. This interest in the production of oil crops was not the result of this decade, but rather hundreds of years

ago, due to the nutritional benefits of vegetable oils extracted from those crops, being a source of energy and a source of essential fatty acids in the body, in addition to being a source of fat-soluble vitamins such as vitamins A and B, it also controls in an indirect way the level of cholesterol in the blood^{15,16}.

II. The Reality of the Cultivation and Production of Oil Crops in Iraq

Oil crops are generally divided according to their growing seasons in Iraq into two groups¹⁷:

1. Summer oil crops group, includes Sunflower, Sesame, Peanuts, Soybeans, Castorbean, Cotton, and Yellow Corn.
2. Winter oil crops group, includes Safflower, Rapeseed (Mustard), and Flax.

Sunflower: This crop is one of the most important summer oil crops in Iraq, as it gives the largest amount of oil per unit of the cultivated area because its seeds contain a high percentage of oil that may reach 50%. Sunflower oil is characterized by its good taste, so it is widely used in the food oils industry. Sunflower crop is planted in Iraq in two seasons, the first in spring, from mid-February to mid-March¹⁸, and the second in autumn, during the month of May until mid-June. This crop occupies large areas of the total areas allocated for cultivation in Iraq. Most of the areas planted with it are concentrated in the northern irrigated and rain-sustaining regions, but the areas planted with oily varieties constitute a small percentage of them due to the increasing demand for non-oil varieties¹⁹. Cultivation of non-oil varieties of it began a long time ago and these varieties were called local varieties. As for the oily varieties, commercial cultivation began in the early seventies, after the Ministry of Agriculture and Agrarian Reform (previously) imported some suitable foreign varieties. At that time, the ministry conducted intensive awareness and guidance campaigns and provided seeds and fertilizers, which helped to increase the cultivated areas, especially in the irrigated areas such as Diyala, Baghdad and Salah Al-Din. In 1980, the largest area planted with oil varieties was recorded, reaching about 22 thousand dunums, but then it decreased until it reached 3 thousand dunums only in 1984. However, the areas planted with non-oil local varieties began to increase significantly until it reached the limits of one thousand dunums in the subsequent years. Despite the success of cultivating this crop in Iraq, especially the non-oil varieties of it, and the increase in the areas planted therein as a result of the demand for these seeds in the local markets, there are some problems that limit the increase in the areas cultivated with it or its spread in other regions of Iraq, these problems are²⁰:

1. Most of the non-oil varieties have low productivity due to their large mixing and heterogeneity of plants in one field, and the percentage of oil in them is low, which makes it difficult to use them for the purposes of oil extraction.
2. Competing with the traditional summer crops especially cotton, maize and vegetables, in the irrigated areas of Iraq.
3. The oil varieties that were planted in Iraq are mixed pollination, which requires the establishment of beehives to ensure the pollination of their flowers at a high rate, but this cannot be easily provided due to the difficulty of managing and sustaining beehives, so empty seeds constitute a large percentage of the yield that may reach in some varieties to more than 50%, which causes a decrease in the productivity of these varieties. The genetic deterioration of the oil varieties caused the low rates of production because they are synthetic varieties that need to be renewed before they are isolated, in addition to the fact that most of the areas planted with these varieties were concentrated in the central region of Iraq, which is characterized by high temperatures at the time of flowering and seed formation, which led to a decrease in the proportion of oil and a high percentage of empty seeds.
4. The oily varieties did not succeed in the rainy wet regions in Iraq due to the length of their growing season and their great water needs in relation to the rainy season in these regions.
5. Sunflower fields attack many types of birds, such as sparrows, large wild pigeons, squirrels, and larks. Where some of them feed on the seedlings of the crop, and some of them pick the seeds from the flower when they are ripe, which causes a loss of yield estimated at 60%, especially in small fields.
6. The method of manual scattering is often followed in planting seeds, which causes low plant density and difficulty in conducting agricultural operations, and then low productivity and deterioration in quality due to the specificity of some agricultural machines needed for the crop and their high price, which limits the possibility of their purchase by farmers, especially seeders and harvesters.

Sesame: This crop is considered an important oil crop in many countries with hot and semi-hot climatic characteristics and temperate regions, including Iraq. Sesame is cultivated with the aim of obtaining its seeds to extract oil from them, as these seeds contain a high percentage of oil ranging 50-60%. Sesame oil is used in the food industry and the industrial butter industry as well is used as a stabilizer in the perfume industry. While the low grades of this crop, it is used to lubricate machines and make soap²¹. Sesame was cultivated in Iraq in the past. In 1968, the Iraqi Ministry of Agriculture produced two varieties: white sesame (local No. 8) and red sesame (Mosli No. 28), which have long adapted to the conditions of the Iraqi environment. These two varieties are distinguished by their abundant yield and high oil content, especially the white variety compared to

the imported ones. Sesame is cultivated in Iraq in areas extending from latitudes 25 south to 35 north, meaning that its cultivation extends to the northern edges of Iraq, and the crop is grown in two seasons: spring in early April and summer during June, but spring cultivation is better because it gives the best yield. The most important provinces that produce sesame are Diyala, Babil, Wasit, Anbar, and Salah Al-Din. Despite the success of cultivating this crop in all regions of Iraq, there are problems that obstruct its cultivation, including²²:

1. The problem of affliction with plant diseases, the most important of which is charcoal rot disease, which spreads in some areas of its cultivation, where this disease causes a great loss in production, and sometimes reaching 100%.
2. Losing a portion of his produce during the harvest process, if the harvest is delayed beyond the date of maturity.

Peanuts: This crop is considered one of the crops of important economic value in the world and Iraq, where it is grown for the purpose of obtaining its seeds, which contain an oil percentage ranging between 40-48% and may reach 54% in the modern varieties of it²³. The oil of this crop is of good quality and high in unsaturated fatty acids, so it is preferred in cooking to reduce cholesterol in the blood. Peanuts were cultivated in Iraq on a commercial scale in 1922 by the agricultural departments in Iraq, where they organized awareness and guidance campaigns in order to expand its cultivation, especially in the central region of Iraq in each of the governorates of Baghdad, Babil, Diyala, and Anbar. However, this expansion was not at the level of the economic importance of the crop, where its cultivation weakened in subsequent years, and Iraq's production of it was low compared to global production, due to many reasons, some of which are technical and others are economic. The most important problems that obstruct the expansion of its cultivation in Iraq can be summarized as follows²⁴:

1. The difficulties faced by the farms and the departments concerned with its production from soil and crop service operations, the lack of breeding and improvement programs, and the length of its growing season, where the crop needs many and expensive service operations, at a time when machines and equipment were not used in the cultivation, service and harvesting operations.
2. In order to give a high yield and good quality of fruits and seeds, the crop needs to cultivate in light and well-drained soils.
3. He was infected with the root-scarring disease, which had the greatest impact on reducing the quantity of production and delaying the cultivation of the crop.
4. The fruits at maturity are exposed to a pest of mice that cannot be controlled, which may cause a great loss in the amount of yield, and sometimes reaching 100% if the field is not controlled from this pest at the beginning of cultivation.

Soybeans: one of the oil crops of great importance and many uses. It is one of the oldest known field crops. The seeds of this crop contain a high percentage of oil ranging between 14-24%. It is used for the manufacture of high-quality food vegetable oils and is used in many other industrial fields. Cultivation of this crop was introduced in Iraq on an experimental scale only since the fifties, and since that time it has not been possible to cultivate it on a commercial scale and expand it for several reasons, including²⁵:

1. The lack of suitable varieties for the environmental conditions in Iraq, and the variety that was cultivated did not prove completely successful in all regions, despite its success in some years at the level of local experiments in each of the governorates of Baghdad and Nineveh.
2. Lack of familiarity or acceptance this crop by the Iraqi farmer for growing the soybean crop, in addition to the lack of experience and full technical information about the problems of its cultivation in Iraq.

Castorbean: This crop is cultivated for the purpose of extracting oil from its seeds. It is also cultivated for ornamental purposes. Its seeds contain an oil content ranging between 40-58%. Its oil is thick in texture and colorless or tends to green. It is widely used in the manufacture of dyes, varnishes and plastics, in addition to its medicinal uses as a laxative. . The cultivation of this crop in Iraq is neglected or almost non-existent, despite its economic importance, where its cultivation is limited to home gardens, the edges of roads, and around agricultural fields as a windbreak²⁶.

Cotton: This crop is one of the most important fiber crops in the world, in addition to being one of the main oil crops, where its seeds contain an oil ratio ranging between 18-26%, which is used for food and soap industry²⁷. The cotton crop is at the forefront of the summer industrial crops in Iraq, where its contribution to the value of the agricultural plant production is about 14.26%. The demand for it has increased according to the requirements of agricultural industrial development, but its production in Iraq is still not enough to meet the needs of fabric and oils factories²⁸. Cotton is grown in Iraq in large areas in the northern and central regions, while it is grown in smaller areas in the border area due to the lack of suitable environmental conditions for its growth. This crop is still suffering from a decline in production and productivity, and its production was unable to meet the needs of various local industries, due to several reasons, including²⁹:

1. The high costs of its production and the disproportion between the cultivated areas and production, which causes a loss of economic and productive resources.
2. Limiting its cultivation in Iraq to one variety only due to its good features and its acceptance in the local and foreign markets, and to preserve it without the other types of lower quality.

Yellow corn: This crop is classified within the group of cereal crops. It is one of the summer crops that are widely grown in Iraq as green fodder and grains. It is also used as food for humans and is used in the manufacture of various other agricultural products, especially vegetable oils³⁰. Maize is grown in Iraq in two seasons, spring and autumn, but in recent years its cultivation has been limited to the fall season only. Maize is grown in all governorates of Iraq and its cultivation is concentrated in the governorates of Babil, Wasit, Diyala, and Kirkuk³¹. Iraq's interest in this crop increased in the nineties to keep pace with the economic blockade imposed on Iraq at that period, where the areas cultivated with yellow corn increased and many varieties were introduced to Iraq with the aim of improving quality and increasing production and productivity. Support policies were followed in terms of providing the necessary agricultural supplies such as seeds, fertilizers, machinery, and modern irrigation systems, in addition to subsidizing the prices of the final product. These support policies have led to clear positive results. However, despite the development taking place in the cultivation and production of the yellow corn crop in Iraq, there are some problems that obstruct the productivity of this crop to reach international levels, including³¹:

1. The problem of production losses during various agricultural and marketing operations, since the using of traditional methods in cultivation of yellow corn crop.
2. Not to include the required mechanical operations during agricultural operations and crop harvesting operations.

Safflower: The main purpose of cultivating this crop at the present time is to extract oil from its seeds that rate ranges between 26-37%. This oil uses for human nutrition and in many industries such as soap making, in addition to its medicinal uses in treating diseases of the circulatory system. Safflower was commercially cultivated in Iraq during the agricultural season 1972-1973 and the results were not encouraging, where the crop was infected with some diseases as well farmers of this crop faced the irrigation and harvesting difficulties. Then another attempt was made by the responsible authorities in Iraq to re-cultivate the crop during the 1978-1979 seasons, but this attempt also ended in failure because the lack of farmers' desire to deal with this crop, which led to the complete stop of its cultivation in Iraq. The most important problems that led to the failure of safflower cultivation in Iraq can be summarized as follows³²:

1. The sensitivity of the crop to infection with root rot, especially in the central and southern regions, as well as its lack of resistance to the bush and infection with the tomato fruit young insect, where safflower crop is the winter unique host for this insect in Iraq, which increases its spread and increases its danger on summer crops.
2. Because safflower is a winter crop, the expansion of its cultivation, especially in irrigated areas, will be at the expense of winter grain crops as a competing crop.
3. The inefficiency of the work of the harvesters in the safflower farms due to the accumulation of dirt resulting from the remnants of the safflower flowers on the cooling device, which must stop the harvester from working and clean it from time to time during its work on the farm, what exacerbates this problem is the inability to replace mechanical harvesting with manual harvesting, even in the small areas planted with the crop.

Rapeseed: The rapeseed or mustard crop is currently the fifth among the main oil crops in the world, where after the oil be extracted from crop's seeds was used for direct feeding purposes in emergency cases, and some of crop's varieties with a high percentage of oil are used for high-quality nutrition purposes in addition to using crop's oil in many industrial and medical purposes, especially in the treatment of some skin diseases. Rapeseed cultivation in Iraq is still in its beginning, where it is considered one of the oily annual winter crops. Experiments conducted on it in fields and laboratories have shown that the best date for planting it is during October to mid-November. The failure or weakness of mustard cultivation in Iraq can be determined by several reasons, including³³:

1. Infection with insects and pests such as aphids and cabbage young insect, and the inability to get rid of them by using chemical pesticides.
2. Not suitable for weather conditions, especially when the weather is very cold.

Flax: Flax is grown for the purpose of obtaining fiber or for the purpose of obtaining its seeds that rich in fatty substances, where its seeds contain an oil percentage ranging between 32-44%, most of which is used for industrial purposes only. Flax is grown in Iraq at present for the purpose of seeds only, and the annual cultivated area is estimated at about 2000 hectares. Its cultivation in Iraq is concentrated in the governorates of Diyala and Kirkuk. The experiences applied to it locally have proven that the best date for its cultivation in the central and southern regions of Iraq is from late October to mid-November, and the best date for planting it in the northern region is from late October to mid-December³⁴.

Table 1 shows the development of the area, production and productivity of the group of summer oil crops in Iraq and the annual growth rates of these economic indicators for the period (1980 - 2015), where the negative sign and low rates of annual growth of these crops indicate a decrease in their annual growth rates, which resulted in the failure to meet individual demand and the local industry of various oil crops.

Table no 1: Cultivated area, production and productivity of the most important summer oil crops in Iraq for the period (1980 - 2015).

| Years | Sunflower | | | Sesame | | | Peanuts | | | Cotton | | | Yellow Corn | | |
|--------------------|-----------|------------|-------|--------|-----|-----|---------|------|------|--------|------|-----|-------------|------|------|
| | Area | Production | Yield | Area | Pr. | Yi. | Area | Pr. | Yi. | Area | Pr. | Yi. | Area | Pr. | Yi. |
| 1980 | 540 | 124 | 230 | 477 | 44 | 92 | 6 | 2 | 333 | 637 | 149 | 234 | 1114 | 596 | 535 |
| 1981 | 401 | 60 | 150 | 479 | 59 | 123 | 4 | 1.9 | 475 | 454 | 132 | 291 | 845 | 393 | 465 |
| 1982 | 313 | 78 | 249 | 466 | 56 | 120 | 3.3 | 1.5 | 455 | 482 | 141 | 293 | 640 | 282 | 441 |
| 1983 | 369 | 60 | 163 | 494 | 62 | 126 | 6 | 3 | 500 | 550 | 118 | 215 | 911 | 281 | 308 |
| 1984 | 506 | 97 | 192 | 501 | 59 | 118 | 5 | 4 | 800 | 399 | 71 | 179 | 1136 | 309 | 272 |
| 1985 | 518 | 104 | 201 | 721 | 85 | 118 | 5 | 4 | 800 | 433 | 72 | 167 | 1160 | 410 | 300 |
| 1986 | 480 | 104 | 217 | 651 | 88 | 135 | 1 | 0.9 | 900 | 922 | 203 | 220 | 1233 | 531 | 431 |
| 1987 | 433 | 85 | 196 | 711 | 91 | 128 | 6 | 2 | 333 | 746 | 142 | 191 | 1477 | 613 | 415 |
| 1988 | 493 | 102 | 207 | 726 | 110 | 152 | 5 | 4 | 800 | 531 | 122 | 230 | 2450 | 772 | 315 |
| 1989 | 1037 | 193 | 186 | 884 | 139 | 157 | 4 | 3 | 750 | 296 | 144 | 487 | 2173 | 1036 | 477 |
| 1990 | 2479 | 593 | 239 | 926 | 139 | 150 | 4 | 4 | 1000 | 365 | 183 | 503 | 2855 | 1719 | 563 |
| 1991 | 796 | 212 | 266 | 918 | 131 | 143 | 5 | 4 | 800 | 195 | 75 | 382 | 4518 | 2968 | 657 |
| 1992 | 2851 | 913 | 320 | 835 | 126 | 151 | 4 | 4 | 1000 | 1128 | 261 | 231 | 5551 | 3128 | 563 |
| 1993 | 2151 | 727 | 338 | 808 | 119 | 147 | 5 | 5 | 1000 | 997 | 343 | 344 | 3391 | 1707 | 503 |
| 1994 | 1682 | 556 | 331 | 699 | 120 | 172 | 0.12 | 0.1 | 833 | 908 | 293 | 322 | 2655 | 1284 | 484 |
| 1995 | 1253 | 380 | 303 | 682 | 137 | 201 | 5 | 4 | 800 | 590 | 176 | 298 | 2009 | 1011 | 462 |
| 1996 | 837 | 197 | 235 | 761 | 120 | 158 | 8 | 7 | 875 | 628 | 271 | 431 | 5397 | 3577 | 651 |
| 1997 | 1148 | 376 | 328 | 1132 | 196 | 173 | 125 | 107 | 856 | 1298 | 477 | 368 | 6472 | 4098 | 633 |
| 1998 | 1920 | 623 | 324 | 1794 | 273 | 152 | 291 | 237 | 814 | 2086 | 689 | 330 | 8768 | 5737 | 654 |
| 1999 | 2391 | 982 | 411 | 1228 | 212 | 173 | 231 | 189 | 818 | 2099 | 790 | 376 | 6788 | 3681 | 534 |
| 2000 | 543 | 201 | 370 | 786 | 203 | 258 | 340 | 293 | 862 | 789 | 328 | 416 | 2909 | 1703 | 585 |
| 2001 | 1146 | 483 | 421 | 680 | 163 | 240 | 384 | 291 | 738 | 1607 | 652 | 406 | 3934 | 2318 | 589 |
| 2002 | 852 | 336 | 394 | 1039 | 241 | 232 | 453 | 635 | 1402 | 1914 | 1128 | 589 | 7342 | 5786 | 786 |
| 2003 | 104 | 38 | 365 | 1009 | 198 | 196 | 443 | 205 | 463 | 673 | 132 | 196 | 3628 | 2357 | 650 |
| 2004 | 368 | 139 | 378 | 1207 | 260 | 215 | 454 | 339 | 747 | 798 | 368 | 461 | 7381 | 4160 | 564 |
| 2005 | 625 | 231 | 370 | 1419 | 242 | 171 | 471 | 342 | 726 | 1080 | 428 | 396 | 6943 | 4011 | 578 |
| 2006 | 477 | 186 | 390 | 970 | 180 | 186 | 501 | 324 | 647 | 892 | 375 | 420 | 6470 | 3990 | 617 |
| 2007 | 279 | 125 | 448 | 873 | 163 | 187 | 475 | 282 | 594 | 658 | 290 | 441 | 6204 | 3845 | 620 |
| 2008 | 193 | 96 | 497 | 656 | 182 | 277 | 70 | 61 | 871 | 306 | 116 | 379 | 4903 | 2880 | 587 |
| 2009 | 168 | 52 | 310 | 305 | 46 | 151 | 242 | 192 | 793 | 532 | 239 | 449 | 4562 | 2381 | 522 |
| 2010 | 227 | 75 | 332 | 530 | 133 | 252 | 159 | 105 | 656 | 823 | 453 | 550 | 4523 | 2667 | 570 |
| 2011 | 179 | 71 | 397 | 701 | 196 | 280 | 219 | 109 | 498 | 542 | 345 | 637 | 5184 | 3357 | 648 |
| 2012 | 87 | 42 | 483 | 480 | 117 | 244 | 62 | 54 | 871 | 655 | 266 | 406 | 6058 | 5034 | 831 |
| 2013 | 76 | 37 | 487 | 421 | 77 | 183 | 56 | 58 | 1036 | 530 | 277 | 523 | 7981 | 8313 | 1042 |
| 2014 | 34 | 18 | 529 | 181 | 74 | 409 | 0.05 | 0.03 | 600 | 33 | 14 | 424 | 3781 | 2893 | 765 |
| 2015 | 18 | 8 | 444 | 84 | 20 | 238 | .02 | .02 | 1000 | 5 | 0.75 | 130 | 2132 | 1823 | 855 |
| Annual growth rate | -6% | -3% | 3% | -1% | 1% | 3% | 9% | 9% | 1% | -2% | 0.3% | 2% | 5% | 7% | 2% |

Source// Ministry of Agriculture, Agricultural Research Department, Agricultural Economics Research Department, Agricultural Crops Statistics Brochure for the period (1980 - 2015), where Area = 100 dunums, Production = 100 tons, and Yield = kg/dunum.

The area planted with oil crops was estimated at about 5,000 hectares (one hectare = 4 dunums) at the level of Iraq in 2019, an increase of 4,000 hectares over the year 2018, which was estimated at about 1,000 hectares, with an increase of 400%, and the areas planted with oil crops constituted 0.20% of the total areas planted with crops and vegetables in Iraq (referring to Table 2). While the production of oil crops was estimated at about 6 thousand tons at the level of Iraq in 2019, an increase of 4 thousand tons over the production of 2018, which was estimated at about two thousand tons, with an increase of 200%, and the production of oil crops constituted 0.06% of the total quantities of production of crops and vegetables In Iraq (Statistics of the Ministry of Planning, 2019).

Table no 2: Comparison between the cultivated area and the production of crops and vegetables by groups (2016 - 2019).

| Items | 2016 | | 2017 | | 2018 | | 2019 | | Annual change rate for production % |
|--------------|-----------------|------------|-----------------|------------|-----------------|------------|-----------------|------------|-------------------------------------|
| | Area cultivated | Production | Area cultivated | Production | Area cultivated | Production | Area cultivated | Production | |
| Grains | 5217 | 3993 | 5443 | 3728 | 3769 | 2450 | 10956 | 6910 | 182 |
| Vegetables | 377 | 1014 | 414 | 1105 | 390 | 1382 | 515 | 1715 | 24 |
| Forage Crops | 342 | 924 | 455 | 731 | 229 | 494 | 442 | 773 | 57 |

| | | | | | | | | | |
|-------------------------|------|------|------|------|------|------|-------|-------|-----|
| Legumes | 33 | 13 | 29 | 9 | 2 | 1 | 27 | 9 | 800 |
| Industrial Crops | 3 | 12 | 2 | 7 | 1 | 1 | 0.03 | 0.002 | 0 |
| Oil Crops | 13 | 3 | 16 | 4 | 4 | 2 | 20 | 6 | 200 |
| Root and Tubers | 41 | 207 | 49 | 282 | 33 | 180 | 74 | 426 | 137 |
| Seeds | 49 | 14 | 25 | 7 | 8 | 3 | 13 | 4 | 33 |
| Total | 6075 | 6180 | 6433 | 5873 | 4436 | 4513 | 12047 | 9843 | 118 |

Source// Ministry of Planning - Central Statistical Organization - Department of Agricultural Statistics for the year 2019, where Area = 1000 dunums, and Production = 1000 tons.

III. The Reality of Vegetable Oil Production and Processing in Iraq

The Vegetable Oil Extraction Company (Al-Rasheed Factory currently) was established in 1940 as a limited joint stock company that was managed according to its bylaws issued under the Indian Companies Act of 1913 and the Companies Statement of 1919. It began production in 1945 and its aim was to provide the local market with solid and liquid vegetable oils and other requirements³⁹. On 6/5/1970, each of the companies below was merged to become a public company called the General Company for Vegetable Oils⁴⁰:

1. Vegetable Oil Extraction Company (currently Al-Rasheed Factory) was established in 1940.
2. Cotton Seed Products Company (Al-Mamoun Factory nowadays) was established in 1952.
3. Al-Rafidain Company for Detergent Industry was established in 1957.
4. Industrial Printing Company was established in 1969.
5. Abu Al-Hail Soap Factory (Al- Ameen Factory currently) was established in 1969

The factories of the vegetable oil sector are the largest factories in Iraq, which specialize in the manufacture of liquid oils, solid fats, soaps, cosmetics and cleaning powders. The company owns several factories scattered in Baghdad, namely (Al-Rasheed, Al-Mamoun, Al- Ameen, Al-Farabi Industrial Printing) and Al-Imam Ali Al-Hadi Factory in Maysan Governorate and Al-Mansour in Salah Al-Din Governorate⁴¹. These factories depend on the local raw vegetable oil that is extracted in Al-Mamoun factories in Baiji city from the seeds of sunflower, cotton, rapeseed, safflower and soybeans, where these seeds are received from the General Company for Industrial Crops affiliated to the Ministry of Agriculture, after receiving the seeds from the farmers according to the regulations in force in the company, including (moisture, impurities, smut and fluff), and after receiving the seeds, the processes of pressing and extracting the raw oil is begin, and then put it in tanks and send it to Al-Rasheed Factory in Baghdad to conduct manufacturing operations on it such as filtering, palace and other operations⁴². However, the factory stopped receiving seeds after 2003 due to the political and economic events that Iraq experienced during this period, which led to the cessation of the manufacture of liquid vegetable oils and the dependence of factories in the manufacture of their products on the purchase of vegetable oils available in the local markets, as well as their reliance on oils imported from abroad by a large proportion to cover domestic demand. At present, each of the company's factories carries out its own production works, which are as follows^{43,44}:

1. Al-Rasheed Factory: The factory is located in the province of Baghdad and has a total area of (99452) m². This factory filters and fills solid fats and liquid oils, produces cleaning powders and soaps (toilet and washing), and produces glycerin, as well as manufacturing plates and industrial printing.
2. Al-Mamoun Factory: This factory is located in the province of Baghdad. Its total area is (170,000) m². This factory specializes in filtering liquid oils, producing all kinds of soaps, detergents and cosmetics, and producing plastic boxes for packing, as well as aluminum tubes for packing cosmetics.
3. Al-Ameen Factory: The factory is located in the province of Baghdad and has an area of (74,600) square meters. This factory produces soaps (laurel, laundry soap) and there are sections to dissolve and intensify the silicate.
4. Al-Imam Ali Al-Hadi Factory: This factory is located in Maysan Governorate, with an area of (10,263) m². The factory specializes in the purification of solid fats, the production of detergents and soaps, the manufacture of plates and packaging.
5. Al-Mansour Factory: This factory is located in Salah Al-Din Governorate, with an area of (428080) m². The factory contains four production lines in the form of contemporary and extracting vegetable oils. It receives the seeds of sunflower and rapeseed, as well as safflower and soybeans. After pressing and extracting the oils, they are sent by tanker cars to the Al-Rasheed Factory in Baghdad for the purpose of manufacturing them.

The activity of the General Company for Food Products - the vegetable oil sector primarily aims to cover the local needs of its products. The company has direct and indirect relations with the rest of the production sectors as it is linked with the agricultural sector on the one hand and the industrial sector on the other hand, as well as scientific relations with universities, institutes and research centers In order to benefit from the exchange of information and experiences in a way that enhances raising the scientific and practical efficiency of the national workforce and making it ready to work in such an important industrial activity in Iraq.

IV. Some Applied Studies Related to Production and Processing of Food Vegetable Oils in Iraq

Study 1: ((Economic problems for the development of the vegetable oils industry in Iraq)). This study was taken up by Mustafa in 1981 (**Mustafa, 1981**) in order to set a scientifically proven direction for the development of the Iraqi vegetable oils industry in the future. In order to achieve this particular objective, the study addressed the following issues:

1. Examine the location of the branches of industry at the present time and the economic capacity of the country and determine the tendency of the internal structures of industrial branches, as well as the level of manufacturing raw materials for vegetable oils in Iraq.
2. Analyzing the state of the agricultural sector in the country from the viewpoint of the cultivation of oil crops which constitute the physical base of the industrial branch and studying the issues of establishing a physical base for the country as an objective preliminary condition for the development of the vegetable oils industry in Iraq in the future.
3. Supporting scientific recommendations for the development of the vegetable oils industry in the future on the basis of; the full use of the internal production reserves, raising its effectiveness, and strengthening the influence of levers and economic incentives in its management.

The methodological and theoretical basis of the study is based on the scientific literature of Soviet scientists in the fields of political economy and industrial economy. The latest research of Soviet and foreign economists on the problems of developing countries, especially Iraq, were widely used. The system was used many methods to solve the issues before the study, such as the methods of technical-economic analysis, economic statistics, and mathematical programming. With regard to the most important conclusions reached by the study, they can be presented as follows:

1. The study demonstrated the necessity of using a new methodological method to research planning and estimating the development of the Iraqi vegetable oils industry in the future in light of improving its organizational structure and establishing its own raw materials base.
2. For the first time, a set of foundations for methods of improving the regulation of vegetable oils production was laid on the basis of research.
3. For the first time, the possibility, supported by scientific arguments, was also presented to establish a local raw material source for the cultivation of oilseeds.
4. Economically proven differential prices for oilseed rape seeds were presented depending on the oil content and acidity in them.
5. It was proposed a schematic diagram of the distribution of state farms specializing in the cultivation of oil crops as well as the construction of a factory for the extraction of vegetable oils.
6. Create a model and determine the possibility of conducting a correlation analysis to suit the change in indicators of the economic activity of vegetable oils factories under the influence of a set of factors.

Study 2: ((Food vegetable oils industry in Iraq)). This study was documented by the researcher Al-Janabi in 1989 (**Al-Janabi, 1989**). The researcher began his study on the subject by identifying a basic problem, which is the dependence of the vegetable oils industry in Iraq on foreign imports to secure its requirements of raw materials. In light of this, the researcher raised many questions that require answering, including: the feasibility of continuing this industry, its efficiency and achieving self-sufficiency from oil products, and whether it is possible to secure its raw materials from local sources. The study reached the following most important results and conclusions:

1. The food vegetable oils industry in Iraq is represented by the production of solid and liquid oils that enter the human diet, the most important sources of which are sunflower seeds, cotton seeds, peanuts, and sesame.
2. The food vegetable oils industry in Iraq is of recent origin, where it was known in 1940, when the first factory was established to produce it with low capacities, and due to the increasing failure of animal sources to keep pace with the local demand for oils, the production capacities of the factory increased until it reached about 900 tons per day.
3. The oils industry depend on local oil seeds, but with the increase in production capacities and the shortage of local sources to secure their requirements of raw materials, it turned to importing oilseeds and then to importing crude oils, the most important of which are palm oil and sunflower oil, where these materials constituted about 79% of the basic cost for the production of oils in Iraq, followed by packaging materials by 14%, then wages by 4%.
4. Iraq produces about 25,000 tons annually of oilseeds, and this quantity cannot meet more than 4% of the industry's need for raw materials. Also, only about 10% of this production enters the oils industry due to some economic obstacles in the country, which led to a decrease in production by about 2% annually.

5. The most important oilseeds produced in Iraq are sunflower and cotton, where their cultivation extends now in the northern and central regions of Iraq after being restricted to the southern region only. However, the cultivation of these crops still suffers from a low rate of productivity, and is characterized by the limited areas cultivated in the regions that have achieved a good rate of yield per hectare.
6. The most important factories for the vegetable oils industry in Iraq are the Baiji factory in the north, Al-Rasheed and Al-Mamoun factories in the middle, and Al-Mu'tasim factory in the south. Al-Rasheed factory is the largest of these factories and the most integrated in the production lines, while Al-Mu'tasim factory is the most efficient in production. Some of these factories suffer from site problems due to the unsuitable selection of the location, and these problems include the limited available plots of land, the lack of manpower, and the difficulty of refueling.
7. The factories' production capacities of eatable vegetable oils are not appropriate with the local demand for them, where the country's total production of them covers about 92% of the actual demand, and the shortage of vegetable oils is compensated by importing from abroad.

Study 3: ((Spatial variation of sunflower crop cultivation in Iraq)). This study was addressed by researcher Hammadi in 2012 (**Hammadi, 2012**). The problem of the study was the exposure of the areas planted with the sunflower crop in Iraq to fluctuation from year to year, which suggests that there are different relationships between the areas planted with the crop on the one hand and the influence of different geographical factors on the other hand. The study aimed to reveal the reasons for the spatial discrepancy of the areas planted with the sunflower crop in the Iraqi governorates according to the spatial relations that are associated with it and contribute greatly to the explanation of this variation. The study reached several conclusions, the most important of which are:

1. The labor force has a prominent role in the reasons for the variation in the cultivation of the sunflower crop in Iraq, where ten provinces were distributed within the middle standard category, especially in the last attempt that the labor force is one of the most independent variables in explaining the reasons for this variation.
2. The yellow corn crop is one of the most agricultural crops affected by the reasons of the variation in the cultivation of the sunflower crop, where it is turned out that all governorates that fall within the middle standard category are also within the standard category of the last attempt, this indicates the effect of the yellow corn crop on the cultivation of the sunflower crop, knowing that the two crops are oil crops that are included in many industries, especially the vegetable oils industry.
3. The agricultural investment of the sunflower crop is affected by a set of variables and not by a single variable. Through the attempts shown by the researcher and comparing them with the areas planted with sunflower, he was able to find that conclusion through the use of statistical criteria, with the exception of two variables: the labor force and the yellow corn crop.
4. There is a clear variation among the Iraqi governorates regarding the role of the independent variables under study, where the governorates of Babylon and Diyala are among the governorates most affected by the cultivation of the sunflower crop because they lay within the middle standard category, which shows the geographical distribution of the dependent variable on the areas planted with the sunflower crop in Iraq.

Study 4: ((An economic analysis of the production plans of the General Company for Food Products - the vegetable oils sector in Iraq)). This study was lectured by researcher Al-Akkabi in 2020 (**Al-Akkabi, 2020**). The problem of the study was that the current reality of the General Company for Food Products - the vegetable oils sector as a production unit indicates that it suffers from a weakness in the production planning processes and is not based on an accurate scientific method in determining the optimal production structure, which leads to the failure to optimally exploit the economic resources available to it, which led to a decrease in the actual amount of production from the available energies, as well as a decrease in the net return, which led to the appearance of a shortage in the size of commodity supply.

The study aimed to analyze the economic and financial reality of the vegetable oils sector in Iraq, and then study the proposed plan whose structure is based on the linear programming model in determining the optimal commodity composition for the vegetable oils sector for the year 2018 by maximizing the value of the objective function and increasing the company's profitability based on data obtained from the company. The research showed a number of results, perhaps the most important of which are: Proving the validity of the hypothesis of achieving high levels of production and profits, as well as the optimal allocation of available resources, where the quantity of production increased from 472.2 tons in the actual production plan (in 2018) to 973.6 tons in the derived plan using the linear programming method, an increase of about 106%.

V. Future Prospects for the Development of the Food Vegetable Oils Industry in Iraq

The spread and development of oil crops in Iraq is determined by the environmental and climatic conditions prevailing in the country. In Iraq, 90% of food vegetable oils are imported from abroad and 10% local oils are manufactured based on yellow corn, sunflower seeds and cotton⁴⁵, while the rest of the other oil crops such as soybeans, rapeseed, castorbean, safflower and others are still below the required level. Therefore, in order to improve and increase the local production of vegetable oils in the future, the following set of proposals has been formulated:

1. The main direction in the development of the Iraqi national economy should be towards strengthening the state sector by all means in industry and at the same level in agriculture. Only on these conditions will realistic introductions be made to the management of the planned economy, and there be advanced technology and scientific organization of work and management on a large scale in all the enterprises of the country.
2. The vegetable oil industry, which is of great importance for the economy of the country as a whole, can develop in the future on the basis of local sources of raw materials only with the aim of gradually stopping and then finally from importing expensive raw materials. In these conditions, it can be justified to completely change the cultivated lands in favor of expanding the cultivation of traditional oil crops in Iraq.
3. Attention should help in raising the yield and doubling the volume of production of oil crops, distinct and economically justified purchase prices for the seeds of these crops according to the percentage of oil and acidity in them.
4. The purpose of completing the economic shortage of oil crop seed manufacturing capacity is appropriate by re-establishing and supplying factories operating with modern equipment and machinery, as well as building factories to extract vegetable oils in appropriate governorates with high production capacities.
5. The modern stage of the development of the Iraqi industry, including the vegetable oil industry, is characterized by the fact that raising the efficiency of production is the main link determining the strategic direction in the country's economic progress. Achieving the goal set for intensifying the development of the vegetable oil industry can only be achieved if the technical level of production is strengthened; the maximum use of production capacities and the productivity of labor are raised to a large extent.
6. The important factor in solving the issues of effective development of the vegetable oil industry should be the study and use of the experience of the factories of developed countries to manufacture and process the seeds of oil crops towards rationalizing production management and planning and introducing high-productivity equipment, advanced technology and modern methods of scientific organization of work.

References

- [1]. Arabain Organization for Translation (AOT). 2014. Agricultural Research and Their Technologies. Edited by Christian Bondgaard and Luke Isaacsen, translated by Hatem Al-Najdi, first edition, Beirut, Lebanon.
- [2]. Al-Miqdad, F., Al-Janadi, O., and Al-Rifai, A. 2017. Analytical economic study of consumptual demand for vegetable oils in Damascus city. *Syrian Journal of Agricultural Research*, 4 (4): 27-38.
- [3]. Gulf Technical Committee for Food and Agricultural Products Specifications Sector. 2008. Eatable vegetable oils - Part Two. Working Papers, Standardization Organization for the Cooperation Council for the Arabain States of the Gulf, Kuwait.
- [4]. Sharabien, I. M. 2014. An economic study of the supply function response to oil crops in Egypt. *Assiut Journal of Agricultural Sciences*, 45 (5): 153-183.
- [5]. Al-Janabi, M. A. 1996. Introduction to field crop production. First edition, College of Agriculture and Forestry, University of Mosul, Higher Education and Scientific Research Press, Iraq.
- [6]. Muhammad, H. J. 2013. "Planning the production and marketing of liquid detergent products in the General Company for Vegetable Oils using linear programming" Master's Thesis, Department of Economics, College of Administration and Economics, University of Baghdad, Iraq.
- [7]. Al-Aqeedi, M. A. 2009. Estimating and Calculating the Quantity of Loss in Maize Crop in Iraq for the Marketing Season (2001/2002), *Al-Taqni Journal*, 22 (1): A62 - A49.
- [8]. Rizk, T. Y., and Ali, H. A. 1981. Oily and sugary crops. First Edition, Printing Press, Directorate of Dar Al-Kutub for Printing and Publishing, University of Mosul, Iraq.
- [9]. Tafiwi, H. A., and Rashid, R. H. 2000. Oil crops. First Edition, Press of Directorate of Dar Al-Kutub for Printing and Publishing, University of Mosul, Iraq.
- [10]. Al-Ma'ini, I. H., and Al-Obaidi, M. O. 2018. Scientific foundations for the management and production of field crops, first edition, College of Agriculture, Al-Qasim University and Al-Anbar University, Dar Al-Warith for printing and publishing, Iraq.
- [11]. Dahla, R. A. 2008. An economic analysis of both functions production and costs of maize crop in Wasit governorate. PhD thesis, Department of Agricultural Economics, College of Agriculture, University of Baghdad, Iraq.
- [12]. Al-Ansari, M. H. 1981. Field crop production. First Edition, Higher Education and Scientific Research Press, Dar Al-Kutub Press for Printing and Publishing, University of Mosul, Iraq.
- [13]. Al-Nuaimi, A. N., and etc. 1991. Summer crop production. First Edition, University of Mosul, Dar Al-Kutub for Printing and Publishing, Iraq.

- [14]. World Bank Group for Environment, Health and Safety. 2007. Environmental, Health and Safety Guidelines for the Processing of Vegetable Oils. <http://www.ifc.org/ifcext/sustainability.nsf/Content/EnvironmentalGuidelines>
- [15]. Al-Fawaz, M. S., 2008. Vegetable oils industry. Journal of Science and Technology / Food Industries, Part One, King Abdulaziz City for Science and Technology, year twenty-two, issue eighty-seven: 27-31.
- [16]. Al-Fadl, S., and Al-Taher, O. 2011. Vegetable food oils. Journal of Science and Technology/ Oils and Fats, Part One, King Abdulaziz City for Science and Technology, year twenty-fifth, issue 98: 22-27.
- [17]. Al-Younis, A. A., and Karkaji, A. A. 2017. Cultivation of oil crops in Iraq and its development. Chapter Four of the Book of Cultivating Industrial Crops in Iraq, First Edition, Dar Al-Kutub Establishment for Printing and Publishing, Iraq.
- [18]. National Agricultural Advisory Office. 2019. A farmer's guide to planting a sunflower. Mohamed Belaraby Alaoui Street, Al-Rabat, Morocco, www.onca.gov.ma
- [19]. Ghaylan, M. S., and Th. G. H. 2002. Response of the supply of areas planted with sunflower crop to changes in prices. Iraqi Agriculture Journal, Iraqi Ministry of Agriculture, 7 (5), special issue: 1-10.
- [20]. Hammadi, K. E. 2012. Spatial Variation of Sunflower Crop Cultivation in Iraq. Journal of the College of Basic Education, University of Babylon, Iraq, September (9): 228-258.
- [21]. Mudhi, A. A., and Saqab, A. M. 2006. Determine the optimum area of the farm (sesame crop as application model). Iraqi Journal of Agricultural Sciences, 37 (2) Supplement: 1-4.
- [22]. Kadhim, Z. R. 2005. An economic analysis of the most important factors affecting the supply response of sesame crop in Iraq. Iraqi Journal of Agricultural Sciences, 36 (6): 149-156.
- [23]. Al-Halfi, I. H. 2001. Effect of planting and cultivating date on yield and quality of peanuts. PhD thesis, College of Agriculture, University of Baghdad, Iraq.
- [24]. Jassim, A. M., and Kadhim, Z. R. 2006. Economic analysis of production cost functions and economies of scale for peanuts crop in Diyala governorate for the 2003 agricultural season. Iraqi Journal of Agricultural Sciences, 37 (2) Supplement: 11-22.
- [25]. Mustafa, S. A. 1981. Economic problems for the development of the vegetable oils industry in Iraq. PhD thesis, Institute of the Maritime Branch of Global Ocean Economy and Environment, Republic of Ukraine - Soviet Union.
- [26]. Safer, N. H. 1990. Oily and sugary crops. First Edition, College of Agriculture, University of Baghdad, Higher Education and Scientific Research Press, Iraq.
- [27]. Zanzel, H. Th. 2001. An economic study of the costs of producing the cotton crop and determining the optimum volume of production and the maximal volume of profit. Master thesis, Department of Agricultural Economics, College of Agriculture, University of Baghdad, Iraq.
- [28]. Abdul Al-Karim, F. M., and Habib, J. M. 2012. Estimating cost functions and economies of scale for the cotton crop for the 2009-2010 agricultural seasons. Iraqi Journal of Agricultural Sciences, 43 (2): 88-99.
- [29]. Farhan, M. A., and etc. 2003. Estimation of cost functions and economies of scale for the cotton crop in Salah al-Din governorate for the year 2000. Iraqi Journal of Agricultural Sciences, 34 (4): 1-12.
- [30]. Farhan, M. A. 2001. An economic analysis of the cost functions of the yellow maize crop in Wasit governorate for the year 1999. Iraqi Journal of Agricultural Sciences, 32 (3): 191 - 196.
- [31]. Al-Amin, M. 2019. Cultivation and production of yellow maize in Iraq. Agricultural Engineering Website <https://agronomie.info/>
- [32]. Al-Aqeedi, M. A., Imad, M., and Hanaa, M. 2005. Measuring the Efficiency of Agricultural Marketing Performance in Iraq for Yellow Maize Crop, Ministry of Agriculture, National Program for the Development of Maize Agriculture, Dar Books and Documentation, Baghdad, Deposit No. 178.
- [33]. Al- Akkabi, R. H. 2020. An economic analysis of the production plans of the General Company for Food Products – the Vegetable Oils Sector in Iraq. Master Thesis, College of Agricultural Engineering Sciences, University of Baghdad, Iraq.
- [34]. Al-Janabi, A. A. 1989. Food vegetable oils industry in Iraq. Master Thesis, College of Arts, University of Baghdad, Iraq.
- [35]. Ministry of Agriculture, Agricultural Research Department, Agricultural Economics Research Subdivision, Agricultural Crops Statistics Brochure for the period (1980 - 2015).
- [36]. Ministry of Agriculture, Planning and Follow-up Department, report on the production of oil crops in Iraq for the 2018 agricultural season.
- [37]. Ministry of Agriculture, Planning and Follow-up Department, report on the production of oil crops in Iraq for the 2019 agricultural season.
- [38]. Ministry of Planning - Central Statistical Organization - Department of Agricultural Statistics, The report of planted areas and production in Iraq for the year 2019.
- [39]. General Company for Food Products - Vegetable Oil Sector, final accounts and annual provisional balances for the period from 2016-2019.
- [40]. General Company for Food Products - Vegetable Oil Sector (Planning and Follow-up Section records) for the 2020 year.
- [41]. General Company for Food Products - Vegetable Oil Sector (Records of the Cost Accounts Department) for the 2020 year.
- [42]. General Company for Food Products - Vegetable Oil Sector (Records of the Human Resources Division) for the 2020 year.
- [43]. A set of reports of the General Company for Food Products - Vegetable Oil Sector for the year 2019.
- [44]. Jibreen, A. H. 1986. "Analysis of the Internal Rejection - An Applied Study in the General Firm for Vegetable Oils". Master's Thesis, College of Administration and Economics, University of Baghdad, Iraq.
- [45]. Ali, M. H. 2011. An economic analysis of maize production costs in the village of Al-Musaliyah, a field study 2010. Iraqi Journal of Agricultural Sciences, 42 (4): 83-92.

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