دراسة اقتصادية قياسية لمحددات الامن الغذائي في مصر

حسن السيد حسن عبد القادر(1)   د. عبدالله محمود عبدالمقصود (1)   د. إيمان فريد أمين قادوس (1)   د. هدى محمد صالح (2)
(1) قسم الاقتصاد الزراعي – كلية الزراعة – جامعة عين شمس – القاهرة – مصر
(2) معهد التخطيط القومي – القاهرة ـ مصر

المستخلص	بيانات البحث
تعتبر قضية الأمن الغذائي ذات أهمية بالغة في ظل المتغيرات العالمية والمحلية المعاصرة، بمكوناتها الاقتصادية والاجتماعية والسياسية والأمنية، ولقد باتت تحديات الأمن الغذائي اليوم هي التهديد الأول لكل الدول والشعوب. واستهدف البحث تشخيص وضعية الإنتاج الزراعي في مجال الغذاء ومدى قدرته على تحقيق الأمن الغذائي وكذلك دراسة الصادرات والواردات والانتاج والاستهلاك للسلع الزراعية وتحديد الأسباب الكاملة لمشكلة الغذاء وعدم تحقيق الأمن الغذائي، ومن ثم اقتراح بعض الحلول المستقبلية لحل المشكلة، ولاسيما في ظل مستجدات الحرب الروسية الاوكرانية وأثارها المتوقعة على اسعار الاعلاف، ومن ثم الانتاج الحيواني من ناحية ومخزون القمح الاستراتيجي من ناحية أخرى. وتتمثل مشكلة البحث في مدى قدرة الدولة على توفير وإتاحة إمدادات غذائية كافية للمواطنين، وإنما تمتد إلى الأوضاع الخاصة بمدى قدرة الأفراد في الحصول على الغذاء في ظل انخفاض نسبة الاكتفاء الذاتي من السلع الغذائية واستمرار تزايد الفجوة الغذائية، مما يؤثر سلباً على الأمن الغذائي المصري، ولاسيما في ظل الاثار المتوقعة للحرب الروسية الاوكرانية الراهنة، وبالرغم من زيادة الإنتاج الزراعي في الآونة الأخيرة إلا أن هذه الزيادة لا تتناسب مع الاحتياجات الاستهلاكية المتزايدة، مما يشير إلى اتساع الفجوة الغذائية من السلع الغذائية الاساسية ومع تزايد الأسعار العالمية للسلع الغذائية، فإن فئات واسعة من السكان محدودي الدخل ستواجه مشكلات حادة في قدرتها على الحصول على احتياجاتها الضرورية من الغذاء، مما يتطلب إلى استيراد الغذاء من الخارج لسد هذه الفجوة. واعتمد البحث لتحقيق أهدافه على التحليل الكمي وذلك باستخدام النماذج متعددة المعادلات (المعادلات الآنية) ويتكون النموذج من عدد (22) معادلة متداخلة مع بعضها بشكل متكامل، ولتحديد أهم المتغيرات ذات التأثير على الأمن الغذائي المصري، كما تم حساب بعض المؤشرات المتعلقة بحجم بدراسة الصادرات والواردات والانتاج والاستهلاك هذا بالإضافة إلى التنبؤ بالمجموعات الغذائية وهى تشمل (الحبوب ـ البقوليات ـ الخضر ـ الفاكهة ـ السكريات- الزيوت ـ اللحوم)، كما اعتمد البحث على مصادر البيانات الثانوية المنشورة كنشرات الميزان الغذائي لقطاع الشئون الاقتصادية وزارة الزراعة وعدد من النشرات الصادرة من المنظمة العربية للتنمية الزراعية.	

الباحث المسئول: حسن السيد حسن عبد القادر
البريد الإلكتروني: hassansayed5553@gmail.com

An econometric study of the determinants of food security in Egypt

Hassan El Sayed Hassan Abdelkadir (1)   **Dr. Abdallah Mahmoud Abdelmaqsoud(1)**

Dr. Eman Farid Amin Qadous (1)   **Dr. Hoda Mohamed Saleh (2)**

(1) Department of Agricultural Economics - Faculty of Agriculture - Ain Shams University - Cairo - Egypt

(2) Institute of National Planning - Cairo - Egypt

A R T I C L E   I N F O

A B S T R A C T

The research aimed at diagnosing the status of agricultural production in the field of food and its ability to achieve food security, as well as studying exports, imports, production and consumption of agricultural commodities and identifying the full causes of the food problem and the lack of food security, and then proposing some future solutions to solve the problem, especially in light of the developments of the Russian-Ukrainian war and its effects. The expected prices of feed, and then animal production on the one hand and the strategic wheat stock on the other hand.

The problem of the research is the extent to which the state is able to provide and make sufficient food supplies available to citizens, but it extends to the circumstances of the extent of individuals' ability to obtain food in light of the low rate of self-sufficiency in food commodities and the continued increase in the food gap, which negatively affects Egyptian food security, especially In light of the expected effects of the current Russian-Ukrainian war, and despite the recent increase in agricultural production, this increase is not commensurate with the increasing consumer needs, which indicates the widening of the food gap in basic food commodities and with the increase in international prices of food commodities, large groups of low-income populations It will face severe problems in its ability to obtain its necessary food needs, which requires the import of food from abroad to fill this gap.

To achieve its objectives, the research relied on quantitative analysis by using multiple equation models (simultaneous equations). The model consists of (22) equations that are integrated with each other in an integrated manner, and to determine the most important variables that affect Egyptian food security. Some indicators related to the volume of studies of exports and imports were also calculated. This production and consumption is in addition to predicting the food groups, which include (cereals - cereals - vegetables - fruits - sugars - oils - meat).

Corresponding Author: Hassan El Sayed Hassan Abdelkadir

Email: hassansayed5553@gmail.com

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Introduction:

Egyptian food security is considered one of the important topics of great interest that is increasing as a result of many factors that surround the supply of food and the demand for it, and the issue of food is no longer only important, but its dimensions have mixed and overlapped with political and strategic trends and severe international repercussions, especially in light of the increasing rates of population growth and what it entails. From pressures on the available resources of agricultural land and water resources, the quantity and quality of the food supply in Egypt is affected by many determinants that affect the performance of the agricultural sector, as well as the risks of shifting the uses of food commodities to produce biofuels, a shift that threatens the present and future of the available commodities for food uses.

Research problem

The problem of the research is the extent of the state's ability to provide and make available sufficient food supplies to citizens, but it extends to the circumstances of the extent of individuals' ability to obtain food in light of the low rate of self-sufficiency in food commodities and the continued increase in the food gap, which negatively affects Egyptian food security, especially in light of the expected effects of the current Russian-Ukrainian war, and despite the recent increase in agricultural production, this increase is not commensurate with the increasing consumer needs, which indicates the increasing of the food gap of basic food commodities. On its necessary food needs, which requires the import of food from abroad to fill this gap

Research objective

The research aims at diagnosing the status of agricultural production in the field of food and its ability to achieve food security, as well as studying exports, imports, production and consumption of agricultural commodities, identifying the full causes of the food problem and the lack of food security, and then proposing some future solutions to solve the problem, especially in light of the developments of the Russian-Ukrainian war.

Research method and data sources

To achieve its objectives, the research adopted quantitative analysis by using multiple equations models (simultaneous equations models). In addition to predicting food groups, which include (cereals - cereals - vegetables - fruits - sugars - oils - meat), the research also relied on secondary data sources published as the Food Balance Bulletins of the Economic Affairs Sector of the Ministry of Agriculture and a number of bulletins issued by the Arab Organization for Agricultural Development.

Description of the econometric simultaneous model equations for food security groups in Egypt

First: demand functions

The demand side of the simultaneous model consists of two equations, consumption and exports, where the first equation includes the factors affecting consumption, while the second equation includes the factors affecting the quantity of exports. These equations can be clarified in the following mathematical form

Consumption equation1-

$Y_4 = f(Y_{2(t-1)}, Y_3, Y_4, Y_5, Y_6, Y_7)$	(1 - 1) Cereals consumption equation
Y_4	**Consumption of cereals in thousand tons**
$Y_{2(t-1)}$	**Production of cereals in thousand tons last year**
Y_{12}	**Quantity of exports of cereals in thousand tons**
Y_5	**The quantity of cereals imports, thousand tons**

Y₆	Production quantity of cereals in thousand tons
Y₇	Amount of consumption of cereals in thousand tons

$Y_7 = f(Y_3, x_7, Y_8, x_8, Y_9, Y_6)$ **(1 - 2) The consumption equation for cereals**

Y₇	Amount of consumption of cereals in thousand tons
Y₃	Amount of consumption of cereals in thousand tons
X₇	Wheat area in acres
Y₈	Amount of consumption of vegetables in thousand
X₈	Amount of consumption of vegetables in thousand
X₉	Citrus area in acres
Y₆	Production quantity of cereals in thousand tons

$Y_{14} = f(x_{20}, Y_{15}, Y_9)$ **(1 - 3) Fruit consumption equation**

Y₁₄ₜ	Consumption of fruit in thousand tons
X₂₀	Retail price of mango in dollars per ton
Y₁₅₍ₜ₋₁₎	Fruit production in thousand tons in the previous year
Y₉	Production of vegetables in thousand tons

$Y_{20} = f(Y_{21(t-1)}, Y_3, Y_3, Y_4)$ **(1 - 4) Sugar consumption equation**

Y₂₀	Consumption of sugars in thousand tons
Y₂₁₍ₜ₋₁₎	. Production quantity of sugars in thousand tons in the previous year
Y₃	Production quantity of cereals in thousand tons
Y₄	Amount of consumption of cereals in thousand tons

$Y_{23} = f(x_4, Y_{13}, Y_3, Y_4)$ **(1 - 5) Oil consumption equation**

Y₂₃	Consumption of oils in thousand tons
X₄	Population in thousand people
Y₁₃	The amount of cereals imports in thousand tons
Y₃	Production quantity of cereals in thousand tons
Y₄	Amount of consumption of cereals in thousand tons

$Y_{25} = f(x_2, Y_{24(t-1)}, Y_{13}, Y_3)$ **(1 - 6) Meat consumption equation**

Y₂₅	Consumption of meat
X₂	Egypt's national income in dollars
Y₂₄₍ₜ₋₁₎	Amount of meat production in the previous year
Y₁₃	The amount of cereals imports in thousand tons
Y₃	Production quantity of cereals in thousand

2 -Export equations

$Y_1 = f(x_3, Y_6, Y_8)$ **(2 - 1) Export equation for cereals**

Y₁ₜ	Quantity of cereals exports in thousand tons
X₃	Exchange rate in pounds to dollars
Y₆ₜ	Production quantity of cereals in thousand tons
Y₈ₜ	Production quantity of vegetables in thousand tons

$Y_{12} = f(x_2, Y_{11}, Y_{10})$	(2 - 2)Export equation for cereals
Y_{12t}	Quantity of exports of cereals in thousand tons
X_2	Egypt's national income in dollars
Y_{11t}	The amount of exports of vegetables in thousand tons
Y_{10t}	The amount of imports for the waist in thousand tons

$Y_{11} = f(x_1, Y_1, Y_{13}, x_9)$	(2 - 3) Equation of exports for vegetables
Y_{11t}	The amount of exports of vegetables in thousand tons
X_1	Export price of vegetables in dollars per ton
Y_1	Quantity of cereals exports in thousand tons
Y_{13}	The amount of cereals imports in thousand tons
X_9	Area in acres for onions

$Y_{16} = f(X_2, Y_{10}, Y_9)$	(2 - 4) Equation of exports for fruits
Y_{16}	Quantity of exports of fruit in thousand tons
X_2	Egypt's national income in dollars
Y_{10}	Imports of vegetables in thousand tons
Y_9	Quantity of exports of fruit in thousand tons

Second: Display functions:

The supply side of the simultaneous model consists of two equations of production and imports. The first equation includes the factors affecting production, while the second equation includes the factors affecting the quantity of imports. These equations can be clarified in the following mathematical form

-Production equations3

$Y_3 = f(X_8, X_{14}, X_{16}Y_4)$	(3 - 1) The production equation for cereals
Y_3	Production quantity of cereals in thousand tons
X_8	Production quantity of cereals in thousand tons
X_{14}	Hours of tractors for cereals
X_{16}	Amount of phosphate fertilizers for cereals
Y_4	Quantity of exports of cereals in thousand tons

$Y_9 = f(X_{15}, Y_1, Y_3, Y_{12})$	(3 - 2) The production equation for vegetables
Y_9	Production quantity of vegetables in thousand tons
X_{15}	Amount of nitrogen fertilizer for vegetables
Y_1	Quantity of cereals exports in thousand tons
Y_3	Production quantity of cereals in thousand tons
Y_{12}	Quantity of exports of cereals in thousand tons

$Y_{15} = f(x_{11}, x_{15}, Y_9)$	(3 - 3) Fruit production equation
Y_{15}	Fruit production in thousand tons
X_{11}	The mango area in acres
X_{15}	The amount of nitrogen fertilizer for fruits
Y_9	Amount of vegetable production in thousand tons

$Y_{21} = f(x_{13}, Y_{13}, Y_3, Y_4)$	**(3 - 4) Production equation for sugars**
Y_{21}	**Amount of sugar production in thousand tons**
X_{13}	**The amount of nitrogen fertilizers**
Y_{13}	**The amount of cereals imports in thousand tons**
Y_3	**Production quantity of cereals in thousand tons**
Y_4	**Amount of consumption of cereals in thousand tons**

$Y_{24} = f(x_7, x_{10}, Y_1)$	**(3 - 5) Meat production equation**
Y_{24}	**Production quantity of meat in thousand tons**
X_7	**Total dry straws (thousand tons)**
X_{10}	**The total area of green fodder crops in thousand acres**
Y_1	**Quantity of cereals exports in thousand tons**

4- Import equations

$Y_{13} = f(x_5, Y_{12}, Y_6, Y_{21}, Y_{22})$	**(4-1) Equation of imports for cereals**
Y_{13}	**Cereals imports in thousand tons quantity**
X_5	**Import price in dollars**
Y_{12}	**Quantity of exports of cereals in thousand tons**
Y_6	**Production quantity of cereals in thousand tons**
Y_{21}	**Production quantity of sugars in thousand tons**
Y_{22}	**The quantity of oil imports in thousand tons**

$Y_5 = f(x_4, Y_{10}, Y_9)$	**(4 - 2) The equation for imports of cereals**
Y_5	**Amount of imports of cereals in thousand tons**
X_4	**Population in thousand people**
Y_{10}	**The amount of imports for the waist in thousand tons**
Y_9	**The amount of imports for the waist in thousand tons**

$Y_{10} = f(x_2, x_7, x_{15}, Y_{9(t-1)})$	**(4 - 3) The equation for imports of vegetables**
Y_{10}	**The quantity of vegetables imports, in thousand tons**
X_2	**Egypt's national income in dollars**
X_7	**Beans area in thousand acres**
X_{15}	**Amount of nitrogen fertilizer for vegetables**
$Y_{9(t-1)}$	**The amount of production of vegetables in thousand tons in the previous year.**

$Y_{17} = f(Y_{10}, Y_9, Y_{19})$	**(4 - 4) Equation of imports for fruits**
Y_{17}	**Vegetable production in thousand tons**
Y_{10}	**The quantity of vegetables imports in thousand tons**
Y_9	**Vegetable production in thousand tons**
Y_{19t}	**Imports of sugars, in thousand tons, quantity**

$Y_{20} = f(X_5, Y_{20(t-1)}, Y_3, Y_4, D_1)$	**(4 - 5) Equation of imports for sugars**
Y_{20}	**The amount of imports of sugars in thousand tons quantity**

X_3	exchange rate
$Y_{20(t-1)}$	The amount of sugar imports in thousand tons in the previous year
Y_{13}	The amount of cereals imports in thousand tons
Y_4	Amount of consumption of cereals in thousand tons
D_1	implicit variable world trade area

$Y_{22} = f(x_2, Y_3, Y_{23}, Y_{24}, D_2)$	(4 - 6) Equation of imports of oils
Y_{22}	Imported quantity of oils
X_2	Egypt's national income in dollars
Y_{3t}	Production quantity of cereals in thousand tons
Y_{23}	Meat production in thousand tons
Y_{24}	Production of oils in thousand tons
D_2	Implicit Variable Mercosur

$Y_{26} = f(x_3, Y_{25(t-1)}, Y_3, Y_4)$	(4 - 7) Meat Import Equation
Y_{26}	Import equation:
X_3	exchange rate
$Y_{25(t-1)}$	Amount of consumption of meat in thousand tons in the previous year.
Y_3	Production quantity of cereals in thousand tons
Y_4	Amount of consumption of cereals in thousand tons

The results of the econometric assessment of the parameters of the simultaneous model for food security in Egypt:

The results of the statistical assessment of the econometric simultaneous model of food security in Egypt in Table (1) showed that the increase in $Y_{2(t-1)}$ the quantity of production of cereals in the previous year in thousand tons, Y_{12} the quantity of exports of cereals   in thousand tons, Y_7 the quantity of consumption of cereals   in thousand tons, Y_3 the quantity of Production of cereals in thousand tons, Y_8, the amount of consumption of vegetables in thousand tons, X_9 the area of citrus in acres, Y_6 the amount of production of cereals   in thousand tons, Y_5 (t-1) the amount of production of fruits in the previous year in thousand tons, Y_9 the amount of production of vegetables in thousand tons, $Y_{21}(t-1)$ The quantity of production of sugars in the previous year in thousand tons, Y_4, the quantity of consumption of cereals   in thousand tons, X_2 the national income of Egypt in dollars, $Y_{24}(t-1)$ the quantity of production of meat in the previous year in thousand tons, Y13, the quantity of imports of cereals in thousand tons) by 1% leads to an increase in consumption for groups The food components of the Egyptian food security model ranged between (0.04% - 3.89%) with an engineering average of about (0.34%) during the study period (1990 – 2020).

While the results indicated that (Y_5, the quantity of imports of cereals   in thousand tons, Y6, the quantity of production of cereals   in thousand tons, X_7 the area of wheat in acres, X_8 the area for beans in acres, X_{20} the retail price of mangoes in dollars per ton, Y_3 the quantity of production of cereals in thousand tons, X_4 the number of people per thousand people, Y_{13}, the quantity of imports of cereals in thousand people, Y_{13} tons) by 1% leads to a decrease in consumption of the food groups that make up the Egyptian food security model by about (0.04% - 2.46%) with a geometric average of about (0.55%) during the study period (1990 - 2020). Where the statistical significance was fixed at the level of 0.05, as was the significance of the model as a whole.

The results also showed that the coefficient of determination adjusted by the equations of the simultaneous model ranged between (54% - 93%) with a geometric mean (75.7%) of the changes

occurring in consumption of the food groups that make up the food security model due to the change in the independent variables under study, which are referred to in each equation From the equations of the estimated simultaneous model.

While the results of the statistical assessment of the econometric simultaneous model for food security in Egypt in Table (1) showed that the increase in (X_3) the exchange rate in pounds to the dollar, X_2 the national income of Egypt in dollars, Y_{11} the amount of exports of vegetables in thousand tons, X_1 the export price of vegetables in dollars per ton, Y_1 The quantity of exports of cereals in thousand tons, Y_{13}, the quantity of imports of cereals in thousand tons, X_9 the area of onions in acres, X_2 the national income of Egypt in dollars, Y_{10}, the quantity of imports of vegetables in thousand tons, Y_9, the quantity of production of vegetables in thousand tons) by 1% leads to an increase in exports of the food groups constituting the Egyptian food security model by about It ranged between (0.21% - 1.50%) with a geometric mean of about (0.45%) during the study period (1990 – 2020).

While the results indicated that an increase in (Y_6, the quantity of legume production in thousand tons, Y_8, the quantity of production of vegetables in thousand tons, Y_{10}, the quantity of imports per thousand tons) by 1% leads to a decrease in exports of the food groups that make up the Egyptian food security model by about (0.24% - 1.51%) with an engineering average of about (0.48%) during the study period (1990 - 2020). Where the statistical significance was fixed at the level of 0.05, as was the significance of the model as a whole.

The results also showed that the coefficient of determination adjusted by the equations of the simultaneous model ranged between (52% - 84%) with a geometric mean (67.7%) of the changes occurring in the exports of the food groups constituting the food security model due to the change in the independent variables under study, which are referred to in each equation From the equations of the estimated simultaneous model.

The results of the statistical estimation of the simultaneous econometric model for food security in Egypt in Table (1) showed that the increase in (X_{14} the number of hours of tractors used for cereals , X_{16} the amount of phosphate fertilizers used for cereals , Y_4 the amount of exports for cereals in thousand tons, Y_3 the quantity of production for cereals in thousand tons, Y_{12} the amount of exports For cereals in thousand tons, X_{11} the area for mangoes in acres, X_{15} the amount of nitrogen fertilizer used for fruits, Y_9, the quantity of production for vegetables in thousand tons, X_{13} the quantity of nitrogenous fertilizers used for sugars, Y_4 the quantity of consumption for cereals in thousand tons, $Y1$ the quantity of exports for cereals in thousand tons) by 1% leads to an increase in production for the constituent food groups The Egyptian food security model ranged between (0.06% - 4.24%) with an engineering average of about (0.35%) during the study period (1990 – 2020).

While the results indicated that an increase in (X_8 the agricultural price of beans in dollars per ton, $X15$ the quantity of nitrogen fertilizers used for vegetables, Y_1 the quantity of exports of cereals in thousand tons, Y_{13} the quantity of imports of cereals in thousand tons, Y_3 the quantity of production of cereals in thousand tons, X_7 the total quantity of dry straws in thousand tons, X_{10} the total area of Green fodder crops per thousand feddans) by 1% leads to a decrease in production for the food groups that make up the Egyptian food security model by about (0.03% - 3.48%) with a geometric average of about (0.24%) during the study period (1990 - 2020). Where the statistical significance was fixed at the level of 0.05, as was the significance of the model as a whole.

The results also showed that the coefficient of determination adjusted by the equations of the simultaneous model ranged between (58% - 95%) with a geometric mean (76.1%) of the changes occurring in production for the food groups constituting the food security model due to the change in the independent variables under study, which are referred to in each equation From the equations of the model

equation number	Estimated equation	Statement
	Table (1): Results of the econometric assessment of the parameters of the simultaneous model of food security in Egypt during the period (1990 – 2020)	
1	$\ln Y_4 = 8.43 + 0.10 \ln Y_{2(t-1)} + 0.12 \ln Y_{12} - 0.04 \ln Y_5 - 0.19 \ln Y_6 + 0.27 \ln Y_7$ (6.71) (2.90) (6.38) (-1.98) (-7.23) (10.02) $R^2 = 0.89$ $R^{-2} = 0.87$ D.W=1.91	consumption of cereals
2	$\ln Y_7 = 14.45 + 0.69 \ln Y_3 - 1.57 \ln X_7 + 0.10 \ln Y_{8t} - 0.35 \ln X_8$ $+ 0.58 \ln X_9 + 0.90 \ln X_6$ (2.96) (2.73) (- 4.28) (3.92) (-4.34) (7.71) (31.54) $R^2 = 0.88$ $R^{-2} = 0.85$ D.W=1.32	consumption of cereals
3	$\ln Y_{14} = 3.41 - 0.27 X_{20} + 0.20 \ln Y_{15(t-1)} + 0.60 \ln Y_9$ (3.70) (-5.13) (8.08) (5.81) $R^2 = 0.68$ $R^{-2} = 0.64$ D.W=1.01	consumption of fruit
4	$\ln Y_{20} = - 4.17 + 0.69 Y_{21(t-1)} - 0.98 \ln Y_3 + 0.78 \ln Y_4$ (2.44) (19.71) (-3.68) (3.07) $R^2 = 0.93$ $R^{-2} = 0.93$ D.W=1.45	Consumption of sugars
5	$\ln Y_{23} = -3.17 - 2.46 X_4 - 0.75 \ln Y_{13} - 2.29 \ln Y_3 + 3.89 \ln Y_4$ (-1.14) (2.46) (-10.56) (-5.45) (11.56) $R^2 = 0.60$ $R^{-2} = 0.54$ D.W=1.41	consumption of oils
6	$\ln Y_{25} = -3.43 + 0.04 \ln X_2 + 0.52 \ln Y_{24(t-1)} + 0.15 \ln Y_{13} + 0.44 \ln Y_3$ (-2.94) (2.62) (11.37) (3.96) (3.17) $R^2 = 0.81$ $R^{-2} = 0.79$ D.W=1.30	consumption of oils
7	$\ln Y_1 = -11.06 + 0.41 \ln X_3 - 0.31 \ln Y_6 - 1.51 \ln Y_8$ (-5.16) (3.24) (4.25) (-5.77) $R^2 = 0.57$ $R^{-2} = 0.52$ D.W=1.52	exports of cereals
8	$\ln Y_{12} = -10.34 + 0.21 \ln X_2 + 1.50 \ln Y_{11} - 0.24 \ln Y_{10}$ (-6.71) (2.90) (10.02) (-2.33) $R^2 = 0.85$ $R^{-2} = 0.84$ D.W=1.78	exports of cereals
9	$\ln Y_{11} = - 4.80 + 0.24 \ln X_1 + 0.40 \ln Y_1 + 0.45 \ln Y_{13} + 0.23 \ln Y_9$ (-4.44) (9.16) (4.96) (4.96) (5.18) $R^2 = 0.66$ $R^{-2} = 0.61$ D.W=1.34	exports of vegetables
10	$\ln Y_{16} = -17.20 + 0.40 \ln X_2 + 0.50 \ln Y_{10} + 1.23 \ln Y_9$ (-5.64) (5.24) (4.67) (4.20) $R^2 = 0.81$ $R^{-2} = 0.79$ D.W=1.71	exports of fruit
11	$\ln Y_3 = 4.14 - 0.24 \ln X_8 + 0.49 \ln X_{14} + 0.06 \ln X_{16} + 0.10 \ln Y_4$ (2.91) (-7.39) (4.14) (5.43) (6.08) $R^2 = 0.80$ $R^{-2} = 0.77$ D.W=1.51	production of cereals
12	$\ln Y_9 = -1.93 - 0.03 \ln X_{15} - 0.10 \ln Y_1 + 1.10 \ln Y_3 + 0.05 \ln Y_{12}$ (-1.69) (-4.76) (-4.56) (9.02) (3.30) $R^2 = 0.80$ $R^{-2} = 0.77$ D.W=1.36	production of vegetables
13	$\text{Ln}_{15} = 0.40 + 0.36 \ln X_{11} + 0.07 \ln X_{15} + 0.20 \ln Y_9$ (6.01) (11.99) (13.01) (5.01) $R^{-2} = 0.94$ $R^2 = 0.95$ D.W=2.34	production of fruit
14	$\ln Y_{21} = 0.071 + 0.17 \ln X_{13} - 0.30 \ln Y_{13} - 3.48 \ln Y_3 + 4.24 \ln Y_4$ (0.24) (6.33) (-3.31) (-8.04) (9.77)	production of sugars

equation number	Estimated equation	Statement
	$R^2 = 0.81$ $R^{-2} = 0.78$ D.W=1.39	
15	$\ln Y_{24} = 11.15 - 0.73X_7 - 0.08\ln X_{10} + 0.52\ln Y_1$ (13.32) (-9.56) (-1.67) (8.72) $R^2 = 0.62$ $R^{-2} = 0.58$ D.W=1.68	production of meat
16	$\ln Y_{13} = 8.82 - 0.27\ln X_5 + 0.08\ln X_{12} + 0.54\ln Y_6 + 0.48\ln Y_{21} - 0.83\ln Y_{22}$ (17.51) (-5.15) (1.84) (5.75) (5.52) (-7.57) $R^2 = 0.52$ $R^{-2} = 0.43$ D.W=2.36	imports of cereals
17	$\ln Y_5 = -7.29 + 0.05\ln X_4 + 0.33\ln Y_{10} + 1.23\ln Y_9$ (-2.53) (1.50) (3.12) (3.66) $R^2 = 0.43$ $R^{-2} = 0.36$ D.W=1.39	imports of cereals
18	$\ln Y_{10} = -29.60 + 1.11\ln X_2 + 0.26\ln X_7 - 0.24\ln X_{15} + 0.12\ln Y_{9(t-1)}$ (-4.06) (5.50) (1.27) (-3.95) (2.04) $R^2 = 0.64$ $R^{-2} = 0.59$ D.W=1.53	imports of vegetables
19	$\ln Y_{17} = -22.05 + 0.53\ln Y_{10} + 2.84\ln Y_9 - 0.24\ln Y_{19}$ (-8.46) (7.65) (10.12) (-6.95) $R^2 = 0.75$ $R^{-2} = 0.72$ D.W=1.18	imports of fruit
20	$\ln Y_{20} = -6.94 - 0.80\ln X_3 - 1.77\ln Y_{20(t-1)} + 2.69\ln Y_4 + 0.07\ln D_1$ (-0.79) (-2.06) (-12.65) (3.07) (0.24) $R^2 = 0.88$ $R^{-2} = 0.87$ D.W=1.22	Imports of sugars
21	$\ln Y_{22} = -8.20 + 0.15\ln X_2 + 1.72\ln Y_3 - 0.25\ln Y_{23} - 0.82\ln Y_{24} - 0.002\ln D_2$ (-2.29) (2.48) (4.12) (-3.50) (-3.81) (0.01) $R^2 = 0.57$ $R^{-2} = 0.49$ D.W=1.50	Imports of oils
22	$\ln Y_{26\,t} = -7.22 - 0.46\ln X_3 + 0.66\ln Y_{25(t-1)} + 1.98\ln Y_3 + 1.76\ln Y_4$ (-2.66) (-3.04) (14.19) (-2.96) (4.78) $R^2 = 0.93$ $R^{-2} = 0.92$ D.W=1.72	Imports of meat

Source: collected and calculated from the tables (1,2,3,4,5,6,7) in the appendices.

Using simultaneous models to predict the expected future values of Egyptian food security

The simultaneous models depend on an explicit rule regarding all explanatory variables that explain the behavior of the phenomenon, and based on the economic theory by identifying all the variables that enter into the interpretation of the phenomenon in the form of an estimable mathematical model. Using the proposed econometric model in estimating the expected values of the internal variables included in the model

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Predicting the behavior of the variables of the simultaneousmodel:

The future expectations of economic conditions are useful in determining the state's policy and necessary directions in line with the current situation, as it is possible to identify the future economic situation of agricultural commodities so that the state can achieve food security for citizens. The proposed econometric model was used to estimate the expected values of the internal variables included in the model.

Forecasting the expected future values of cereals:-

It is clear from Table (1) that the average cereals exports, imports and   consumption during the period (2023-2027) amounted to about 181.074,13808.45,189920.51,2652.86 thousand tons, respectively.

Forecasting the expected future values of cereals :-

It is evident from Table (2) that the average exports, imports and consumption of cereals   during the period (2023-2027) amounted to about 159.24, 21618.09, 444505.26 thousand tons, respectively.

Forecasting the expected future values of vegetables:-

It is evident from Table (3) that the average exports, imports and production of vegetables during the period (2023-2027) amounted to about 205,760.74,9531,684,20529.89 thousand tons, respectively

Predicting the expected future values of the fruit:-

It is evident from Table (4) that the average exports, imports, production and consumption of fruits during the period (2023-2027) amounted to about 15600.88,36143.88,87638.22,10555.52 thousand tons, respectively

Predicting the expected future values of sugars:-

It is evident from Table (5) that the average imports, production and consumption of sugar during the period (2023-2027) amounted to about 9229.76, 33095.50, 36836.02 thousand tons, respectively

Predicting the expected future values of oils and fats:-

It is evident from Table (6) that the average imports and consumption of oils and fats during the period (2023-2027) amounted to about 83,169.49,79408.8 thousand tons, respectively

Predicting the expected future values of meat:-

It is evident from Table (7) that the average exports, imports, production and consumption of meat during the period (2023-2027) amounted to about 4373.55,9535.36,10319.90 thousand tons, respectively

Table (1): Forecasting the demand and supply of a group of cereals in thousand tons During the period (2023 – 2027)

Model	Amount of exports, thousand tons	Amount of imports in thousand tons	Production in thousand tons	Consumption in thousand tons
Period	Forecast	Forecast	Forecast	Forecast
2023	51.47	13020.61	4449.57	3008.15
2024	48.30	13414.54	4586.08	3055.35
2025	45.12	13808.45	4722.59	3102.55
2026	41.95	14202.37	4859.10	3149.76
2027	38.78	14596.29	4995.60	3196.95
average	45.125	13808.45	4722.59	12955.20

Source: Table No. (1,2,3,4, 5,6,7) in the appendices.

Table (2): Forecasting the demand and supply of a group of cereals   in thousand tons During the period (2023 - 2027)

Model	Amount of exports, thousand tons	Amount of imports in thousand tons	Consumption in thousand tons
Period	**Forecast**	**Forecast**	**Forecast**
2023	100.32	**21038.64**	415573.45
2024	128.70	**21329.92**	430039.04
2025	157.09	**21621.02**	444505.14
2026	196.27	**21897.40**	458971.24
2027	213.86	**22203.48**	473437.41
average	**159.24**	**21618.09**	**444505.26**

Source: Table No. (1,2,3,4, 5,6,7) in the appendices.

Table (3): Forecasting the demand and supply of vegetables in thousand tons During the period (2023 – 2027)

Model	Amount of exports, thousand tons	Amount of imports in thousand tons	Production in thousand tons
Period	**Forecast**	**Forecast**	**Forecast**
2023	**5993.60**	**13547.77**	**20570.61**
2024	**6080.01**	**11539.73**	**20550.25**
2025	**6166.43**	**9531.68**	**20530.02**
2026	**6252.84**	**7523.64**	**20509.49**
2027	**6339.26**	**5515.60**	**20489.07**
average	**25760.74**	**9531.684**	**20529.89**

Source: Table No. (1,2,3,4, 5,6,7) in the appendices.

Table (4): Forecasting the demand and supply of the fruit group in thousand tons During the period (2023 – 2027)

Model	Amount of exports, thousand tons	Amount of imports in thousand tons	Production in thousand tons	Consumption in thousand tons
Period	**Forecast**	**Forecast**	**Forecast**	**Forecast**
2023	**15357.35**	**35579.94**	**83617.85**	**10319.07**
2024	**15476.91**	**35864.38**	**85627.93**	**10437.31**
2025	**15596.33**	**36148.54**	**87638.37**	**10555.50**
2026	**15738.39**	**36409.12**	**89648.44**	**10673.74**
2027	**15835.44**	**36717.41**	**91658.52**	**10791.97**
average	**15600.88**	**36143.88**	**87638.22**	**10555.52**

Source: Table No. (1,2,3,4, 5,6,7) in the appendices.

Table (5): Forecasting the demand and supply of sugars in thousand tons During the period (2023 – 2027)

Model	Amount of imports in thousand tons	Production in thousand tons	Consumption in thousand tons
Period	Forecast	Forecast	Forecast
2023	9130.40	31253.7	35275.30
2024	9180.10	32174.6	36055.64
2025	9229.80	33095.5	36836.05
2026	9279.40	34016.4	37616.38
2027	9329.10	34937.3	38396.72
average	9229.76	33095.50	36836.02

Source: Table No. (1,2,3,4, 5,6,7) in the appendices.

Table (6): Forecasting the demand and supply of a group of oils in thousand tons During the period (2023 – 2027)

Model	Amount of imports in thousand tons	Consumption in thousand tons
Period	Forecast	Forecast
2023	77733.17	24999.8
2024	79092.34	32078.5
2025	80451.33	45233.3
2026	81810.33	58329.4
2027	83169.49	79408.8
average	80451.33	48009.96

Source: Table No. (1,2,3,4, 5,6,7) in the appendices.

Table (7): Forecasting the demand and supply of meat group in thousand tons During the period (2023 – 2027)

Model	Amount of imports in thousand tons	Production in thousand tons	Consumption in thousand tons
Period	Forecast	Forecast	Forecast
2023	656.05	294.02	1581.63
2024	671.39	276.78	1598.95
2025	686.72	2595.33	1616.27
2026	702.06	2422.90	1633.60
2027	717.40	2250.48	1650.92
average	4373.55	9535.36	10319.90

Source: Table No. (1,2,3,4, 5,6,7) in the appendices.

Recommendations:

In light of the previously obtained results, the study recommends the following:

1- Educating citizens about the need to rationalize consumption and not waste quantities of food.
2- Conducting awareness programs to reduce population growth.
3- Establishing joint projects Establishing projects related to land reclamation to achieve food security.
4- Contracting with farmers and targeting increased production of strategic crops.
5- Reconsidering the price policy of crops and for farmers to obtain a price that will achieve a rewarding return for them and encourage them to continue farming.
6- Taking into account the appropriate time for planting to avoid infection with fungal and insect diseases.
7- Encouraging the provision of soft loans to farmers to set up investment projects for raising and fattening farm animals.
8- Providing agricultural inputs of fertilizers, pesticides and good seeds to farmers.
9- Work to establish an infrastructure of roads, transportation, means of transport and storage of agricultural crops.
10- Attention to open marketing outlets internally and externally, while working to reduce the cost of marketing.
11- Encouraging the use of modern irrigation methods and staying away from traditional irrigation methods.
12- Increasing investments directed at agriculture and taking the necessary legislative and administrative measures.

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Appendices

Table(1)

Farm price of beans in dollars	Export Quantity of Cereals	Imported quantity of oils	production of sugars	Import price in dollars for cereals	vegetable production	exchange rate	years
252.865	4.060	770.120	863.850	185.533	9295.000	2.730	1990
279.433	6.020	777.220	948.480	149.344	9175.000	3.140	1991
318.694	3.240	760.860	984.360	133.270	9682.000	3.320	1992
308.137	9.000	354.750	924.380	845.953	9654.410	3.350	1993
293.082	5.350	186.190	1011.280	120.039	8069.330	3.390	1994
300.695	18.020	648.300	1041.000	161.716	8969.340	3.390	1995
321.629	11.160	488.120	1297.630	206.447	10454.040	3.390	1996
357.789	12.990	421.250	1355.940	162.131	10926.490	3.390	1997
363.498	11.490	468.478	1073.980	142.254	14061.820	3.390	1998
368.121	13.860	667.950	1067.300	140.296	15257.810	3.400	1999
360.695	34.360	459.860	1163.320	130.430	15356.300	3.470	2000
315.268	49.170	599.740	1357.920	127.513	13500.640	3.970	2001
282.437	31.100	449.420	1403.000	136.681	14396.690	4.500	2002
240.419	20.840	313.260	1403.000	128.196	17490.180	5.850	2003
341.311	32.410	948.010	1402.130	162.784	15285.170	6.200	2004
371.693	38.756	1218.641	1553.926	147.576	17146.861	5.780	2005
390.700	40.416	1273.726	1553.926	164.050	18093.611	5.730	2006
447.094	15.278	552.360	1553.926	245.064	18093.611	5.640	2007
690.311	63.660	552.420	1553.930	245.064	20104.450	5.430	2008
666.085	138.340	615.050	1481.200	413.986	21920.420	5.550	2009
660.085	235.560	632.190	1988.280	227.684	19937.980	5.620	2010
648.425	58.360	966.120	2057.880	319.565	18388.760	5.930	2011
759.574	119.780	728.947	2057.882	475.254	18034.141	6.090	2012
722.343	107.580	872.510	2104.280	481.450	18883.120	6.520	2013
310.283	176.700	2254.100	2114.200	3851.000	19610.000	7.078	2014
333.724	126.500	1097.800	2182.600	4392.000	17031.700	7.691	2015
337.737	161.200	2336.200	2021.100	3823.000	19067.000	10.025	2016
410.992	202.000	1613.000	26283.000	4417.000	12015.000	17.783	2017
694.457	159.000	1778.000	25759.000	4236.000	11821.000	17.740	2018
977.922	150.000	1133.000	28070.000	4249.000	12223.000	15.730	2019
1261.387	141.000	1028.000	28491.000	4132.667	12227.667	15.032	2020

Source: Compiled and calculated from-:

-Yearbook of Arab Agricultural Statistics, Arab Organization for Agricultural Development, miscellaneous issues.

Arab Agricultural Statistics Yearbook, Central Agency for Public Mobilization and Statistics, miscellaneous issues.

-Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Central Administration of Economy. Agricultural Economic Bulletin of Agricultural Economics, miscellaneous issues.

Table(2)

years	Hours of tractors for cereals	Amount of phosphate fertilizers for cereals	Amount of consumption of cereals	Cereals production quantity	The amount of cereals exports	The amount of cereals imports	Amount of cereals export
1990	22594.393	7.586	19845.390	13838.000	91.580	6740.900	4.060
1991	20166.305	5.374	20086.230	14574.500	217.600	6465.830	6.020
1992	23092.162	6.482	21719.940	14790.850	187.560	7333.000	3.240
1993	14322.899	4.836	19586.800	12808.940	188.950	4984.900	9.000
1994	19343.470	4.457	21458.820	16736.710	248.230	8898.110	5.350
1995	20310.889	5.084	24802.020	17494.250	166.360	8231.660	18.020
1996	18844.191	5.197	25522.630	18316.510	144.530	8172.910	11.160
1997	19171.682	38.556	25700.040	17939.390	208.590	7592.120	12.990
1998	21294.418	31.660	26198.300	19375.580	434.840	8693.750	11.490
1999	19737.934	32.903	28128.940	20081.850	327.900	9081.260	13.860
2000	18738.379	31.072	29590.090	19300.520	368.890	9877.130	34.360
2001	19240.671	34.023	27807.100	20164.330	732.660	9239.240	49.170
2002	17560.495	32.405	29990.260	20651.930	492.260	10318.190	31.100
2003	17635.741	33.279	28215.500	21285.060	618.880	7563.570	20.840
2004	16310.443	35.437	27246.923	22984.640	847.960	6809.820	32.410
2005	14636.961	31.468	33009.250	22207.420	850.810	10875.690	38.756
2006	13284.819	26.473	30783.990	22207.420	1023.820	9600.390	40.416
2007	15742.380	33.427	31346.720	23648.020	1249.330	10388.630	15.278
2008	14415.420	19.430	32787.320	22658.930	1249.330	10388.630	63.660
2009	16065.401	24.425	27931.670	19499.990	691.690	5964.430	138.340
2010	15325.004	22.809	34530.000	21880.380	743.790	15773.800	235.560
2011	14345.337	29.912	38659.520	23665.789	222.000	17001.140	58.360
2012	10620.418	25.358	35458.010	25847.850	351.498	12143.720	119.780
2013	9357.476	26.447	37143.850	23713.400	345.500	11342.810	107.580
2014	14266.420	2891.369	35987.300	23248.400	256.100	12530.100	176.700
2015	14625.997	2384.424	38577.100	23298.100	596.600	15925.200	126.500
2016	12630.567	7674.233	40028.200	22370.000	374.000	17104.500	161.200
2017	478995.136	60813.578	43320.000	22744.000	421.000	21328.000	202.000
2018	16569.329	2960.780	42771.000	20856.000	519.000	21065.000	159.000
2019	268000.182	61372.467	44152.000	20476.000	534.000	2355.000	150.000
2020	326903.407	72067.518	44246.333	24944.384	604.333	11928.040	141.000

Source: Compiled and calculated from-:

-Yearbook of Arab Agricultural Statistics, Arab Organization for Agricultural Development, miscellaneous issues.

Arab Agricultural Statistics Yearbook, Central Agency for Public Mobilization and Statistics, miscellaneous issues.

-Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Central Administration of Economy. Agricultural Economic Bulletin of Agricultural Economics, miscellaneous issues.

Table(3)

years	The quantity of imports of cereals	Amount of production of cereals	Amount of legume consumption	Wheat area in acres	Amount of vegetable consumption	The area in acres of beans	Area in acres for citrus
1990	71.460	531.000	598.400	1954696.000	9162.740	302890.000	50808.000
1991	299.180	544.000	837.160	2215070.000	9064.860	292474.000	52398.667
1992	304.720	284.500	585.980	2091653.000	9538.930	390044.000	59040.000
1993	131.160	297.700	419.860	2171330.000	9450.810	265865.000	59636.667
1994	199.740	357.670	552.060	2110944.000	7868.170	342168.000	63333.667
1995	181.750	454.590	618.320	2511814.000	8805.560	294662.000	67316.000
1996	164.070	484.700	637.610	2420918.000	10281.880	329329.000	66170.333
1997	106.190	413.240	506.440	2486131.000	10773.190	355010.000	67613.000
1998	116.530	581.740	686.780	2421131.000	13849.840	384911.000	69761.333
1999	183.760	375.730	545.630	2379450.000	15128.880	318579.000	75702.333
2000	331.340	462.490	759.470	2463265.000	15146.370	270524.000	72035.000
2001	370.760	518.440	840.030	2341795.000	13278.580	333693.000	71609.667
2002	412.980	491.220	873.100	2450428.000	14017.240	302845.000	71842.000
2003	392.960	423.600	795.720	2506178.000	14401.630	252558.000	72412.333
2004	432.900	408.300	808.790	2605483.000	14834.330	240854.000	73076.333
2005	532.963	416.088	910.295	2985286.000	16713.383	198172.000	73716.333
2006	571.252	389.493	920.320	3063701.000	17684.820	175353.000	76460.000
2007	5911.147	7378.919	13274.79	2715529.000	17709.340	211972.000	77619.333
2008	394.780	358.940	690.060	2920384.000	19714.480	170106.000	79360.667
2009	339.440	379.570	580.670	3179274.000	21163.650	205997.000	81568.333
2010	355.520	305.700	425.660	3001381.000	19136.420	183687.000	82764.000
2011	444.110	295.600	681.350	3048601.000	17570.890	131428.000	83745.000

2012	363.302	219.540	463.060	3160660.000	17343.950	97906.000	85252.667
2013	395.430	187.450	560.760	3377876.000	16224.620	104917.000	93719.667
2014	404.500	275.100	503.000	3393000.000	18601.300	89707.000	106339.000
2015	382.100	259.800	515.400	3468864.000	15908.500	81934.000	231562.000
2016	817.500	250.900	907.100	3353151.000	18011.700	83356.000	221743.000
2017	929.000	325.000	1052.000	2921715.000	11228.000	242070.000	220726.000
2018	1423.000	265.000	1529.000	3156835.000	11.360	82181.000	1485061.000
2019	1113.000	252.000	1216.000	3134947.000	11486.000	89142.000	212843.000
2020	1339.000	207.667	1628.820	3284397.667	3535.981	69814.000	631660.333

Source: Compiled and calculated from-:

  -Yearbook of Arab Agricultural Statistics, Arab Organization for Agricultural Development, miscellaneous issues.

Arab Agricultural Statistics Yearbook, Central Agency for Public Mobilization and Statistics, miscellaneous issues.

-Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Central Administration of Economy. Agricultural Economic Bulletin of Agricultural Economics, miscellaneous issues

Table(4)

years	Egypt's national income in dollars	The amount of exports of vegetables	The amount of imports of vegetables	population	Export price in dollars for vegetables	The area in acres for onions	Amount of nitrogen fertilizer for vegetables
1990	42479445600.327	132.260	3.400	56336.614	318.388	21614.000	66.530
1991	41972720706.976	110.140	5.200	57387.589	307.699	24109.000	60.555
1992	43515180839.822	143.070	4.200	58370.712	306.214	27899.000	61.066
1993	44296350086.704	203.600	3.900	59307.778	273.821	31586.000	57.530
1994	49945170121.933	201.160	6.100	60231.864	252.933	21687.000	46.899
1995	57335055103.306	171.550	7.770	61168.397	197.377	40857.000	59.891
1996	64970045588.071	172.840	3.680	62123.592	118.260	45916.000	62.213
1997	73493056455.090	157.070	3.770	63094.069	446.043	36478.000	372.605
1998	79460853898.641	216.860	4.880	64084.443	266.116	49877.000	542.543
1999	88467462832.895	129.950	1.020	65097.777	120.739	82745.000	770.738
2000	97275155830.861	211.200	1.270	66136.590	236.269	68070.000	856.599
2001	100574741582.512	225.080	3.020	67204.189	201.839	54001.000	837.856
2002	96330755963.694	387.270	7.820	68302.914	203.992	64187.000	835.533
2003	92984397790.598	391.770	3.220	69432.477	198.535	55343.000	764.823
2004	90582509995.006	453.640	2.810	70591.288	266.445	69161.000	701.511
2005	92773200895.856	436.102	2.624	71777.678	268.612	101385.000	784.759

2006	101664618946.926	417.095	8.308	72990.754	354.141	59362.000	742.449
2007	120046968873.192	398.636	14.365	74229.577	468.640	80371.000	675.935
2008	146925557342.189	398.640	8.670	75491.922	468.643	101598.000	737.247
2009	172103418536.566	777.900	21.130	76775.023	770.780	115295.000	710.546
2010	196209247988.058	805.330	3.770	78075.705	824.569	125397.000	643.738
2011	216689464021.191	828.570	10.700	79392.466	687.763	123487.000	386.190
2012	240326339951.429	851.527	16.130	80721.874	865.112	129083.000	474.568
2013	257359956190.763	874.670	19.350	82056.378	912.140	117178.000	428.991
2014	2079378981000.000	1021.800	13.100	90424668	373418.000	152539.000	49011.927
2015	2401599322000.000	1142.500	19.300	92442549	838.200	189396.000	17759.251
2016	2672955645000.000	1069.300	14.000	94447071	613.200	350404.000	18373.137
2017	3402751680000.000	815.000	21.000	96442590	760.300	198942.000	2373822.098
2018	4325811508000.000	821.000	36.000	98423602	659.300	4840.000	26582.198
2019	5128771424000.000	790.000	40.000	100388076	620.400	184506.000	713334.626
2020	6011797948000.000	705.487	43.060	102363575.333	540.100	114993.333	888553.099

Source: Compiled and calculated from-:

  -Yearbook of Arab Agricultural Statistics, Arab Organization for Agricultural Development, miscellaneous issues.

Arab Agricultural Statistics Yearbook, Central Agency for Public Mobilization and Statistics, miscellaneous issues.

-Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Central Administration of Economy. Agricultural Economic Bulletin of Agricultural Economics, miscellaneous issues.

Table(5)

years	Amount of fruit consumption	Farm price of mango in dollars	The quantity of exports of fruit	Fruit production quantity	Acreage in mangoes	The amount of nitrogen fertilizer for fruit
1990	4838.900	439.560	144.340	4976.000	48000.000	50.915
1991	4928.410	429.936	160.810	5078.000	53000.000	60.487
1992	5200.440	476.807	156.720	5344.000	52000.000	60.333
1993	5040.730	502.388	84.520	5117.340	54000.000	58.573
1994	5171.020	574.631	304.120	5446.200	57000.000	63.981
1995	5289.950	653.687	79.810	5337.270	58000.000	68.470
1996	5655.680	614.159	74.120	5688.040	65000.000	71.866
1997	5525.640	707.965	78.120	5568.180	69000.000	418.551
1998	7815.630	707.965	48.800	7807.090	75000.000	420.511
1999	5905.240	650.000	263.770	6095.370	76000.000	558.917
2000	7161.300	786.744	80.470	7152.140	79000.000	594.618
2001	7522.580	692.695	84.860	7523.110	81240.000	605.676
2002	7677.320	655.556	393.860	7991.760	80400.000	614.413
2003	7708.850	594.872	227.310	7875.660	73025.270	579.341
2004	8110.100	569.355	372.570	8428.060	81382.580	563.499
2005	8695.602	659.170	354.798	8953.822	99430.560	571.861

2006	9502.490	713.787	426.862	9831.667	110335.540	535.737
2007	9406.880	797.872	463.870	9774.463	115097.540	482.371
2008	9689.970	618.785	463.870	10056.160	132074.070	501.253
2009	8952.120	695.495	1243.720	10073.020	144979.090	441.006
2010	9339.650	555.160	1178.550	9961.510	151883.990	451.429
2011	9235.550	728.162	1400.060	10362.020	169074.810	318.306
2012	9883.620	710.837	1600.181	11160.812	183337.000	400.185
2013	10030.240	670.552	1814.560	11694.080	199551.610	436.474
2014	11387.400	622.809	1470.400	12428.100	134257.000	39278.583
2015	12283.000	439.070	1690.100	13421.000	133704.000	15146.311
2016	10996.100	443.673	1898.300	12428.600	132226.000	15421.320
2017	12698.000	248.783	2468.000	14647.000	130881.000	59656.325
2018	12866.000	255.806	2719.000	15026.000	304845.000	49488.497
2019	12756.000	294.412	3145.000	15010.000	139284.000	67889.079
2020	12831.333	316.785	3454.333	15821.073	200073.000	79439.025

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Table(6)

years	The quantity of imports for fruit	The amount of imports of sugars	The amount of nitrogen fertilizer for sugars	Meat production quantity	Oil production quantity
1990	7.240	749.130	17.479	863.030	156.490

1991	11.220	482.730	21.328	877.230	163.050
1992	13.160	391.780	20.566	894.000	171.460
1993	7.910	266.150	20.489	550.720	182.200
1994	28.940	326.700	23.327	646.260	226.380
1995	32.490	559.020	25.590	560.900	228.520
1996	41.760	683.810	25.648	644.110	204.650
1997	35.580	1405.760	150.363	736.800	196.100
1998	57.340	519.790	167.377	678.380	208.620
1999	73.640	523.730	234.566	869.310	238.980
2000	89.630	96.580	265.234	927.980	226.720
2001	84.330	408.240	264.864	1433.960	270.210
2002	79.420	466.600	266.734	1687.140	266.670
2003	60.500	350.960	262.641	1600.240	249.720
2004	54.600	282.510	250.740	1504.350	271.120
2005	96.578	536.824	254.942	1497.089	246.054
2006	97.681	359.887	242.804	1388.180	244.595
2007	96.285	440.342	244.054	1388.180	255.450
2008	97.680	440.340	241.859	1308.340	227.450
2009	122.820	372.560	211.079	1580.610	270.640
2010	556.690	800.650	276.500	1552.530	254.550
2011	273.590	1156.350	184.216	1635.690	265.290
2012	322.985	1176.228	242.945	1639.650	259.756
2013	372.380	1196.110	243.212	1696.410	265.070
2014	429.600	1031.800	22429.871	2005.200	337.600
2015	552.000	901.000	8717.404	2021.200	339.900
2016	465.700	658.500	8757.316	2025.600	310.000
2017	516.000	2.000	35500.625	737.000	184.000
2018	556.000	2.000	13031.668	1263.000	259.000
2019	668.000	2.000	20420.086	544.000	282.000
2020	656.647	1.000	21274.217	345.747	339.667

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Table(7)

years	Total dry straws (thousand tons)	Total dry straws (thousand tons)	Meat consumption	mango retail price
1990	5809.036	17659.140	1001.040	659.341
1991	6049.316	2558.458	1027.310	722.293

1992	6289.596	2587.778	687.500	861.446
1993	6529.876	2690.218	848.790	957.015
1994	6770.156	2748.506	683.420	1033.628
1995	7010.436	2613.595	739.340	1441.003
1996	7250.716	2557.467	899.560	1703.540
1997	7490.996	2498.803	847.230	1882.301
1998	7731.276	2665.460	1047.700	2206.785
1999	7971.556	2696.830	1095.610	2790.294
2000	8617.980	2665.503	1535.640	3141.210
2001	8193.910	2778.490	1826.670	2292.191
2002	8469.650	2848.500	1724.870	2111.111
2003	8528.210	2871.010	1619.930	1435.897
2004	9652.230	2744.370	1688.409	1403.226
2005	9026.260	2444.000	1580.500	1513.841
2006	9396.100	2479.340	1665.680	1675.393
2007	8548.630	2670.290	1573.020	1640.071
2008	8889.160	2397.010	1735.580	1760.589
2009	9615.280	2208.250	1768.130	1936.937
2010	9176.000	2316.120	1879.660	2633.452
2011	9250.140	2321.960	1915.980	1635.750
2012	8899.383	2117.720	2002.440	1198.686
2013	8761.303	1951.660	2058.500	1579.755
2014	37523.000	6558.816	2681.400	1083.699
2015	37965.000	5472.768	2349.700	1469.200
2016	36694.000	7874.880	1155.000	1177.010
2017	32584.000	7675.080	2887.000	734.991
2018	37876.000	5442.456	1003.000	1107.666
2019	43168.000	3209.832	1529.667	1185.315
2020	48460.000	977.208	2213.192	1450.850

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