American-Eurasian Journal of Scientific Research 15 (2): 56-64, 2020
ISSN 1818-6785

DOI: 10.5829/idosi.aejsr.2020.56.64

Productivity and Economic Efficiency of Maize Using Several Irrigation Methods in Egypt (Case Study-Beheira Governorate)

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Abstract: The current study aimed to to evaluate the current situation of maize production and consumption, with an indication of the most important factors affecting production and how to achieve productivity and economic efficiency of crop producers through a sample of the crop cultivator's specification, different methods are used to irrigate maize. The study depended on published and unpublished data from government agencies such as the Ministry of Agriculture, in addition to preliminary data from a survey sample consisting of 100 products of maize crop, The statistical treatment of the data included descriptive and quantitative analysis to analyze data and achieve the goals of the study as well as using the method of simple regression analysis and stepwise regression in logarithmic double function. The results showed that the production functions of flood, lined and sprinkler irrigation methods indicated that the nitrogenous and phosphates' fertilizers are the most important factors then followed by the amount of irrigation water, the amount of seeds and manure fertilizer, so these factors must be taken care, despite the producers working in a non-economic stage but they have an opportunity to increase their production. It was clear from the results that efficiency of the productive factors affecting the production of maize, the inefficiency of the seed component, manure fertilizer, nitrogen fertilizer and phosphate fertilizer in case of different irrigation systems.

Key words: Maize · Irrigation · Descriptive statistics · Regression

INTRODUCTION

Maize crop is considered one of the main important cereal crops cultivated in Egypt in terms of economic and relative importance, as it is used in human and animal nutrition as it is used in many varied food industries, especially after the country targeted mixing maize flour with wheat flour to narrow the gap between production and consumption to rise the self-sufficiency ratio of cereal crops from 55% to about 75%. The consequential of the reduction will be reflected in the agricultural trade balance deficit and promoting of economic growth rates. Maze production in Egypt is estimated about 7587 thousand tons, while the consumption is 11919 thousand tons, despite that it is the most important major grain crops grown in Egypt [1, 2]. The animalsconsumed about6075 thousand tons, while the humans consumed about 6159 thousand tons and the consumer gap is about 4784 thousand tons and the self-sufficiency rate is 65% and the loss is 733 thousand tons, for the average period (2000-2018). The average agricultural water consumption is 84% of the total available water resources and the water loss from Aswan until The field is about 13.5 billion cubic meters [3].

Research Problem: The problem resulted from increasing the prices of agricultural production inputs in general as a result of the economic liberalization policy as well as the lack of rationalization of irrigation water use, which the state spends on lining canals and watering sums and imposing premiums on its cost to farmers, in the same time the prices of products did not rise. Also, maize producers may not adhere to some best agricultural practices that affect the productivity of the crop and may result in lower production and economic efficiency [3, 4]. Such negative affects reflect on the Egyptian agricultural trade balance,

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since maize is considered one of the most important strategic cereal crops, as it is the first and main basis in promoting and establishment of white and red meat industries, which is reaches a rate of about 70% in the manufacture of all different animal feeds [1, 2].

MATERIALS AND METHODS

Research Objective: This research aims to study the current status of maize production in Egypt during the period (2000-2018) with an indication of how this production is distributed. Through the field sample, the most important factors that affect crop production will be studied, as well as estimating both the average costs and the bulk of profits and measuring some indicators of both productive and economic efficiency that benefit agricultural policy makers when making productive decisions to maximize agricultural production as a national goal. Moreover, increase the profits of farmers as a personal goal when using advanced methods to irrigate maize.

Data Sources, Sample and Research Method: The study depends on published and unpublished data from government agencies such as the Ministry of Agriculture. In addition to preliminary data from sample consisting of 100 maize producers using flood irrigation, modern padded irrigation, sprinkler and drip irrigation in Beheira Governorate in the year 2018. The statistical treatment of the data included descriptive and quantitative analysis to analyze data and achieve the goals of the study using statistical and economic methods where the method of simple regression analysis and stepwise regression was used in the logarithmic function.

Description of the Study Sample: A deliberate sample was chosen from 100 viewers representing the farmers under different irrigation systems in Beheira Governorate. The sample was distributed by about 54 farmers using sprinkler irrigation in Abu Homs District in the villages of Elisha and Adam with about 22, 32 farmers (representing about 22%, 32%) of the total sample and the areas of these farmers are about 980, 1147 acres and also about 26 farmers for the crop, an area of about 1987 acres in the village of ZawiaNaim, in which the lining of canals and drains was applied as a modern irrigation system applied by the state to rationalize irrigation water and reduce wastage of water. In addition to a second area, which is kind as an area where irrigation is used by flooding, where about 20 farmers whose area planted with maize has been chosen about 1020 acres for the agricultural season 2018.

The Development of Production and Consumption of Maize in Egypt: By studying the amount of production of maize at the national level during the period (2000-2018) it illustrated ranged between a minimum size production of about 6421 thousand tons in 2000 and a maximum of about 8863 thousand tons a year 2015 with an increasing rate estimated at about 38% of the minimum, as shown in Table No. 1 in the appendix and with an estimate of the general trend furcation for the amount of production during the study period, the annual statistically significant increase estimated at 75.3 thousand tons, representing about 0.99% of the average amount of production, is estimated 7587 thousand tons and the determination coefficient reached 0.41, as shown in the first equation in Table (2).

As for the amount of animal consumption of maize, it ranged between a minimum of about 2570 thousand tons in 2004 and a maximum of about 8980 thousand tons in 2018, an increase that represents about 249.4% of the minimum and by estimating the general time trend equation for the amount of animal consumption of maize During the study period (2000-2018), the annual statistically significant increase estimated at 283 thousand tons, representing about 4.6% of the average amount of animal consumption, is estimated at 6075 thousand tons. This determination factor reached 0.78, as shown by the second equation in the table.

Table 1: Distribution of study sample for green bean producers in El-Beheira Governorate in season2018.

Items	Number of holders	Area / acre	Holders%	Area%	Holders x area%	Rate engineering	Engineering average	Sample size	Type of irrigation
Adam	980	3385	19.08	24.27	463	21.55	22.40	22	Sprinkler irrigation
Elisha	1147	5737	22.3	41.13	918.9	30.31	31.55	32	Sprinkler irrigation
ZawyetNaim	1987	2300	38.7	16.41	638.2	25.26	26.29	26	Lined
Taybah	1020	2525	19.8	18.1	359.61	18.96	19.74	20	flooded
Total	5134	1394	100	100	10000	96.06	100	100	

Source: collected and calculated from data of Agriculture Directorate, El-Beheira Governorate

Table 2: General trend series equation for production and consumption and gap consumption and the loss by thousand tones and Self-sufficiency percentage and Net revenue of Fadden with pound for Maize through period (2000-2018).

Independent variable	Estimated Equations	T	Period mean	R^2	Annual growth rate%
Total production	y ^ = 6834 +75.3 x	3.4	7587	0.41	0.99
Animal consumption	y ^ = 3249 +283 x	7.7	6075	0.78	4.6
Human consumption	y ^ = 4290 +187 x	2.3	6159	0.23	3.03
Total consumption	y ^ = 8166+305 x	7.7	11919	0.78	3.15
Gap consumption	y ^ = 1738 +305 x	5.3	4784	0.63	6.4
The loss quantity	y ^ = 18.3 +75x	8	733	0.79	10.2
% Self-sufficiency	y ^ = 77 -1.17 x	-3.4	95	0.42	-1.8
Net revenue of Fadden	y ^ =751+88.3 x	3.7	1633	0.54	5.4

Source:
- Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Agricultural Economy Bulletins, separate numbers.
- Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Food Balance, Miscellaneous Preparation.

By extrapolating the data of the human consumption of maize, it ranged between a minimum of about 4824 thousand tons in 2000 and a maximum of about 12949 thousand tons in 2018, an increase representing about 168.4% of the minimum and by estimating the general trend function for the amount of human consumption of maize During the study period (2000-2018) as shown in Table (2), the annual statistically significant increase estimated at 187 thousand tons represents about 3.03% of the average human consumption amount and is estimated at 6159 thousand tons.

As for the total consumption of maize, it ranged between a minimum of about 8391 thousand tons in 2004 and a maximum of about 17785 thousand tons in 2018, an increase representing about 112% of the minimum and by estimating the general time trend equation for the total amount of consumption of maize During the study period (2000-2018), the annual statistically significant increase estimated at 375 thousand tons, representing about 3.2% of the average consumption amount, estimated at 11,919 thousand tons, is evident. The determination coefficient reached 0.78 as shown in the fourth equation.

By studying the consumption gap in maze, it ranged between a minimum of about 1861 thousand tons in 2004 and a maximum of about 10669 thousand tons in 2018, by increase of about 473% from the minimum. In estimating the equation of the general trend of the consumption gap of maize during the study period (2000-2018), the statistically significant annual increase is estimated at 305 thousand tons, representing about 6.4% of the average amount of the consumption gap, estimated at 4784 thousand tons and the determination coefficient reached 063 as shown in the fifth equation in the table

A review of maize losses at the national level during the period (2000-2018) shows that it ranged between a minimum of about 163 thousand tons in 2000 and a maximum of about 1982 thousand tons in 2015, with an increase rate estimated at 1116% of the minimum. As shown in Table (1) in the appendix and with an estimate of the general trend equation for the amount of losses during the study period, the statistically significant annual increase is estimated at 75 thousand tons, representing about 10.2% of the average amount of losses, estimated at 733 thousand tons. From the sixth equation in Table (2).

While it is clear that the rate of self-sufficiency of maize, which is the product of dividing production by consumption, ranged between a minimum of about 40% in 2018 and a maximum of about 82% in 2006, with an increase that represents about 105% of the minimum and by estimating the general time trend of sufficiency The subjectivity of maize during the study period (2000-2018) statistically significant annual deficiency, estimated at 1.17%, representing -1.8% of the average and estimated at about 65%. This determination coefficient reached 0.42, as shown by the seventh equation in Table (2) in the study.

A review of the data on the acre yield of maize at the national level during the period (2000-2018) shows that it ranged between a minimum of about 543 pounds / acre in 2000 and a maximum of about 3051 pounds / acre in 2009 at an increase rate estimated at 1116% of the limit The lowest as shown in Table (1) in the appendix and with an estimate of the equation of the general time trend of the feddan yield during the study period, the statistically significant annual increase is estimated at 88.3 pounds / acre, representing about 5.4% of the average acre yield, estimated at 1633 pounds / acre. 0.45 As shown in the eighth equation in Table (2).

Description of the Mathematical Model Used in the Production Function: The result (the dependent variable) was expressed in the productive function in its physical image and all the explanatory variables were expressed in its physical image, which is supposed to affect the dependent variable and among the many mathematical images the logarithmic image was The double is the best estimate of the Cob Douglass, so the production function takes the following mathematical image:

$$\text{Ln Yi} = \alpha + \beta 1\ln X1i + \beta 2\ln X2i + \beta 3\ln X3i + \beta 4\ln X4i + \beta 5\ln X5i + \beta 6\ln X6i + \beta 7\ln X7i + \beta 8\ln X8i$$

where:

Yi = Estimated value of production quantity estimated (ARDB / acre) per view (i)
X1i = Seed quantity, in kilograms / acre, in observation (i)
X2i = The amount of manure fertilizer (m^3 / acre) in observation (i)
X3i = Human work volume in man (man / day) in view (i)
X4i = Automated workload in hours (watch)
X5i = Amount of effective nitrogen fertilizer added (unit / acre) per observation (i)
X6i = Amount of Effective Phosphate Fertilizers Added (units / acre) per viewing
X7i = Amount of pesticides per liter per acre in observation (i).
X8i = The amount of irrigation water in cubic meters per acre in observation (I).

β1, β2, ..., β7, estimated function parameters, i = 1,2, ..., views

The Following Was Concluded

Civil Volume of Average Costs: By equalizing the product of the first partial differential, the function of the average total costs is zero.

Maximum Profit Size: Equal marginal costs (first differential for total costs) with marginal revenue (unit price of the crop)

Cost elasticity = marginal costs / average costs

RESULTS AND DISCUSSION

Maize Production for Farmers Using Flood Irrigation System: The results of the production function using a stepwise regression and double logarithmic function method show that the explanatory variables that most affect the amount of maize production produced by the method of immersion irrigation are the amount of seed in kilogram, the amount of nitrogen fertilizer in the effective unit and the amount of fertilizer Phosphate in the effective unit, where the evaluation results indicated in the table that the statistical significance of the elasticity's of the seed quantity in kilograms, the amount of nitrogen fertilizer in the effective unit and the amount of phosphate fertilizers in the active unit have been proven. The least squares method revealed an increase in the quantity produced from the maize crop, which increased by about 0.558%. As for the nitrogen fertilizer component, the estimated elasticity of the production function has proven statistically significant and therefore the increase in the human quantity by 1% only increases the production significantly. About 0.251% and with regard to the amount of phosphate fertilizers, the estimated elasticity of the production function has proven statistically significant and therefore an increase in the element of the amount of phosphate fertilizers by 1%, but it leads to an increase in production, a significant increase of about 0.339%, with regard to the other remaining factors, it became clear It has not been proven Statistical significance of the estimated elasticity,

The value of total elasticity, which was estimated at 1.15, reflects that the 1% increase in the production factors leads to an increase in the production of maize by 1.15%. The value of the determination coefficient (R^2), which estimated to about 0.69, indicates that the aforementioned production factors were responsible for explaining about 69% of the total change in the production of maize and the calculated value of (F) of 18.5 indicated the significance of the model used and its relevance to the nature of the statistical data The phenomenon being studied as in Table (3). These results are in accordance with [3-6].

The Production of Maize for Farmers Using the Padded Irrigation: The results of the production function using the stepwise gradient and double logarithmic function form as shown in Table (3) indicate that the explanatory variables most affecting the amount of production of the maize are represented in the amount of manure fertilizer in cubic meter and the amount of phosphate fertilizers in the effective unit and the amount of irrigation water m^3 where the results of the estimation presented in the table indicated that the statistical significance has been proven for the elasticity of the amount of manure fertilizer m^3 and the amount of phosphate fertilizers in the effective unit and the amount of irrigation requirements (m^3).

Assuming the availability of the conditions for the least squares method in estimating, increasing the amount of manure fertilizer by 1% with the stability of other productive factors as they are, it leads to an increase in the quantity produced from the yield of maize, a significant increase of about 0.591%. As for the element

Table 3: The production function for maize using stepwise analysis in log form for study sample.

Items	Estimated Equations	R^2	F	Els
Maize production with irrigation by flooding	Ln Y^i= 1.6+ 0.558ln X1i + 0.251 ln X5i + 0.339 ln X6i (3.7)** (3.4) ** (2.9) **	0.69	18.5	1.15
Maize production With lining of canals and drivers	Ln Y^i= 0.78 + 0.591ln X2i + 0.37 ln X6i+ 0.262 ln X8i (4.6)** (3.1)* * (2.8)* *	0.68	18.1	1.22
Maize production with sprinkler irrigation	Ln Y^i= 0.242 + 0.893ln X5i + 0.288 ln X8 (3.2)** (3.1)* *	0.77	27.8	1.18

Source: Computed from questionnaire forms for sample of study in Beheira Governorate. 2018/2019.

of phosphate fertilizer, the estimated elasticity of the production function has proven statistically significant. Therefore, the increase of phosphate fertilizer by 1% leads to an increase in the production of a significant increase of about 0.37%. As for the amount of irrigation water, the estimated elasticity of the production function has proven statistically significant. The amount of irrigation water b Ratio of 1% but lead to increased production significantly increased amounted to about 0.262% with respect to the other remaining factors, it became clear that it did not demonstrate statistical estimated moral flexibility,

The value of the total elasticity, which was estimated at about 1.22, reflects that 1% increase in the factors of production included leads to an increase in the production of maize by 1.22%. The value of the determination coefficient (R^2), which amounted to about 0.68, indicates that the aforementioned production factors were responsible to explain about 68% of the total change in the production of maize and the calculated value of (F) of 18.1 indicated the significance of the model used and its relevance to the nature of the statistical data Of the phenomenon under study.

Maize Production for Farmers Using Sprinkler Irrigation: The results of the production function using the gradient regression and the double logarithmic image in the case of using drip irrigation and sprinkling as in Table (3) indicate that the explanatory variables that affect the production quantity of maize are the amount of nitrogen fertilizer in the effective unit and the amount of irrigation water (m^3) where the results of the estimate indicated In the table, the statistical significance of the elasticity's of the nitrogenous fertilizer elasticity's in the effective unit and the amount of irrigation water (m^3) have been proven and on the assumption that the conditions of the least squares method are met in estimating

The increase in the amount of nitrogen fertilizer, the estimated elasticity of the production function has proven statistically significant and therefore the increase in nitrogen fertilizer by 1% only leads to a significant increase in production of about 0.893% and for the amount of irrigation water, the estimated elasticity of the production function has been proven Its statistically significant and accordingly, the increase of the irrigation water factor by 1% leads to an increase in the production of a significant increase of about 0.288%. As for the other remaining factors, it has been shown that the statistical significance of the estimated flexibility has not been proven and it reflects the value of

Total elasticity, which was estimated at 1.18, indicates that the 1% increase in the factors of production included in the estimate leads to an increase in the production of maize by 1.18%. The value of the determining factor (R^2), which amounted to about 0.77, indicates that the aforementioned production factors were responsible for interpreting about 77% of the total change in the production of maize and the calculated value of (F) of 27.8 indicated the significance of the model used and its relevance to the nature of statistical data Of the phenomenon under study.

It was clear from the study of the production functions for immersive and padded irrigation users for irrigation and sprinkler irrigation that nitrogenous and phosphate fertilizers are the most important factors affecting that amount of irrigation water and then the amount of seeds and manure fertilizer, so these factors must be taken care of despite the producers working in a non-economic stage but they have an opportunity to increase their production This confirms the productive elasticity of about 1.15, 1.22 and 1.18 for flood irrigation and padded irrigation users and sprinkler irrigation, respectively.

To show the productive and economic efficiency of the production factors affecting the production of maize in the case of flood irrigation, it was found that there was no efficiency for the seed quantity component, the nitrogen fertilizer component and the phosphate fertilizer amount in order to increase the price of the productive resource over the marginal product value, while the efficiency of the manure fertilizer amount and the amount of phosphate fertilizer was not confirmed While the efficiency of the water element was confirmed, as the

Table 4: Economic efficiency of factors affecting the production of maize using different irrigation methods

Irrigation methods aimed	Economic efficiency	Seeds	Manure	Nitrates fertilizer	Phosphate fertilizer	Irrigation amount
Flood irrigation	Marginal product	0.512		0.292	0.292	
	Value of marginal Product	2.44		1.18	1.17	
	Price input	12		8.9	5.9	
Lining of canals and drivers	Marginal product		0.858		0.317	0.103
	Value of marginal product		2.63		1.27	0.412
	Price input		20		5.9	0.35
Sprinkler irrigation	Marginal product			0.498		0.112
	Value of marginal product			1.99		0.447
	Price input			8.9		0.35

Source: collected and calculated from the study sample data in the Lake District in 2018.

Table 5: Cost function for maize using different irrigation methods in study sample in season 2018.

Items	Flood irrigation	Irrigation with lining of canals and drivers	Sprinkler irrigation
A	17622	64782	1070
B1	-1373.9(3.7)**	-5719(3.4-)**	-328(-4.5)**
B2	35(3.1)**	135(2.9)**	3.6(3.3)**
Productivity by Ardab	22.1	21.7	18.9
Size minimize of average costs by Ardab	22.4	21.9	17.2
Size maximize Gross profit ardabby	25	22.9	21.8
MC	111	217.5	185
AC	199.3	140	204
Elasticity	0.61	0.94	0.96
R^2	0.51	0.51	0.69
F	11.1	8.9	12.8

where: α, B1, B2 are parameters of the Maize production cost function in the short term for the study sample in Beheira Governorate in the quadratic image, the numbers in the brackets indicate the value of T)) calculated and all of them are at a significant level of 0.05, (F) indicates the significance of the model used and all of them are significant At the significance level 0.01, (R2) indicates the value of the determination coefficient, (*) indicates the significance of the regression coefficients.

Source: collected and calculated from the questionnaire forms for the field study sample in Beheira2019 Governorate for the agricultural season. /2018.

marginal product value exceeded the resource price in the case of producing maize using the padded irrigation of irrigation and irrigation, in the case of sprinkler irrigation, the inefficiency of the nitrogen fertilizer component was shown. The efficiency of water as an element Table (4).

The Statistical Estimation of the Cost Functions for Maize Producers: The results of the statistical estimate in Table (5) indicate that the relationship between the total costs and the quantity produced from the maize using irrigation flood system, which showed that the square type is the best mathematical type and the results show that there is a statistically confirmed positive relationship between each of the total costs and production of maize that Flood irrigation is used and the value of the determination coefficient is 0.61, indicating that about 61% of the changes in total costs are due to changes in production. The volume of production minimize average cost was estimated at 22.4 ardab(1Ardab=140kg) and it was clear from the results that the majority of farmers had achieved this size (average acre production was about 22.1ardab). The maximum profit size was estimated at about 25 ardabs and this volume was achieved by a small number of farmers. This indicates that crop farmers still have an opportunity to increase their production to maximize their profits, through vertical expansion in crop production and the cost elasticity reached about 0.56 and this indicates that production In the stage of non-economic production and that productivity can be increased by 10% by increasing costs by 5.6% in light of the current production level, which indicates the possibility of increasing production by adding units of different productive factors, this indicates the calculated value (F) of about 11.1 To the morale of the form used and AD The nature of the data leaders for the phenomenon under study.

Regarding the farmers using padded irrigation of watering canals, the results of the statistical estimate presented in Table (5) indicating the relationship between the total costs and the quantity produced from the maize, which showed that the square image is the best mathematical image and that there is a statistically confirmed positive relationship between both the total costs and the production of corn using flood irrigation.

The value of the determination coefficient was 0.51, indicating that about 51% of the changes in total costs are due to changes in production. The volume of production minimize average cost was estimated at reached 21.9 ardab,

It isclear from the results that the majority of farmers have achieved this size (average production per feddan ($4200m^2$) is about 21.7 ardab). From the equation, the greatest profit volume was estimated at 22.9 ardab and this volume was achieved by a small number of farmers. This indicates that crop farmers still have an opportunity to increase their production in order to maximize their profits, through vertical expansion in crop production. The elasticity of costs is about 0.94 and this indicates that production is in the stage of non-economic production and that productivity can be increased by about 10%, through increasing costs by 9.4% in light of the current production level, which indicates the possibility of increasing production by adding units of different productive factors. This calculated value (F) of about 8.9 indicates the significance and suitability of the model used.

The results of the statistical estimate in Table (5) indicate that in the case of farmers using sprinkler irrigation for the relationship between the total costs and the amount produced from the maize that the square image is the best mathematical approach the results show that there is a statistically confirmed positive relationship between each of the total costs and the production of maize that is used Irrigation by immersion, the value of the determination coefficient reached 0.69, indicating that about 69% of the changes in the total costs are due to the changes in production. The volume of production average cost was estimated at 17.2 ardab and it was clear from the results that the majority of farmers had achieved this size (average acre production was about 18.9 (ardab).

The maximum profit size was estimated at 21.8 ardab, which was achieved by a small number of farmers. Hence, crop farmers still have an opportunity to increase their production to maximize their profits, through vertical expansion in crop production. The cost elasticity reached about 0.96 and this indicates that production is in the non-economic production stage and that productivity can be increased by 10% by increasing costs by 9.6% under the current production level, which indicates the possibility of increasing production by adding units of different productive factors The calculated (F) value of about 12.8 indicates the significance of the model used and its relevance to the nature of the data for the phenomenon under study.

From the above, it was found that the civil volume of costs for producers using flood irrigation, padded irrigation for irrigation and sprinkler irrigation was 22.4, 21.9 and 17.2 ardab, while the maximum profit size was 25, 22.9 and 21.8 ardab, respectively. Whereas, the cost elasticity was estimated at 0.56, 0.94 and 0.96 for both flood irrigation and paddy irrigation and sprinkler irrigation, respectively.

Summary: Maize production in Egypt is considered small, amounting to about 7587 thousand tons, while the amount consumed is about 11919 thousand tons, although it is the most important major grain crops grown in Egypt. The amount consumed for animals is estimated at 6075 thousand tons, while the amount consumed for humans is about 6159 thousand tons and the consumer gap is about 4784 thousand tons, the self-sufficiency rate is 65% and the loss is about 733 thousand tons, for the average period (2000-2018).

It is clear that the producers of maize may not adhere to some best agricultural practices that affect the productivity of the crop and may result in a decrease in production and economic efficiency, which negatively affects the Egyptian agricultural trade balance. The average agricultural water consumption is 84% of the total available water resources and the water loss is about 13.5 billion cubic meters.

Therefore, the main goal of the study, was to evaluate the current situation of maize production and consumption, with an indication of the most important factors affecting production and how to achieve productivity and economic efficiency of crop producers through a sample of the crop cultivator's specification, different methods are used to irrigate maize.

The study depended on published and unpublished data from government agencies such as the Ministry of Agriculture, in addition to preliminary data from a survey sample consisting of 100 products of maize crop, The sample was distributed by about 54 farmers using sprinkler irrigation in Abu Homs District in the villages of Elisha and Adam with about 22, 32 farmers (representing about 22%, 32%) of the total sample and also about 26 farmers for the crop in the village of ZawiatNaim, in which the lining of canals and drains was applied as a modern irrigation system applied by the state to rationalize irrigation water and reduce wastage of water. In addition to a second area) Taybeh, (which is kind as an area where irrigation is used by flooding, where about 20 farmers whose area planted with maize for the agricultural season 2018.

The statistical treatment of the data included descriptive and quantitative analysis to analyze data and achieve the goals of the study as well as using the method of simple regression analysis and stepwise regression in logarithmic double function.

It was clear from a study of the production functions of flood, lined and sprinkler irrigation methods indicated that the nitrogenous and phosphates' fertilizers are the most important factors then followed by the amount of irrigation water, the amount of seeds and manure fertilizer, so these factors must be taken care, despite the producers working in a non-economic stage but they have an opportunity to increase their production This confirms the productive elasticity of about 1.15, 1.22 and 1.18 for flood and padded irrigation users and sprinkler irrigation, respectively. It was clear from the efficiency of the productive factors affecting the production of maize, the inefficiency of the seed component, manure fertilizer, nitrogen fertilizer and phosphate fertilizer in case of different irrigation systems. On the other hand, the efficiency of the water element in the case of irrigation was demonstrated by using the lining of watering and irrigation and sprinkler irrigation.

It was found that the minimum costs of the producers using flood irrigation and padded irrigation for irrigation and sprinkler irrigation reached 22.4, 21.9 and 17.2 ardab, while the maximum profit size reached about 25, 22.9 and 21.8 ardab respectively, while cost elasticity was estimated at 0.56, 0.94, 0.96 for both users Flood irrigation padded irrigation and sprinkler irrigation, respectively.

Recommendations:

- Paying attention to the production factors affecting the productivity of maize, which are seeds, manure fertilizer, nitrogen and phosphates, by achieving economic and productive efficiency.
- Trying to convert irrigation with immersion into modern methods of irrigation in order to achieve the efficiency of irrigation water in these systems, which are irrigation using the lining of irrigation and irrigation and sprinkler irrigation.
- Application effective role of protection policy and price policies for maize in order to motivate farmers to increase the cultivated area of the crop and increase acre productivity by activating the role of agricultural extension, which leads to achieving the highest net acre yield compared to the safe crops.

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Appendix: 1

Table No. 1: Production, consumption, wastage, gap and redemption yield of maize during the period (2000-2018)

Years	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
2000	6421	5236	4824	10060	277	4.3	3916	63.8	543
2001	6756	4959	5273	10232	281	4.2	3757	66	752
2002	7130	4892	5581	10473	288	4	3631	68.1	760
2003	6692	4139	5592	9731	261	3.9	3300	68.8	752
2004	6693	2570	5821	8391	163	2.4	1861	79.8	821
2005	7312	4918	5812	10730	584	8	4002	68.1	855
2006	8272	4222	5871	10093	574	6.9	2395	82	1935

Table No. 1: Continued

Years	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
2007	7479	4890	5516	10406	570	7.6	3497	79.1	1821
2008	7530	5455	5298	10753	600	8	3823	70	1881
2009	7999	5371	5320	10691	598	7.5	3290	74.8	3051
2010	8319	5490	5892	11382	633	7.6	3696	73.1	2343
2011	8027	6989	5648	12637	844	10.5	5454	63.5	1611
2012	7946	6989	5940	12929	740	9.3	5723	61.5	1635
2013	7652	7150	5686	12836	750	9.8	5196	59.6	1521
2014	8325	7578	5689	13267	884	10.6	4942	62.7	2921
2015	8864	8367	5164	13531	980	11.1	6820	65.5	2234
2016	7803	8413	3795	13909	1235	16	6106	56	1629
2017	7818	8815	11345	16627	1663	21	8809	47	1784
2018	7116	8979	12949	17785	1982	28	10669	40	2185
Average	7587	6057	6159	11919	732	10	4784	66	1633

Source:(1)production,(2)animal consumption, (3)human consumption, (4) total consumption, (5) the loss quantity, (6) the loss percentage, (7) gap consumption, (8) self-sufficiency, (9) net revenue.

- Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Agricultural Economy Bulletins, separate numbers.
- Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Food Balance, Miscellaneous Preparation.