

Vol. 8. No.1. 2021.

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Contents available at:

[www.crdeepjournal.org](http://www.crdeepjournal.org)

Global Journal of Current Research (ISSN: 2320-2920) CIF: 3.269

**Full Length Research Article**

## The Economics of Tomato Production from green houses in Egypt: A Case Study of the Nubaria region

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**ARTICLE INFORMATION****ABSTRACT****Corresponding Author:**

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**Article history:**

Received: 24-02-2021

Accepted: 05-03-2021

Published: 09-03-2021

**Keywords:**

Greenhouses, Tomato, Nubaria, Production, new lands.

The research aims mainly to identify the current situation of tomato cultivation in greenhouses and the possibility of expanding their production. This requires the encouragement of protected agriculture with new lands to double production and achieve a surplus that contributes to an increase in agricultural development rates in that field. The research relied on achieving its objectives on both the descriptive and quantitative analytical methods using different economic and analytical methods. The research mainly relied on the available secondary data and relied on the primary data collected from the questionnaire form prepared for this purpose for the agricultural season from the Nubaria region for the 2019/2020 agricultural season. The research reached a set of results, the most important of which are the following, The total construction costs of a Feddan of greenhouses in the research sample were estimated at about 61.32% of the total adaptation for a Feddan of the greenhouse, and the costs of iron structures came at the forefront of construction costs, representing about 60.73%, the costs of the plastic sheeting, reaching about 18.19% of the total construction costs. The productivity of greenhouses is 5.08 times higher than the open field. The net yield of greenhouses increased by 7.78 times over that of the open field. By comparing the return on the invested pound from greenhouses with its counterpart in the open field of Tomatoes crop, it amounted to about 1.1 pounds, while in the open field it reached about 0.77 pounds, with a change rate of about 141.03%.

**Introduction**

Achieving food security in Egypt faces many problems that lead to a large nutritional gap in most agricultural crops. Vegetable crops are of great importance as they are one of the most important daily nutritional needs for all members of society because of their high nutritional value and a rich source of vitamins and minerals. Tomatoes occupy an important position in the crop composition in Egyptian agriculture, as the area cultivated from it in the open system amounted to about 1.902 million feddans, representing about 52.9% of the total area of vegetables in the three loops in Egypt. The state has given attention and adoption of modern methods and technologies in agriculture, including the technology of protected agriculture through cultivation under plastic greenhouses and plastic tunnels, As well as providing varieties with high-quality specifications compatible with the requirements of the external market.

There is no doubt that adopting modern technology methods and technical innovations in the field of agriculture are some of the most significant methods of agricultural development that contribute to the development of the agricultural sector. Besides, due to the limited areas cultivated in the open field, it has been possible to cultivate vegetable crops, including tomatoes, under the protected systems of cultivation as one of

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the applications of modern agricultural technology to meet the domestic and international demand throughout the year (Ashraf,2018). It allows farmers to obtain products and crops that are characterized by productive capacity and high quality in production, to achieve the maximum benefit from the land and water suppliers. In addition to saving and reducing the quantity of water used in the production of the tomato crop, as well as to overcome the seasonality of production and protect it from climate fluctuations. This requires the encouragement of protected agriculture with new lands to double production and achieve a surplus that contributes to the promotion of vegetable production, and to achieve an increase in the rates of agricultural development in that field.

The research aims mainly to identify the current situation of tomato cultivation in greenhouses and the possibility of expanding it through studying a set of the following sub-goals, the current situation of tomato crop in Egypt during the period (2005-2019), the current situation of tomato crop in Egypt during the period (2005) -2019), items of construction costs, variable costs, productive and economic indicators for harvesting tomatoes in the research sample, a comparison between the productivity and economic indicators of tomatoes from greenhouses and comparing them with their counterparts in the open field.

**Materials and Methodology**

*Study area,*

The Nubaria region, which is the second-largest region and governorate of the republic in terms of numbers and area tomato greenhouses production in Egypt, and the first governorates outside the valley. Besides, the sugar beet monitoring selection, alnahda control, and Mariout were chosen because they are the largest monitors in terms of the number of tomato greenhouses and the largest areas of open field tomatoes.

*Sampling method*

The sample was selected using a simple random sampling method based on the agricultural inventory records in the selected locations.

*Sampling size*

The size of the research sample was determined by 50 individuals, which were divided equally by 25 individuals for each of the tomato farms in open fields, and the tomato farms in the greenhouse. Data were collected through a questionnaire designed to meet the purpose of the research. The questionnaires were also collected in the manner of a personal interview with farmers in the 2019/2020 agricultural season.

*Data analysis*

In achieving its objectives, the research relied on the use of both descriptive and quantitative analytical method, whereby arithmetic averages and percentages were used, in addition to some economic indicators, and simple regression analysis to estimate the general trend equations and predict some economic variables.

**Table 1-**Area, production and productivity of tomatoes in the open field, number, area, production and productivity of tomatoes, greenhouses nationwide during the period (2005-2019).

Unit: Area: 1000feddans,

Number of greenhouses: 1000 greenhouses

year	Tomato in the open field				tomato in the greenhouses				in the Republic		Total number of greenhouses nationwide			Relative importance %		
	Area	production 1000 tons	productivity Ton/fed.	number	Area m <sup>2</sup>	Area (feddans)	production	productivity Kg/m <sup>2</sup>	Area	production 1000 tons	number	Area	production 1000 tons	number	Area	production
2005	465	7641	16	4	1766	0.4	23	13	465	7664	32	12178	125	12	15	19
2006	524	8576	16	2.4	911.2	0.2	12	13	524	8588	34	13377	143	7	6.8	8.4
2007	537	8639	16	2.2	795.2	0.2	12	15	537	8651	36	15526	193	6	5.1	6.3
2008	572	9204	16	2.3	1070	0.3	18	17	572	9222	39	19947	226	5.9	5.4	8
2009	600	10279	17	3.4	1299	0.3	23	18	600	10302	34	13578	156	10	9.6	15
2010	515	8545	17	3	1371	0.3	17	12	516	8562	44	17832	176	6.8	7.7	9.5
2011	506	8054	16	3.2	1512	0.4	17	11	506	8071	55	23804	201	5.8	6.4	8.5
2012	515	8571	17	2.5	1163	0.3	12	11	516	8583	61	30196	271	4.1	3.9	4.5
2013	489	8269	17	1.8	1045	0.3	14	13	489	8283	62	20373	237	2.9	5.1	5.7
2014	681	8265	12	2.4	1036	0.3	15	15	681	8280	64	21833	265	3.7	4.8	5.7
2015	469	7727	16	4.3	1446	0.4	20	14	469	7747	50	19551	213	8.6	7.4	9.2
2016	440	7311	17	4.4	1471	0.4	19	13	441	7331	49	19971	196	9.1	7.4	9.9
2017	396	6723	17	3.4	1053	0.3	16	15	396	6740	52	18535	192	6.6	5.7	8.4
2018	457	7970	18	3.6	1125	0.3	17	15	457	7987	57	20321	202	6.3	5.5	8.6
2019	409	6794	17	3.7	1150	0.3	17	16	409	6811	56	20680	207	6.6	5.6	8.2
<b>Average</b>	<b>505</b>	<b>8171</b>	<b>16</b>	<b>3.1</b>	<b>1214</b>	<b>0.3</b>	<b>17</b>	<b>14.1</b>	<b>505</b>	<b>8188</b>	<b>48</b>	<b>19180</b>	<b>200</b>	<b>6.8</b>	<b>6.7</b>	<b>9</b>

Source: Ministry of Agriculture, Economic Affairs Sector, Central Administration for Agricultural Economy, Agricultural Statistics Bulletin, Cairo, miscellaneous issues.

**Table 2-**Equations for the temporal trend of area, open production, number, area and greenhouse production in the Republic during the period (2005-2019)

Item	The Equation	R <sup>2</sup>	F	Rate of change
total tomato of the republic	Area $\text{Ln } \hat{Y}_i = 6.34 - 0.016 T_i - (-2.11)^*$	0.26	4.44**	-1.6
	Production $\text{Ln } \hat{Y}_i = 9.13 - 0.015 T_i - (-2.92)^{**}$	0.4	8.53**	-1.5
	No. $\text{Ln } \hat{Y}_i = 3.52 + 0.041 T_i$	0.6	19.21**	4.1

**Results and Discussion**

**The current status of Tomatoes crop in Egypt during the period (2005-2019)**

By reviewing the current status of the Tomatoes crop in Egypt during the period (2005-2019), as shown in Table (1), (2)

*Area, production, and productivity of tomatoes from the open field in the Republic*

A study of the area cultivated by the Tomatoes crop in the open field showed that it decreased during the period 2005-2019, at an annual average of about 504.9 thousand feddans, and the Tomatoes production in the open field decreased during the same period at an annual average of about 8171.1 thousand tons, while the feddan yield of Tomatoes crop in the field increased. Exposed at an annual average of about 16.3 tons/feddan.

*Number, area, production, and productivity of tomatoes from greenhouses*

By studying the number of greenhouses planted with tomatoes, it was found that they decreased during the period from 2005-2019 at an annual average of about 3.1 thousand greenhouses, and the area planted with greenhouses and Tomatoes production in greenhouses also decreased during the study period, but productivity increased at an annual average of about 11.4 tons during the same period. By estimating the general trend equation for the area, production and productivity of tomatoes from the open field in Egypt, and the numbers, area, production and productivity of greenhouse tomatoes in Egypt, the statistical significance was not confirmed at the different levels of significance.

total greenhouses of the republic	greenhouses					
	Area	$\text{Ln } \hat{Y}_i = 9.59 + 0.030 T_i$	(4.38)**	0.33	6.29**	3
		(2.51)**				
Production	$\text{Ln } \hat{Y}_i = 5.08 + 0.025 T_i$	(2.19)**	0.27	4.81**	2.5	

\*\* Significance at 0.01 level \* Significance at 0.05 level  
**Source:** Calculated from Table (1).

#### The relative importance of Tomato greenhouse in relation to the total Vegetables area in the Republic

The relative importance of the number of tomato greenhouses in relation to the area of vegetables in the Republic ranged between 2.9% as a minimum in 2013 and a maximum of about 12.4% in 2019, with an annual average of about 6.8%, and the relative importance of the greenhouse area is about 3.85% in 2012 and a maximum of about 14.5% in In 2015, with an annual average of about 6.7%, the relative importance of tomato production in relation to the total green area in the republic ranged between a minimum of about 4.53% in 2012 and a maximum of about 18.5% in 2005 with an annual average of about 8.96%.

By estimating the general time trend equation for the total area and production of tomatoes from the open field and greenhouse in Egypt, it was found that there is a statistically significant **B** decreasing general trend at the probability level 0.05 for area, 0.01 for tomato production at an annual rate of decrease of about 1.6%, about 1.5% for total tomato production. The annual decrease in the area amounted to about 8.1 thousand feddans, and about 122.82 thousand tons for the total production of tomatoes.

#### Geographical distribution of greenhouses of tomatoes as an average for the period (2017-2019)

By studying the geographical distribution of greenhouses of tomato as an average for the period (2017-2019), as shown in Table (3)

#### Geographical distribution of the greenhouse numbers nationwide

By studying the geographical distribution of greenhouses from the Tomatoes crop, it was found that the total number of Tomatoes greenhouses nationwide reached about 3.9 thousand greenhouses for that period. The governorates of Central Egypt came at the forefront of the areas towards tomato cultivation, as the number of greenhouses reached about 2.28 thousand greenhouses, representing about 58.61% of the total greenhouses for tomatoes in the Republic. The governorate of Giza comes at the forefront of the governorates in terms of the total number of greenhouses, which amounted to about 2,258 thousand greenhouses, representing about 57.84% of the total number of greenhouses for tomatoes nationwide, followed by Nubaria in second place with a total number of about 448 greenhouses, representing about 11.48%.

#### Geographical distribution of the greenhouse area of tomatoes at the level of the Republic

By studying the distribution of Tomatoes crop areas under the greenhouse on the governorates of the Republic and the relative importance of these areas as an average for the period (2017-2019), it was revealed that the total area of Tomato crop under greenhouses nationwide reached about 1.26 million square meters as an average for that period. The Nubaria region came in second place in terms of the area cultivated from tomatoes after Giza at the level of the Republic, and in the first place in terms of governors outside the valley, where the area reached about 224 square meters, representing about 17.69% of the total area at the level of the republic, and about 63.62% of the total area governors outside the valley.

**Table 3-** Geographical distribution of tomatoes from greenhouses nationwide as an average for the period (2017-2019)

Governorate	greenhouses		Area		Production	
	N0.	%	m <sup>2</sup>	%	Ton	%
Alexandria	10	0.25	4140	0.33	20	0.11
Beheira	223	5.71	53725	4.24	1358	7.39
Gharbiya	9	0.24	3731	0.29	37.33	0.2
Kafr El Sheikh	26	0.67	11725	0.93	121	0.66
Sharqia	100	2.57	54069	4.27	616	3.35
Ismailia	188	4.83	67800	5.36	791	4.31
Port Said	2	0.05	600	0.05	5	0.03
Suez	85	2.18	33200	2.62	310	1.69
Menofia	253	6.49	122164	9.65	810	4.41
Qalyubia	10	0.25	5238.33	0.41	50	0.27
Cairo	88	2.25	31680	2.5	249	1.35
Total of Lower Egypt	995	25.48	388073	30.65	4367	23.77
Giza	2258	57.84	563358	44.5	8392	45.68
Fayoum	30	0.77	10325	0.82	31	0.17
Total Central Egypt	2288	58.61	573683	45.31	8423	45.85
Total inside valley	3282	84.1	961756	75.97	12790	69.62
the new Valley	38	0.97	14731	1.16	76.7	0.42
Red Sea	10	0.26	3613.33	0.29	29.33	0.16
North Sinai	53	1.36	29436	2.33	265	1.44
South Sinai	57	1.45	19892	1.57	199.7	1.09

Matrouh	15	0.38	12600	1	75	0.41
Nubaria	448	11.48	224000	17.69	4935	26.86
Total outside valley	621	15.9	304272	24.03	5581	30.38
Total Republic	3903	100	1266028	100	18371	100

**Source:** Compiled and calculated from: Ministry of Agriculture, Economic Affairs Sector, Central Administration for Agricultural Economy, *Bulletin of Agricultural Statistics*, Cairo, miscellaneous issues.

### Geographical distribution of greenhouse Tomatoes production nationwide

By studying the geographical distribution of Tomatoes crop production, it is found that the total production of Tomatoes seedlings nationwide amounted to about 18.37 thousand tons for that period, and the production of Tomatoes seedlings in all governorates within the valley is about 12.79 thousand tons, representing about 69.62% of the total Tomatoes production at the level of the Republic, in When the total production of Tomatoes greenhouses outside the valley reached about 5.88 thousand tons, representing about 30.38% of the total Tomatoes production in the republic.

The governorate of Giza, comes at the forefront of the governors in terms of the total production of greenhouse Tomatoes, which amounted to about 8.39 thousand tons, representing about 45.68% of the total production of greenhouse tomatoes at the level of the republic, followed by Nubaria in second place with a total production of about 4.95 thousand tons, representing about 26.86%, followed by Menoufia Governorate is in third place with a total production

of about 810 tons, representing about 4.41% of the total greenhouses in the republic.

### The current situation of Tomatoes crop in Noubaria region during the period (2015-2019)

By reviewing the current status of Tomatoes crop in Noubaria region during the period from (2005-2019) as shown in Table (4)

### Area, production, and productivity of tomatoes from the open field in Nubaria

The area of the tomato crop from the open field ranged between a minimum of about 79.1 thousand feddans in 2015 and a maximum of about 131.1 thousand feddans in 2009, with an annual average of about 103.24 thousand feddans, and the production of Tomatoes crop ranged between a minimum of about 1015.3 thousand tons in 2005 and a maximum The yield of Tomatoes crops ranged between a minimum of about 12.8 tons / feddan in 2005 and a maximum of about 17.5 tons / fadden in 2014, with an annual average of about 14.73 tons / fadden.

**Table 4-** Area, production and productivity of the most important vegetable crops in open and protected cultivation in the Nubaria region during the period (2005-2019).

Year	Tomatoes In open field			Tomatoes In the greenhouses				Total tomatoes in Nubaria		The relative importance of greenhouses tomato in Nubaria			
	Area 1000 Fed.	Production 1000 tons	Productivity ton/fed.	No. greenhouses	Area 1000 m <sup>2</sup>	Area feddan	production 1000 tons	Productivity Kg/m <sup>2</sup>	Area 1000 Fed.	production 1000 tons	No. %	Area %	production %
2005	79.1	1015	12.8	1586	802	200.5	12	15	79.3	1027	39.65	45.41	51.72
2006	103.5	1362	13.2	114	57	14.25	0.7	12.1	103.5	1362	4.75	6.26	5.83
2007	97.9	1293	13.2	124	62	15.5	0.7	10.5	97.92	1293	5.636	7.8	5.74
2008	105.7	1408	13.3	77	38.5	9.625	0.2	6.3	105.7	1408	3.348	3.6	1.11
2009	131.1	1753	13.4	170	85	21.25	0.6	6.8	131.1	1753	5	6.54	2.56
2010	122.9	1738	14.1	321	160.5	40.13	1.2	7.6	122.9	1739	10.7	11.71	7.19
2011	128.9	1860	14.4	331	165.5	41.38	1.4	8.5	128.9	1861	10.34	10.95	8.24
2012	120.5	1886	15.7	490	245	61.25	4.4	18.1	120.6	1890	19.6	21.07	35.77
2013	107.3	1843	17.2	500	250	62.5	6	24.1	107.4	1849	27.78	23.93	44.12
2014	93.7	1640	17.5	509	254.5	63.6	6.1	24.2	93.76	1646	21.21	24.56	40.4
2015	97.6	1557	16	510	255	63.8	7.2	28.4	97.66	1564	11.86	17.63	36.73
2016	99	1492	15.1	533	266.5	66.6	6.8	25.4	99.07	1499	12.11	18.11	35.23
2017	80.9	1107	13.7	436	218	54.5	4.9	22.3	80.95	1112	12.82	20.71	30.25
2018	91.01	1185	13.02	439	219.5	54.9	4.8	21.9	91.06	1190	12.19	19.51	27.76
2019	89.46	1151	12.87	469	269.1	67.3	5.1	19.1	89.52	1157	12.73	23.4	30.36
<b>Average</b>	<b>103.2</b>	<b>1486</b>	<b>14.37</b>	<b>440.6</b>	<b>223.2</b>	<b>55.8</b>	<b>4.14</b>	<b>16.69</b>	<b>103.3</b>	<b>1490</b>	<b>13.98</b>	<b>17.41</b>	<b>24.2</b>

**Source:** Compiled and calculated from: Ministry of Agriculture, Economic Affairs Sector, Central Administration for Agricultural Economy, *Bulletin of Agricultural Statistics*, Cairo, miscellaneous issues.

### Number, area, production, and productivity of tomatoes from greenhouses

The number of greenhouses of tomatoes ranged between a minimum of about 77 greenhouses in 2008 and a maximum of 1586 greenhouses in 2005 with an annual average of about 440.6 greenhouses. The area of tomato crops ranged from greenhouses in Nubaria region between a minimum of about 14.25 acres in 2006 and a maximum of about 200.5 acres. In 2005, with an annual average of about 223.21 acres, the tomato crop production ranged between a minimum of about 200 tons in 2008 and a maximum of about 12,000 tons in 2005, with an annual average of about 4.14 thousand tons, and the productivity of the tomato crop ranged between a minimum of

about 6.3. Tons in 2008 and a maximum of about 28.4 tons in 2015, with an annual average of about 16.69 tons..

### The relative importance of tomato greenhouses in the Nubaria region in relation to the total tomato greenhouse in the Republic

The relative importance of the number of tomato greenhouses in the Nubaria region in relation to the number of tomato greenhouses in the Republic ranged between a minimum of about 4.75% in 2006 and a maximum of about 39.65% in 2005 with an annual average of about 13.98%, and the relative importance of the area ranged between a minimum of about 3.6% In 2008 and a maximum of about 45.41% in 2005, with

an annual average of about 17.41%, the relative importance of tomato production in the Nubaria region in relation to the total greenhouse of tomatoes in the republic ranged between a minimum of about 1.11% in 2008 and a maximum of about 51.72% in 2005 with an annual average of About 24.2%. The estimation of the general time trend equation for the total number and area of tomato greenhouses in the Nubaria region revealed that the statistical significance of the possible significant levels was unclear, while the presence of an

increasing general and a statistically significant trend was found at the 0.05 probability level for tomato production in the Nubaria region. At a probability level of 0.01 for the productivity of greenhouse tomatoes, the annual growth rate for each of them was 14.8% and 7.9%, respectively, and the annual increase was approximately 610 tons and 1.32 tons for both the production and productivity of the total greenhouse tomatoes in the Nubaria region, Table no.(5).

**Table 5-** Equations for the general trend of total greenhouse production and productivity of tomatoes in the Nubaria region during the period (2005-2019).

Item		The Equation	R <sup>2</sup>	F	Rate of change %
Total greenhouses of tomatoes in Nubaria region	Production	$\text{Ln } \hat{Y}_i = -0.26 + 0.148 T_i$ (2.38)*	0.30	5.64*	14.8
	Productivity	$\text{Ln } \hat{Y}_i = 2.06 + 0.079 T_i$ (3.31)**	0.46	1093**	7.9

\*\* Significance at 0.01 level

\* Significance at 0.05 level

Source: Calculated from Table (4).

Items of construction, variable costs, productivity, and economic indicators of the tomato crop in the research sample in the Nubaria region and Items of construction costs, variable costs and productive and economic indicators of the open field Tomatoes crop

1.92, 3.69 3.18, 2.15, 1.79, and 0.73 thousand pounds, representing about 4.34%, 32.49%, 9%, 17.3%, 14.9%, 8.42% and 3.45% for each of them, respectively, out of the total variable costs amounting to about 85.43%.

**Items of fixed and variable costs**

By reviewing the average items of fixed and variable costs of the tomato crop in the research sample in the Nubaria region, as shown in Table No. (6), it becomes clear that the items of fixed costs represented in renting the land for the duration of the tomato crop remaining in the land amounted to about 3.64 thousand pounds, representing about 14.57% of the total costs of feddanof tomatoes. While the operational costs items for feddan of tomatoes from the open field included each of the preparation and preparation of the land for cultivation, the costs of tomato seedlings, the costs of planting and irrigation, natural and chemical fertilization, pesticides, collecting and packing the crop, others, which amounted to about 0.926, 6.93,

**Productivity and economic indicators of open field tomatoes**

By reviewing the productive and economic indicators of the tomato crop in the open field in the research sample in the Nubaria region, as shown in Table No. (6), the following is evident, The amount of tomato harvest reached about 22.6 tons/feddan, at an average price of about 19.6 thousand pounds per ton for the research sample. The average Total return per feddan was about 44.18 thousand pounds, while the average net return per feddan was about 19.20 thousand pounds, and the return on the invested pound was about 0.77 pounds, which means that every pound spent on producing a feddan of tomato crop gives a return of 77 piasters, while The return to cost ratio was approximately 1.77.

**Table 6-** Average items of fixed and, variable costs, and productive and economic indicators of tomato crop from the open field in the research sample in the Nubaria region for the agricultural season (2019/2020).

Statement	Items	value pounds	Proportion of %total variable costs	Proportion of total costs %	
fixed costs	Rent the land	3640		14.57	
Items of operating costs	Preparing the land for cultivation	926	4.34		
	Total cost of seedlings	6934.8	32.49		
	Agriculture and irrigation costs	1924	9.02		
	Total fertilization and chemical	3692.4	17.3		
	Total pesticides	3180	14.9		
	Harvest collection	2152	10.08		
	Packing	1796	8.42		
	Others	736	3.45		
	Total variable costs		21341.2	100	85.43
	Total costs		24981.2		100
Productivity	tons/fed.	22.6			
Price per ton	pound/ton	1960			
Economic indicators	Total return (EGP)	44186.7			
	Net return (EGP)	19205.5			
	Return on the invested pound	0.769			
	Cost-benefit ratio	1.769			

Source: collected and calculated from data from the research sample.

**Items of structural and variable costs of crop tomato in greenhouses**

The greenhouse data for the study sample in the Nubaria region, as shown in Table No. (7), shows the following:

*Items of structural costs*

It is evident from the study sample that the greenhouse planted with tomatoes is (9 meters x 40 meters) - it is the most common area in Egypt - where a feddan of greenhouses planted with tomatoes contains about (8-10) greenhouses with the same area as the previous one with leaving an area of not less than a meter between the greenhouse And the other, for the ease of movement between the greenhouses, in terms of supplying them with production requirements or collecting the crop.

The construction costs for a feddan of tomato greenhouses consist of 10 greenhouses as an average for the sample of the study, and the construction costs items for one greenhouse consist of an iron structure, galvanized wire, plastic cover, climbing line, trays, irrigation network of pipes and hoses,

floor motors and cocks, spray motors Pesticides, fiber cabinets, living room and store, In addition to the costs of installing the greenhouse components, the total construction costs per feddan of greenhouses in the research sample amounted to about 392.43 thousand pounds, which represents about 61.32% of the total costs of a feddan greenhouse, at 39.24 thousand pounds for one greenhouse. 60.73% of the total construction costs, with a value of about 238.31 thousand pounds, followed by the costs of the plastic covers, which amounted to about 71.38 thousand pounds, representing about 18.19% of the total construction costs, followed by the costs of establishing a living room and store, floor motors and valves, pesticide spraying motors, tanks Fiber, the irrigation network of pipes and hoses with a value of about 36.1, 19.3 and 16.78 thousand pounds, representing about 9.18%, 4.92% and 4.28% for each of them, respectively. While the costs of galvanized wire and climbing yarns, installation expenses, and flat trays came in the last ranks in terms of relative importance in the construction costs, representing about 1.77%, 0.89% and 0.56% for each of them, respectively.

Table 7- Average construction and variable costs items per fadden of greenhouse tomato in the study sample in Nubaria region (2019/2020).

		<i>Feddan: 10 greenhouses</i>		
	<b>Items</b>	<b>Value EGP/Cycle</b>	<b>Value EGP/Annual</b>	<b>% % of total costs</b>
construction costs	Iron structure		238312	60.73
	Plastic		71384.8	18.19
	Basket and climbing line		6939.6	1.77
	Greenhouse installation		3480	0.89
	Plinth fol		2189.2	0.56
	Irrigation pipes, hoses and fibertanks		16784	4.28
	Floor motors and pesticide spraying		19300	4.92
	Living room and pantry		36012	9.18
	<b>Total construction costs</b>		<b>392431.3</b>	<b>100</b>
Variable cost	preparing greenhouses for cultivation	6528	13056	5.27
	Organicfertilization	4088	8176	3.3
	Chemicalfertilization	17445.6	34891.2	14.09
	Totalfertilization	21533.6	43067.2	17.4
	Seeds and seedling preparation	9939.6	19879.12	8.03
	Growingseedlings	2128	4256	1.72
	Fertilization	3168	6336	2.56
	Irrigation	2008	4016	1.62
	Pesticides	3604	7208	2.91
	Collectthe yield and the packages	11360	22720	9.18
	<b>Total</b>	<b>22268</b>	<b>44536</b>	<b>17.99</b>
	Out-of-pocket expenses annually		904	0.37
	Electricity and water costs		7801.2	3.15
Total labor costs		108480	43.82	
Rent		9840	3.97	
<b>Total annual operating costs</b>			<b>247563.5</b>	<b>100</b>
<b>Total annual total costs</b>			<b>639994.8</b>	<b>100</b>

Source: collected and calculated from data from the research sample

**Items of Variable (operational) cost**

The variable costs items for a feddan of greening tomatoes consist of 10 greenhouses as an average for the study sample in the costs of cultivation, which includes all of the preparation and preparation of the land for cultivation and the processes involved in plowing, squaring and washing the land, fertilization operations before planting, buying and incubating seeds and preparing seedlings for planting, fertilization after seedlings Irrigation, spraying pesticides, collecting and packing the crop, in addition to other items related to electricity and water expenses used in agriculture, permanent and seasonal employment, the annual rent per feddan, in addition to other miscellaneous expenses.

The operating costs came in second place after the construction costs, as they amounted to about 247.56 thousand pounds, representing about 38.68% of the total costs of a feddan of tomato greenhouses, and the annual permanent and seasonal labor costs required to operate an acre towards the direction came at the forefront of the operational costs items, reaching about 108.48 thousand pounds It represents about 43.82% of the total annual operating costs, followed by the costs of planting, fertilization, buying seeds and preparing seedlings, preparing and preparing the land for cultivation, which represents about 17.99%, 17.41%, 8.03%, 5.27%, for each of them, respectively. While the costs of rent, electricity and

water, and other minorities came in the last order in terms of relative importance for the items of operating costs, as they represent about 3.97%, 3.15%, 0.37% of the total operating costs.

**Productive and economic indicators of Tomatoes crop from greenhouses**

It is evident from the productive and economic indicators of the tomato crop in the direction of the study sample in the Nubaria region, as shown in Table No. (8) that the average production per square meter of the tomato crop was about 28.7 kg /m<sup>2</sup>, while the average production per feddan of the tomato crop was 103.34 tons, the average price was A ton of tomatoes throughout the year is about 2.8 thousand pounds. By reviewing the economic indicators, it is evident that the total per feddan return for the session from tomatoes under greenhouses amounted to about 206.7 thousand feddans, and the total return per feddan per year was about 585.56 thousand pounds. The year's share of fixed costs amounted to about 39.24 thousand pounds, while the annual operating costs per feddan amounted to about 247.56 thousand pounds, with total costs amounting to about 286.81 thousand pounds. The average net return per feddan of greenhouses was about 298.8 thousand pounds, while the return on the invested pound was about 1.1 pounds, which means that every pound spent on producing a feddan of tomato crop gives a return of 1.1 pounds.

**Table - 8** Average productivity and economic indicators of Tomato crop from greenhouses in the research sample in Nubaria region for the agricultural season (2019/2020).

	Item	Unit	Value
Productive indicators	No. of times of production per year	Cycle	2
	Productivity per M <sup>2</sup>	Kg	28.7
	Greenhouse productivity	Ton	10.34
	Feddan productivity per Cycle	Ton	103.34
Economic indicators	Average price for tomatoes	EGP/Ton	2800
	Total return for the greenhouse		29.28
	Total return per feddan		206.7
	Total annual return per greenhouse		58.56
	Total annual return per feddan	1000 EGP	585.6
	Annual per feddan share of fixed costs		39.24
	Annual operating costs per feddan		247.56
	Total annual costs per feddan		286.81
	Net annual yield per feddan		298.8
	Return on the invested pound	EGP	1.1

**Source:** collected and calculated from data from the research sample

**Comparison between the productivity and economic indicators of tomato greenhouses and their counterparts in the open field**

Revenues are the encouraging factor for the producer to produce different crops, whether it is the open cultivation system or the greenhouse system, along with some other variables, and the choice between either of the two systems depends on the profitability achieved from each system, and from this standpoint we will deal with this part A comparison between the revenues for both the open and under greenhouse systems for the tomato crop, by comparing the productive and economic indicators of tomatoes from greenhouses and their counterparts in the open field as in Table (9), the following is found:

**Average productivity:** the average productivity per square meter of tomato crop in greenhouses was about 28.7 kg, while the average productivity per square meter of tomato crop in the open field was about 5.7 kg, with a change rate of about

507.9%, meaning that the productivity of greenhouses exceeds the open field. About 5.08 times.

**Price:** By comparing the price obtained from selling a ton of tomatoes in greenhouses and obtained from selling tomatoes in the open field, it becomes clear that the price of a ton of tomatoes from the greenhouse amounted to about 2.8 thousand pounds, while in the open field it reached about 1.96 thousand pounds, which means the high price of tomatoes In greenhouses, compared to that in the open field, a change rate of about 142.86%.

**Total production costs:** By comparing the total costs in greenhouses, which amounted to about 143.41 thousand pounds, with their counterpart in the open field of tomato crop, which amounted to about 24.98 thousand pounds, with a change rate of about 574.1%, which means an increase in the total costs of tomato production in the greenhouse over its counterpart. In the open field, about 5.7 times.

**Total return per feddan:** By comparing the total return from a feddan of greenhouses with its counterpart from an open field of tomato crop, which amounted to about 292.8 thousand pounds, while in the open field it reached about 44.19 thousand pounds with a change rate of about 662.64%, which means an increase in the total return from a feddan of greenhouses About 6.6 times in the open field.

**Net return per feddan:** by comparing the net return per feddan of greenhouses with its counterpart in the open field of tomato

crop, which amounted to about 149.4 thousand pounds, while in the open field it reached about 19.21 thousand pounds with a change rate of about 777.9%, which means an increase in the net return per feddan of greenhouses Than that of the open field by about 7.78 times.

**Return on the invested pound:** by comparing the return on the pound invested in greenhouses with its counterpart in the open field of tomato crop, which amounted to about 1.1 pounds, while in the open field it reached about 0.77 pounds, with a change rate of about 141.03%.

**Table 9** - Comparison between the productive and economic indicators of tomatoes feddan from greenhouses and their counterparts in the open field

Item	Unit	Greenhouses	open field	Change rate %
Average Productivity	Kg/m <sup>2</sup>	28.7	5.7	507.96
Average Productivity	Ton/feddan	103.3	22.6	457.08
Price	EGP/ton	2800	1960	142.86
Total costs		143405	24981.2	574.05
Total return	Pound	292800	44186.7	662.64
The net return		149400	19205.5	777.9
Return on the invested pound		1.1	0.77	141.03

**Source:** collected and calculated from data from the research sample

### Conclusion

In light of its findings, the study recommends the necessity of expanding the cultivation of tomatoes in greenhouses on the new lands instead of cultivation in open fields, as all productive and economic indicators of production in greenhouses exceed production in open fields, in addition to the quality of production due to ease of control in Adding fertilizers and pesticides, which are in line with health and phytosanitary standards, and thus increasing the ability to meet the needs of the local market and export to foreign markets.

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