



Financial and Economic Evaluation of the Production and Marketing of Cucumber Crop in Protected Agriculture "Field Study in Dakahlia Governorate in Egypt"

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Abstract: Low productivity and uncertainty of production are the most important negative features of agriculture in developing countries such as Egypt. Protected cultivation can be the solution to these problems, in addition it is considered to be an intensive production system requiring relatively high investment in several aspects of the production and marketing, and can be a key for sustainable crop production, to achieve food security and optimizing water and soil resources. this study was conducted 2018/2019, under conditions of plastic greenhouse at Dakahlia Governorate, where the sample included a small model of greenhouses sized 240 m², to evaluate the performance of Cucumber production in Protected Agriculture Technology, under plastic green house conditions and under conventional farming "open Field" conditions, to provide a guide for greenhouse Cucumber growers budget, cost categories and estimating a net return for Cucumber production under greenhouse conditions in Egypt. The results indicated: Cucumber production under plastic greenhouse conditions is an economically viable alternative for growers, although materials and total costs are higher for plastic greenhouse farming system compared to conventional farming" open Field" conditions, Cultivars under conditions of plastic greenhouse revealed a good productivity (total and marketable yield), due to Higher profitability than the open-field system. Using the multi linear Regression Model, to Determinate the most important factors effects on plastic greenhouse productivity of Cucumber in Dakahlia Governorate (2018/2019), cultivated area, and quality of seeds, and number of control times, are conceders the main factors in Cucumber productive. There are some difficulties facing marketing of greenhouse products, But the biggest constraints in its adoption of the technology and use by the farmers are the high initial cost of the greenhouse structures, long distance between Farm and markets, dominate of a few traders on the price determines, and the great differences between the Low price of vegetables paid to the farmer at farm gate and the price had the retailer.

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Key Words: Cucumber -plastic greenhouse- Conventional farming-Dakahlia Governorate-cost analysis– marketing.

Introduction:

The Egyptian Government seeks to achieve sustainable agricultural development, in accordance with the priorities and plans of the development strategy (MALR 2009), using scientific method and good management of agricultural activity, and the dissemination, introduction and application of modern technologies. In order to increase the productive efficiency of the unit of land and water, to ensure the nutritional needs of current generations and to preserve the rights of future generations from these resources, especially in light of the growing demand for food as a result of population growth, limited cultivated area, and the nature of the climate in Egypt is not appropriate To produce vegetables all time of the year, which requires the modernization and intensification of agriculture to increase the

productivity of scarce economic resources, to reach the required level using scientific methods, In this regard, the Egyptian government adopted the technology of protected agriculture represented in the project of 100,000 greenhouses and other projects, as a means of using modern technology in agriculture in order to provide suitable conditions for crop growth and improve the crop productivity, quality and achieve great economic return from land unit and rationalize water consumption. In the light of water scarcity, taking into account the quality and safety of the product in accordance with the standard specifications and market requirements, In Egypt, there are about 70 thousand greenhouses for the production of vegetables, producing about 263 thousand tons of vegetables in 2017, (MALAR,2017),

and the most important vegetable crops grown in plastic greenhouses due to the high economic return per unit area because of the lack of competition open crops for the crop during the period of production as well as the possibility of providing crop Throughout the year. Therefore, there is need for studying production under greenhouse grower conditions.

Research Problem:

Food situation in Egypt is linked to agricultural performance, however, domestic agricultural production represents only 20% of the available food, which represents a burden on the trade balance, so that Farmers adopted protected agriculture technology to face unfavorable conditions and increase productivity, Especially vegetables, such as cucumber crop grown under plastic greenhouses, not to compete with conventional farming" open Field" during the production period, despite the advantages of protected agriculture technology "greenhouse", the adoption of this technique is still below the target level. Conducting this study to identify if the greenhouse can be used as a solution of problems that are exposed to or lead to the cultivation of the open field, in addition to achieving a surplus for export as well as improving the trade balance?

Objective of the research:

Applied research, especially in the farm management, used to help monitor and evaluate agricultural projects to maximize the productive, marketing, financing and export capabilities, especially for small farmers who represent the majority of agricultural producers in Egypt, to reduce loss in irrigation water, and increase Fadden productivity, increase agricultural production, and improve the standard of living of farmers to achieve Sustainable agricultural development through:

- Describe the structure of the greenhouse industry in Egypt and Dakahlia Governorate.
- clarifying the advantages of protected agriculture technology "greenhouse" to the producer, consumer and even the country through using financial assessment "estimated greenhouse production and marketing costs and returns" of vegetable crops" Cucumber", comparing it to open field agriculture based on current conditions is important to contribute to informed decision making in addition to determining the project's ability to continue, under uncertainty or uncertainty.
- Identify the main factors influencing production of Cucumber greenhouse crops in Egypt.
- Identify major problems experienced by greenhouse producers in Egypt.
- Develop proposals and mechanisms to increase production efficiency under the protected agriculture technology, to help policy makers and decision-makers in the development of agricultural

policies for achieving food security, which will lead to increased contribution of the agricultural sector In the GDP in light of "Sustainable Agricultural Development Strategy 2030.

Research Methodology and Data Sources:

The research was based on the use of descriptive and quantitative statistical analysis methods, to identify the production costs and return, and some indicators and criteria for financial evaluation.

Net Present Value (NPV):

The present value equivalent of a group of amounts of money paid at different times. To calculate the net present value of the project, the present value of the total project costs is subtracted from the present value of the total returns according to the law: Net Present Value = Total Present Value of Revenues (Returns) - Total Present Value of Costs, Financial flows for the coming years can be converted to net present value by:

$$NPV = \frac{\sum_1^n R_n}{(1+t)^n} - \frac{\sum_1^n C_n}{(1+t)^n}$$

Where: NPV = net present value, R_n = project returns in year n, C_n = Project costs per year n,

T = discount rate at which the present value is calculated = year in which calculation = 1, 2, 3...

benefit / Cost Ratio = the sum of the present values of project returns over its useful life The total present values of project costs during its useful life

$$B / C . Ratio = \frac{\sum_1^n R_n}{(1+t)^n} / \frac{\sum_1^n C_n}{(1+t)^n}$$

Where: R_n , C_n , t, n: have the same meanings as in the net present value criterion and the decision taken according to this criterion is: At a certain discount rate the project accepts if the ratio is greater than 1.

- The project is rejected if this ratio is less than or = 1

IRR Internal Rate of Return:

The discount rate at which the ratio of current returns to current costs of the project is equal to the whole one. In other words, the discount rate makes the present value of the net return flow of the project equal to zero as follows.

$$IRR = \sum_1^n \frac{R_n - C_n}{(1+r)^n} = 0$$

The decision based on this criterion is: The project is accepted if the project's internal rate of return is greater than the opportunity cost (or interest rate on deposits in banks) in the community.

1) The project shall be rejected if the internal rate of return is less than the return of the alternative opportunity for capital in the society.

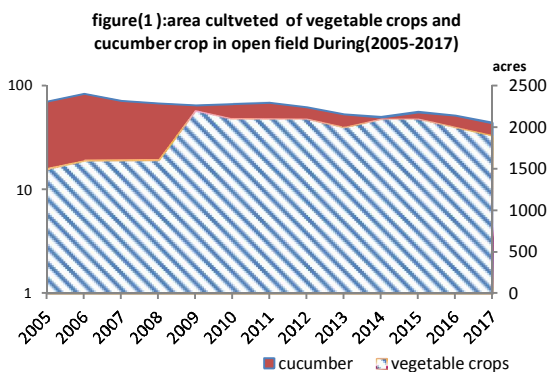
2) Project sensitivity analysis: The process of re-evaluating the project under the assumptions of changing returns and costs due to the assumption of changing circumstances is defined by the sensitivity analysis of the project i.e. the extent of the project's responsiveness or sensitivity to the change in the factors that affect its profitability.

Break-even point (BEP) = Total cost of production ÷ Price per unit of yield.

The research was based on published and unpublished data from the relevant authorities such as the Economic Affairs Sector (Agricultural Statistics Bulletin), the Central Agency for Public Mobilization and Statistics (Bulletin of Water Resources and Irrigation), and references, researches and relevant studies.

The Study Sample:

The research was based on primary data, A questionnaire specifically designed for Cucumber greenhouse operations was used to obtain the required information from a selected sample of greenhouse operators in Dakahlia Governorate, from villages of "Gezayer, Manshiyat Shoman" at Belqas center was selected, and face-to-face interview, A random sample of (100) greenhouse operators were interviewed to obtain production costs and returns data on Cucumber crop, during the agricultural season 2018/2019, where the sample included a small model of greenhouses



Evolution of production indicators for vegetable crops and cucumber crops in greenhouses in Egypt during the period (2005-2017):

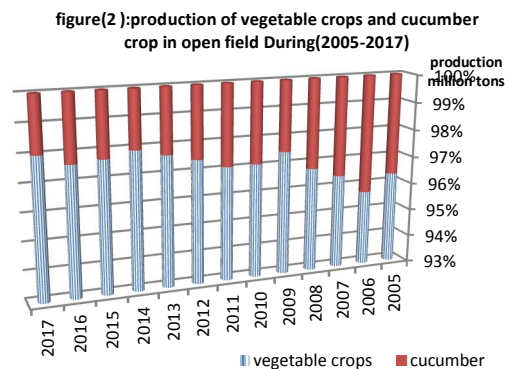
During the last decade, the greenhouse number in Egypt grew rapidly. This growth was prompted by consumer demand for fresh and quality produce all time of the year, Table (2) appendix shows the development of the production indicators for vegetable crops and cucumber crops in greenhouses during the period (2005-2017), area of vegetable crops in greenhouses reached about 9212.45 feddan in the average study period, with a total quantity of vegetable crops produced about 260.46 thousand tons during the

sized 240 m² with an area (6 m x 40 m), which is the most common area in Dakahlia Governorate in Egypt.

Results and Discussion:

Production Indicators for Vegetable Crops and cucumber Crops in conventional farming" open Field" in Egypt during the period (2005-2017):

Farmers depend on vegetable crops to increase their incomes, as well as their nutritional and monetary importance, making them the most consumed among other crops. Evolution of production indicators for vegetables and cucumber crops in the open field Table (1) appendix during the period (2005-2017), Data in Tables 1 appendix provide historical overview of the growth of the area vegetable crops conventional farming" open Field" in Egypt, has increased to reach about 1.9 million feddan on average for the study period, with a total production of vegetable crops about 20.2 million tons during period (2005-2017). Cucumber area on average about 62.4 thousand feddans during the period (2005-2017), which represents about 3.4% of the area planted with vegetable crops, and the average production of cucumber crop is about 276.6 thousand tons / Fadden, which represents about 2.9% of the production of vegetable crops during the same period. Figure (1, 2).



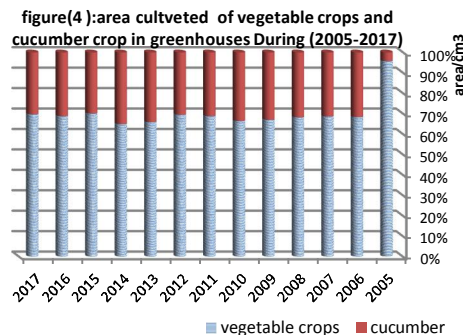
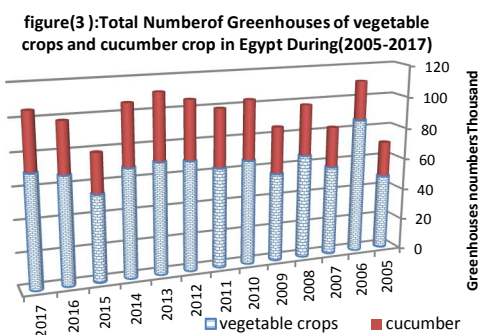
same period. The cucumber crop area in greenhouses reached about 2844.32 feddan during the period (2005-2017), which represents about 43.69% of the total area planted with vegetable crops in greenhouses in the average period (2005-2017). The average production of cucumber crop is about 142.50 thousand tons, which represents about 54.93 % of vegetable crop production during the same period (Figure 3, 4, 5).

Number of Greenhouse Operations by production and by Governorates in Egypt, 2017:

Table (1) shows the number of greenhouses in Dakahlia Governorate are about 40 thousand

greenhouses, which represents about 58% of the total number of greenhouses in the Egypt, 2017, vegetable crops production under greenhouses conditions about 97 thousand tons, which represents about 41% of the total production of vegetable crops in Egypt, in 2017. The number of greenhouses for cucumber in Dakahlia

governorate about 20,000 greenhouses, represents about 57% of the total number of greenhouses planted with cucumber crop in Egypt, 2017, the production of greenhouses about 52 thousand tons representing about 41.4% of the total crop production in Egypt, 2017.



figure(5): production of vegetable crops and cucumber crops in greenhouses (During(2005-2017))

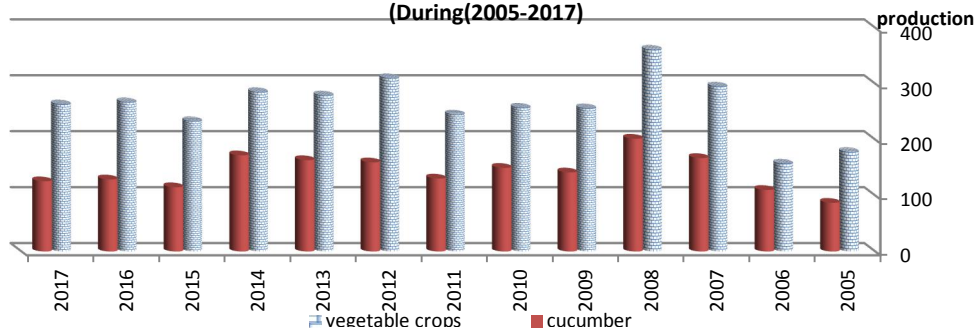


Table (1) Number of Greenhouse Operations by production and by Governorates in Egypt, 2017 (production: Ton)

vegetable crops			cucumber								
Governorates	Number	%	Governorates	production	%	Governorates	Number	%	Governorates	production	%
Dakahlia	40833	58	Dakahlia	97202	41.1	Dakahlia	20368	57.4	Dakahlia	51998	41.4
Giza	6397	9	Giza	26527	11.2	Gharbia	4235	11.9	Gharbia	14196	11.3
Gharbia	4352	6	Noubaria	20891	8.8	Giza	2530	7.1	Giza	12712	10.1
Ismailia	3036	4	Behera	18127	7.7	Menoufia	1906	5.4	Behera	9258	7.4
Noubaria	2774	4	Gharbia	14764	6.2	Kafr ElSheikh	1525	4.3	Kafr ElSheikh	8137	6.5
Menoufia	2330	3	Ismailia	12931	5.5	Ismailia	1031	2.9	Noubaria	7419	5.9
Sharkia	1647	2	Sharkia	10228	4.3	Damietta	1013	2.9	Menoufia	6396	5.1
Kafr ElSheikh	1623	2	Kafr ElSheikh	8481	3.6	Noubaria	877	2.5	Damietta	5130	4.1
Damietta	1483	2	Damietta	7566	3.2	Behera	498	1.4	Ismailia	4570	3.6
New valley	1225	2	Menoufia	7091	3.0	Cairo	444	1.3	Sharkia	2958	2.4
Others Governorates	4496	6	Others Governorates	12582	5.3	Others Governorates	1082	3.0	Others Governorates	2829	2.3
total	70196	100	total	236390	100	total	35509	100	total	125603	100

Source: Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Agricultural Statistics Bulletin, -2017.

The quantities and value of Egyptian exports of cucumber to world markets during the period (2002-2017):

The quantity of Egyptian exports of cucumber crops ranged from a minimum quantity about 77 tons in 2003 to a maximum quantity about 4707 tons in

2006, figure (6) average about 1147 tons during the period (2002-2017).

The figure (7) indicate the value of Egyptian exports of cucumber during the period (2002-2017), The value of Egyptian exports of cucumber crops ranged from a minimum value about 29 thousand \$ in 2003 to a maximum value about 2374 thousand \$ in

2006, An average about 1147 thousand \$during the period (2002-2017).

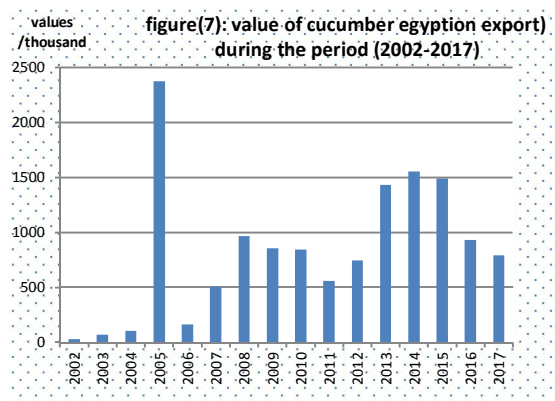
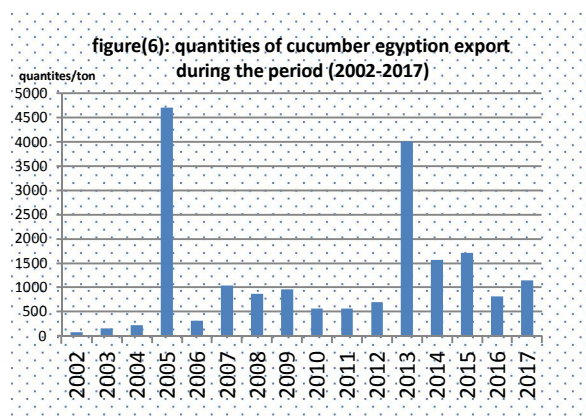
Costs and Returns of conventional farming "Open Field", and Greenhouse, 2017:

Table (2) shows the average production costs of the fadden in the open field in 2017, it found that labour Costsranked first with a value of about 2600 pounds / fadden or 0.62 pounds / m², representing about 30.2% of the total value of operating costs, while the value of machinery Fees, Chemical fertilizers ranked second and third in the total operating costs, representing about 10.9% and 8.7% respectively of the total operating costs under conventional farming "Open Field conditions.

Table (2) average production costs of Cucumber Crop in the open field in 2017

Variable Costs	costs of fadden (L E)	costs of m ² (L E)
Labour Wages	2600	0.62
Machine Fees	939	0.22
Seed	490	0.12
Municipal Fertilizer	526	0.13
Chemical Fertilizers	745	0.18
Pesticides	240	0.06
Other Expenses	499	0.12
Land rent	2561	0.61
Total	8600	2.05

Source: Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Agricultural Statistics Bulletin, 2017.



Average fixed costs "construction" for single greenhouses sized 240 m²(6 m² * 40 m²) in Dakahlia Governorate season 2018/2019:

The fixed costs include iron brackets, plastic cover, wires, irrigation network and installation, as shown in Table (3) the average cost of the steel structure, which gives the greenhouse its known form, ranked first importance, by value about 5000 pounds, representing about 44.6% of total fixed costs, while value of plastic cover about 2250 pounds, ranked second importance of the fixed costs, representing about 20% of total fixed cost, the value of the irrigation network, including the motor and installation ranked third importance, with a value about 3000 pounds, representing 26.78% total construction costs.

Average Operating Costs for cucumbers Crop in Greenhouses Season 2018/2019:

Include seeds, pesticides, fuel, workers' wages, etc. Table (4) shows that the cost of chemical fertilizers ranked first, with a value of about 3.56 LE / m², representing about 25% of the total value of the operating costs in the protected agriculture "green", while the value of seeds Pesticides ranked second and

third in the total operating costs, representing about 23.87% and 13.71%, respectively, of the total operating costs in greenhouses.

Table (3) Average fixed costs "construction" for single greenhouses sized (240 m²) for production of cucumber in Dakahlia Governorate, study sample season 2018/2019

STATMENT	investment Costs "Construction" of greenhouse LE/ greenhouse
Rent the greenhouse	470
Iron brackets	5000
Plastic Cover	2250
Doors	300
Installation	300
Wires	350
Irrigation network and installation	3000
Total Fixed Assets	11670

Source: Compiled and calculated from the results of the analysis of the study sample in the study sample villages in Belqas Center in Dakahlia Governorate for the agricultural season 2018/2019.

Table (4) Average Operating Costs for cucumbers Production in Greenhouses Season 2018/2019.

Variable Costs	costs of Fadden (L E)	costs of m ² (L E)
* Labor Wages	350.4	1.46
Machine Fees	156	0.65
Seed	823.2	3.43
Municipal Fertilizer	384	1.6
Chemical Fertilizers	854.4	3.56
Pesticides	472.8	1.97
Other Expenses	408	1.7
Total	3448.8	14.37

Source: Compiled and calculated from the results of the analysis of the study sample in the study sample villages in Belqas Center in Dakahlia Governorate for the agricultural season 2018/2019.

Returns for cucumber production for the conventional farming "open field", 2017:

Farmers can get 10 times more yield with greenhouse production system than with the open-field system of production (Semini-Kenya, 2007). Table (5) shows that the average quantity per square meter

of cucumber crop within the open field was about 2.05 kg, the average total costs for Fadden reached 8600 pounds, and the average price per ton of sale was estimated at about 1837 pounds, and the net return per Fadden was about 7189 pounds.

Table (5) Average Net returns of Cucumber Crop Production in Open Field, 2017

STATEMENT	Fadden	M ²
Total costs	8600	3.58
Production quantity (ton/Fadden) Average	8.595	0.002
Average Selling Price ((LE/ ton)	1837	0.77
Total gross return (LE /Fadden)	15789	6.58
Net return (LE /Fadden)	7189	3.00
Break-even yield point (BEP) ton*	4.68	

Source: Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Agricultural Statistics Bulletin, 2017.

Average Net returns for cucumber production under the greenhouse conditions in the sample season, 2018/2019:

Table (6) shows that the average yield per square meter of cucumber yield was about 14.58 kg m², the

average total cost per square meter was LE 37.16, the average price per ton was estimated at LE 3,500, and the net yield per square meter was LE 13.88.

Table (6) Average Net returns for Cucumber Production under Greenhouses Season, 2018/2019.

STATEMENT	Single green house	m ²
Average Production quantity (ton/ single green house)	3.5	14.58
Total cost (LE/ single green house)	8917.92	37.16
Average Selling Price ((LE/ ton)	3.5	3.5
Total gross return (LE/ single green house)	12250	51.04
Net return (LE/single green house)	3332.08	13.88
Break-even yield point (BEP) ton*	44.59 (fadden)	

*Break-even yield point (BEP) ton per fedden under Greenhouses.

Source: calculated from the results of the analysis of the study sample in the study sample villages in Belqas Center in Dakahlia Governorate for the agricultural season 2018/2019.

The break-even point for cucumber cultivation under greenhouses and open-field the conventional farming:

Table (6) shows that both systems were able to recover all the total production costs " variable and fixed cost", but cucumber under greenhouse

conditions has been shown to have a higher profitability than the open-field system, break-even point for cucumber cultivation were about 44.59 and 4.68 ton, respectively. which means the average yield of greenhouse cucumber in the study sample area is higher by 16.66 ton (61.25-44.59=16.66) ton. while in

the conventional farming the average yield of is higher by 3.91 ton (8.59-4.68=3.91).

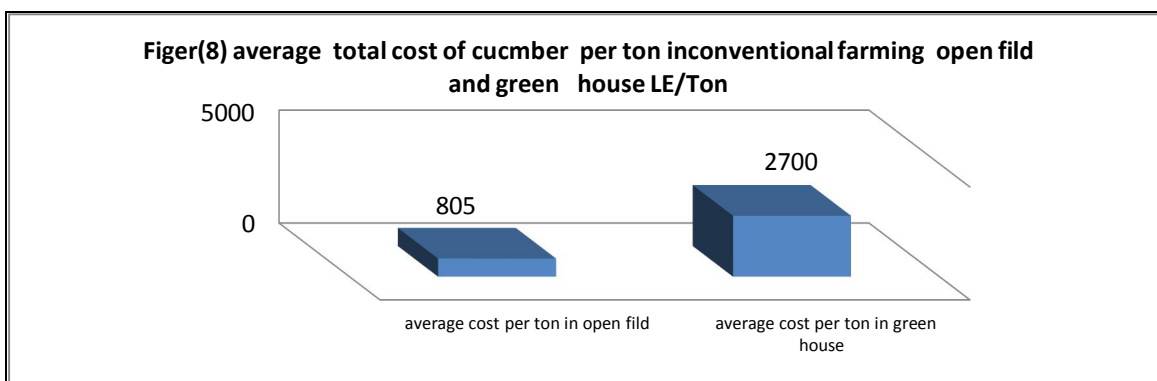


Figure (8) shows an increase in the average cost of producing a ton of cucumbers inside the greenhouse by three times compared to the cultivation in the open field.

Financial Evaluation Criteria for Cucumber Production under Greenhouses conditions:

Table (7) shows the financial evaluation criteria for the production of cucumbers in greenhouses, Costs are greater than the whole one, and the project

recovery period for capital investment costs is about 2yearsand9 months. Cucumber cultivation is economically feasible under greenhouse IRR about 35.7%.

Table (7) Financial Evaluation Criteria for cucumbers Production under plastic greenhousein the Sample Season,2018/2019.

Statement	Un heated plastic green house
Net presents value (NPV) (3172
benefit /cost ratio	1.37
Return (LE)	0.37
Internal rate of return (IRR)	%35.7
Discounted Pay-Back Time (DPBT)	2years and 9 months
Return of green house (LE)	3332.08
Return of square meter (LE/M ²)	13.88

A discount of 16% was used as an opportunity cost.

Source: collected and calculated from the results of the analysis of the study sample in the study sample villages in Belqas Center in Dakahlia Governorate for the agricultural season 2018/2019.

The sensitivity analysis for cucumbers under the green house:

Sensitivity analysis was carried out by increased costs by 10%, which causes decreased the net return about 2987.28 LE Table (8), while decreasing revenue

about 10%, causes decreasing net revenue to 2017 LE, also increased cost by 10% and the decreased revenue about 10%, the net return decreased about 1762.28 LE, it's clear the sensitivity for cucumbers production under the green house To increase production costs.

Table (8) Sensitivity Analysis of Cucumber production under plastic green house.

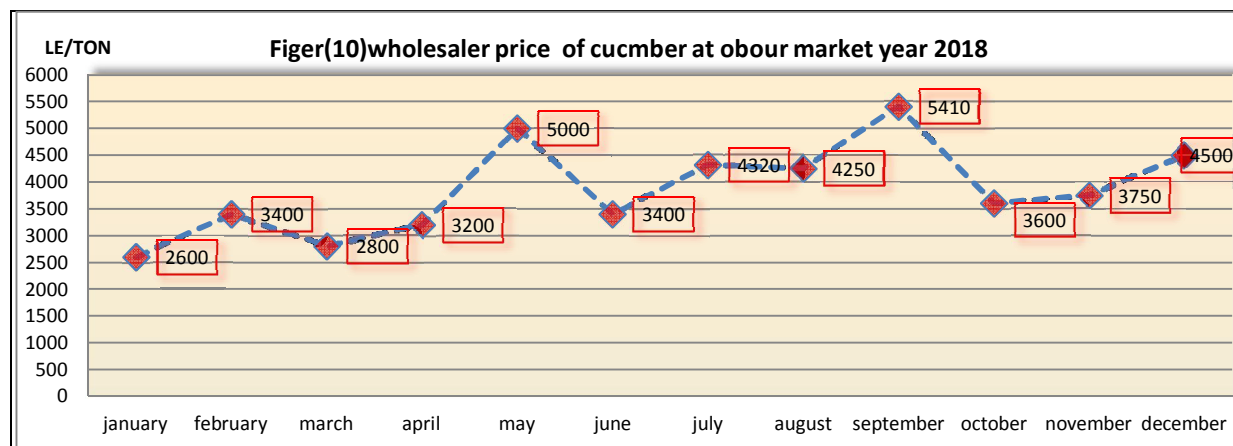
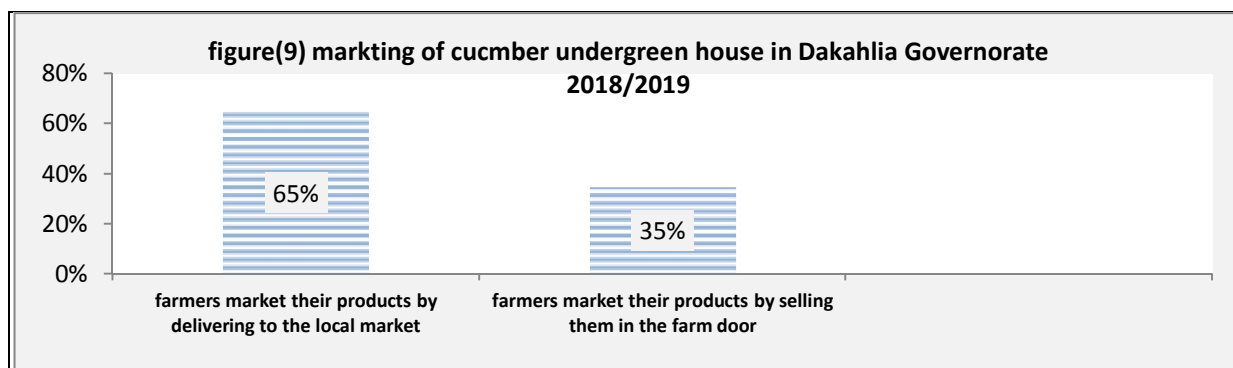
Statement	Actual Status	The impact		
		10% Increase Costs	10% Decrease Revenue	Increase Costs and Decrease Yield 10%
benefit /cost ratio	1.37	1.32	1.24	1.19
Return of LE	0.37	0.32	0.24	0.19
Return of green house (LE)	3332.08	2987.28	2017.08	1762.28
Return of square meter (LE/M ²)	13.88	12.45	8.78	7.34

Source: collected and calculated from the results of the analysis of the study sample in the study sample villages in Belqas Center in Dakahlia Governorate for the agricultural season 2018/2019.

Marketing and Pricing for cucumber under green house in the sample in Dakahlia Governorate, 2018/2019:

The questionnaire included some questions about how to market the harvested greenhouse cucumber, about 15% are self-consumed, and about 85% are sold in the market or to the wholesaler & retailer. As shown in the figure (9), greenhouse operators use several channels to market their produce, about 65% of

farmers market their products by delivering to the local market, and about 35% of farmers market their products by selling them in the farm door, Most farmers in the sample do not sort and classify the cucumber before the product is sent to the market. The results of the sample showed the presence of randomness in the methods used by farmers in marketing greenhouse products "cucumber" in the study sample.



Approximately 65% of farmers market their products by delivering them to the local market, “the central market or point of sale”, and About 35% of farmers market their products by selling them in front of the farm door.

Although the initial and total costs of Cucumber production under plastic greenhouse conditions was higher in the present study, Cucumber production under plastic greenhouse conditions products can be sold at a higher price than the conventional ones, but high price of the cucumber produced from the greenhouse doesn't compete with the open field cultivation during the production period inside the greenhouse (Figure 10).

About 16% of the respondents confirmed that the prices of agricultural products are determined by the interaction between the forces of supply and demand, while 80% of the respondents in the sample of the

study, clarify that the wholesaler is the main determinant of the prices of cucumber, and the remaining 4% due to Others factors, such as farms, brokers, etc., also the results showed that most farmers use the method of instantaneous agreement on the price at the time of sale, about 100% of the total methods of determining the sale prices of the cucumber, figure (11), the farmers explained that there are some difficulties Facing the process of marketing agricultural products such as long distance between Farm and markets, the impact of a few traders on the price setting, in addition to the great differences between the Low price of vegetables paid to the farmer at farm gate and the price had the retailer.

Calculate the marketing margin between the product price and the consumer price of the option crop in the sample of research in Dakahlia Governorate in 2018/2019:

The increase in marketing margins for agricultural crops is due to the multiplicity of those involved in marketing operations, the distance of production areas from consumption areas, high risk and exposure to damage, etc. LE (12.5% of the total

marketing margin between the producer and consumer price), while the retailer's share is about LE 1.75, representing about 29% of the total marketing margin between the producer and consumer price (Table 9).

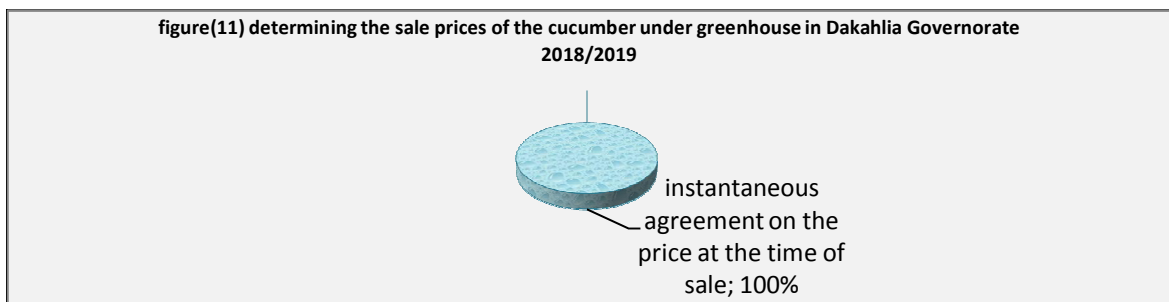


Table (9) marketing margin between the product price and the consumer price of the Cucumber in the sample in Dakahlia Governorate, 2018/2019:

Statement	Product Price EGP / Kg	Wholesale Price EGP / Kg	Retail Price EGP / Kg	Market Margins			% Distribution of Consumer LE			Share of Brokers
				share Wholesaler	share Retail	Total	Product%	Wholesale%	retailer%	
cucumber	3.5	4.25	6	0.75	1.75	2.5	58.33	12.50	29.17	41.67

Source: collected and calculated from the results of the analysis of the study sample in the study sample villages in Belqas Center in Dakahlia Governorate for the agricultural season 2018/2019.

Economic assessment of the role of Protected Agriculture "Greenhouse" in achieving sustainable agricultural development:

The economic role of greenhouse is production vegetables at the target level to meet local needs and achieve a surplus for export, on the other hand, rationalizing the use of irrigation water in the agriculture sector. Cultivated areas in old land, which were cultivated in the traditional crops in the open field, to be allocated and cultivated with strategic crops such as wheat and maize, and thus reduce the food deficit and achieve food security.

The role of protected agriculture "greenhouse" in achieving sustainable development of irrigation water resource

The technology of protected agriculture "greenhouse", is one of the most important means to rationalize the use of irrigation water in the agricultural sector, Egypt faced scarcity of water resources, and the method of drip irrigation most used in the production Greenhouse, irrigation water of square meters of cucumber in the greenhouse are reduced by about 68%, respectively, compared to agriculture in the open field Table (10), which led To increase the productivity of cubic meter of water, compared to agriculture in the open field, thus help to save large amounts of irrigation water, used in the reclamation of more new land.

Table (10) Economic Evaluation for the Role of Protected Agriculture "Greenhouse" in Achieving Sustainable Agricultural Development

statement	Open field	Greenhouse
Irrigation system	Immersion	Dripping
Water Requirements needs: m ³ / faddan	3031	966
m ³ / faddan The quantity of water saved	-	2065
m ³ / faddan The quantity of water saved%	-	68%
Cultivated Area in cucumber 2017(thousand m ²)	128520	2.785
Total Water Requirements for Agriculture in the Open Field in Million m ³	92.75	0.0006
The quantity of water saved at the level of the Republic is one million cubic meters in case of replacing cultivated area in open field with green house	-	63.23
Land unit productivity (kg / m ²):	2.14	14.58
Quantity of increase in land unit productivity (kg / m ²)	-	12.44

Source: Compiled from the survey questionnaire data, Ministry of Agriculture, Economic Affairs Sector, 2017, Central Agency for Public Mobilization and Statistics, Water Resources and Irrigation Bulletin.

The role of protected agriculture "greenhouse" in achieving sustainable development of land resources:

Table (10) shows that the adoption of greenhouse technology "greenhouse" leads to increase the productivity of agricultural land of cucumber crop, compared to agriculture in the open field, where the productivity per square meter of agricultural land of cucumber in greenhouses about 14.58 kg / m², In comparison with 2.14 kg / m² of cucumber in the open field, As shown in Table (10) the productivity of agricultural land unit of cucumber in greenhouses increased by about 12.44 kg/m², compared to

$$Y = a \pm b_1X_1 \pm b_2X_2 \pm b_3X_3 \pm b_4X_4 \pm b_5X_5 \pm b_6X_6 \pm b_7X_7 \pm b_8X_8 \pm \varepsilon$$

X ₁	Cultivated area of cucumber crop (m2).	X ₅	Used amount of municipal fertilizers M ³
X ₂	Number of irrigation times	X ₆	Seed quality used (Dummy variable) (good (1), poor (0))
X ₃	Control times	X ₇	Number of workers employed Man / day.
X ₄	Quantity of Chemical Fertilizers.	X ₈	Quantity of seeds used
□	Random error		

The double logarithmic formula is the best form of the function a statistically, and is as follows:

$$\ln Y = -4.13 + 0.15 \ln X_1 - 0.03 \ln X_2 + 0.23 \ln X_3 - 0.54 \ln X_4 + 0.11 \ln X_5 + 0.34 \ln X_6 + 0.10 \ln X_7 - 0.41 \ln X_8$$

(2.63)* (-1.04) (2.58)* (-2.61)* (4.40)* (4.88)* (3.58)** (-5.35)**

$$R^2 = 0.89 F = 55^{**}$$

The value of (F) shows the statistically significant significance of the model, and it is clear from equation (1) that the variables of the model are responsible for about 89% changes in the yield per square meter of cucumber greenhouse, where there are independent factors affecting the productivity Square meters of cucumber crop in plastic greenhouse have been shown to be significant, namely the cultivated area of crop "X1", the number of times control "X3", the amount of chemical fertilizer "X4", the amount of fertilizer used "X5", the quality of seeds used x6, number Workers used x7, as the standard model indicates the following:

- Increasing the cultivated area "X1" by 1% increases the yield per square meter of the crop in the greenhouse about 0.15%.

- Increasing the number of times control X3 by 1% to increase the productivity per square meter of crop option in plastic greenhouse by about 0.23%, as a result of the elimination of fungal and insect diseases that affect plants.

- Increasing the amount of municipal fertilizers X5 by 1%, increases the productivity per square meter of cucumber in plastic greenhouse, about 0.11%, where municipal fertilizers lead to improve soil qualities and help plants to grow.

agriculture in the open field, respectively, and the area of cucumber in Egypt about 30.6 thousand acres in 2017, the expected water savings due to the protected agriculture "greenhouse" is estimated at 63.23 million m³ water / season Li arrangement, if the case and replace the cultivated areas in the open field, protected agriculture system "greenhouse technology.

Estimation of the most important variables affecting the production of cucumber Cultivation in plastic greenhouse season 2018/2019:

The independent variables, which may affect the yield per square meter of cucumber in greenhouses (y), as follows:

- Usage of good seeds x6 by 1%, increase the productivity per square meter of crop in greenhouse about 0.34%.

- Increasing the use of human labor by 1% increases the quantity produced about 0.10%.

- Increasing the amount of chemical fertilizers X4 reduces the yield per square meter of cucumber yield in plastic greenhouses, about 0.25%, which shows that the amount of fertilizer used by farmers is greater than the required level, and misuse of fertilizers.

- Increasing the usage amount of seeds x8 by 1%, causes decrease in the quantity about 0.41%, because the farmer relies on his experience, and does not follow scientific recommendations and rely on varieties from unreliable sources, as it was noted that some farmers use round seeds from the previous season, Which negatively affects germination rate and productivity.

Problems facing the producers of cucumber in the greenhouses in Dakahlia Governorate

Season, 2018/2019: Identifying the most important problems facing producers of cucumbers under the plastic greenhouse in monitoring and evaluating the agricultural projects to maximize the productive, marketing, and financing and export capacities, especially for small farmers who represent the majority of agricultural producers. To provide

recommendations to solve the problems facing farmers and provide information to help them manage their farms to achieve the targeted economic and social returns, and propose possible solutions to overcome them. The questionnaire will include many important aspects related to plastic greenhouses, as shown in Table (11), while 100% of the farmers explained that one of the most important reasons for choosing the greenhouse is high productivity and thus return, about 100% of farm owners supervise and manage their own farms.

It turned out that the majority of farmers are dissatisfied because they suffer from many problems

of construction, productivity, marketing and financing as follows:

(A) Structural problems

- 100% of farmers confirmed High costs of establishing greenhouses, due to absence of government role to provide this service.

- About 100% of farmers suffer from the Iron wires used as brackets are not flexible, in addition to the high price.

- About 100% of the total respondents confirmed that there are two types of plastic, one is expensive plastic, and the other the cheap plastic, but low quality, used only one time or twice maximum.

Table (11): Problems and Obstacles Facing Cucumber Producers under Greenhouses in the Study Sample in Dakahlia Governorate

First: Problems in establishing greenhouses	available or suitable	no	%
❖ High costs of establishing greenhouses.	inappropriate	100	100
❖ Availability of greenhouse components.	Available	100	100
❖ Quality of plastic.	inappropriate	89	89
❖ Iron wires that are used as brackets are not flexible enough in addition to the high price	inappropriate	100	100
❖ The cost of irrigation networks (price of pipes, hoses, etc.)	inappropriate	100	100
Second: productivity problems			
❖ Purpose of production	Local market	100	100
❖ Lack of high-productivity and affordable cucumber varieties.	inappropriate	89	89
❖ Availability of chemical fertilizers and pesticides	Available	90	90
❖ High prices of chemical fertilizers and pesticides.	inappropriate	100	100
❖ high humidity, which leads to the spread of diseases and fungi, which leads to reduced production.	Average	56	56
❖ The availability of experienced and trained labor	Available	76	76
❖ High wages for expert and trained workers	inappropriate	95	95
❖ Lack of training and extension workers in greenhouse production.	inappropriate	93	93
❖ Lack of efficient means of heating greenhouses in times of low temperature	inappropriate	90	90
❖ Availability of municipal fertilizers free of soil diseases at affordable prices	Average	55	55
Third: funding problems			
❖ Lack of loans to finance greenhouse production at appropriate interest rates.	inappropriate	98	98
❖ High interest rate on lending	inappropriate	100	100
❖ Multiple routines for obtaining the loan	agree	100	100
❖ Appropriate loan repayment deadline	inappropriate	100	100
Fourth: marketing problems			
❖ Lack of transportation, high transportation costs of crop option, from production to distribution or consumption	inappropriate	98	98
❖ The role of agricultural cooperatives in educating farmers in the production and marketing of vegetables in greenhouses	inappropriate	85	85
❖ Exploitation and control of brokers without providing marketing services	agree	89	89

Source: collected and calculated from the results of the analysis of the study sample in the study sample villages in Belqas Center in Dakahlia Governorate for the agricultural season 2018/2019.

(B) Second: Production Problems:- 100% of farmers in the sample confirmed that the purpose of production is the local market.

- 100% of the total respondents confirmed that difficult in availability of high-yield varieties of cucumbers at the right time for agriculture at reasonable prices.

- About 90% of the total respondents confirmed the availability of chemical fertilizers and pesticides, while about 100 % of the total respondents confirmed the high prices of chemical fertilizers and pesticides.

- About 56% of the total respondents confirmed the high humidity, which leads to the spread of diseases and fungi, which leads to decrease in production.

- About 24% of the total respondents confirmed that, unavailability of skilled and trained workers, while about 100% of the respondents confirmed the high wages of experienced and trained workers, according to the farmers of Cucumber.

- About 93% of the total respondents confirmed the lack of training and agricultural

extension workers in the field of greenhouse production.

- Approximately 90% of the total respondents confirmed that there is no efficient heating system for greenhouses during times of low temperature in winter.

- About 55% of the total respondents confirmed the difficult to found municipal fertilizers free of soil diseases at reasonable prices.

(C) Third: Financing Problems

- 100% of the total respondents indicated the high cost of construction and production, forcing them to borrow.

- About 98% of the total respondents confirmed that loans are not available to finance production in the greenhouses at suitable interest rates, which reached 14% in official sources.

(D) Fourth: Marketing Problems:

- About 98% of the total respondents indicated that transportation is not available, and it's high costs, especially after the elimination of energy subsidies.

- 85% of the total respondents indicated the weak role of agricultural cooperatives in educating farmers in the production and marketing of vegetables in greenhouses.

- Approximately 89% of the total respondents indicated the Exploitation and control of brokers without providing marketing services.

solutions from the point of view of cucumber producers under plastic greenhouse in season 2018/2019:

It is clear from table (12) that about 100% of the respondents in looking for government support to help adopt this technology, and the seeks for reducing the costs of establishing greenhouses technology without compromising its functionality and efficiency, continue in the national projects to encourage the expansion of production under the greenhouses and show its results to encourage farmers to adopt this technology, provide plastic high quality for suitable prices, coordination of payment dates and obtaining returns to farms, preventing imported or circulation of pesticides, seeds and fertilizers from unknown origin, providing proof of their origin and specifications, and the need for approval from the Ministry of Agriculture and Land Reclamation, and the provide seeds which have high productivity and resistance to diseases, at reasonable prices.

In the light of the results, the research recommends the following:

- Expansion in protected agriculture and increase investment for achieving sustainable agricultural development.

- Ministry of Agriculture and Land Reclamation established greenhouse models in all governorates to persuade farmers to adopt the protected agriculture technology "plastic greenhouse" and adopt drip irrigation to rationalize water consumption.

- Activating the role of the Ministry of Agriculture, Land Reclamation, and Agricultural Cooperatives to avoid problems related to production under greenhouses and suggested solutions.

- Provide seeds that have high productivity and resistance to diseases.

- Provide the requirements of greenhouses establishment such as plastic with standard specifications at reasonable prices.

- Applied contract farming to reduce the price risks.

- Provide the requirements for the establishment of greenhouses, especially plastic specifications and standard at reasonable prices.

- Prevent imports and circulation of pesticides, seeds and fertilizers of unknown origin, and providing proof of their origin and specifications, and the need to take the approval of the Ministry of Agriculture and Land Reclamation.

- Providing loans to greenhouses at appropriate interest rates, coordinating the repayment dates and obtaining the return to the farmer.

- Activating the role of agricultural cooperatives in providing production requirements, in addition to marketing of agricultural products from greenhouses.

- Activating the role of the Agricultural Union in protecting farmers.

- Preventing circulation of pesticides, seeds and fertilizers of unknown origin, and provide proof of their origin and specifications, and the need to obtain the approval of the Ministry of Agriculture and Land Reclamation.

- Conducting more studies about marketing for products from greenhouses, spread the culture of marketing from producer to consumer directly, to reduce the number of intermediaries and marketing costs, and thus maintain appropriate prices.

- Monitoring and evaluate protected agriculture, to overcome the obstacles.

Table (12) solutions from the point of view of cucumber producers under plastic greenhouse in season 2018/2019

Proposed solutions	Responsible Authority	no	%
❖ Government support to assist in the adoption of this modern technology, and reduce the cost of the greenhouse technology without compromising its functionality and efficiency	Ministry of Agriculture and Land Reclamation (MALR) & Ministry of Foreign Trade	100	100
❖ Continue in the national projects and published the results to encourage the expansion of vegetable production in the greenhouses	Ministry of Agriculture and Land Reclamation (MALR)	100	100
❖ Provide standard plastic" high quality" at reasonable prices. Ministry of Agriculture and Land Reclamation.	Ministry of Agriculture and Land Reclamation (MALR)	100	100
❖ provide loans to greenhouses at appropriate interest rates, coordination of repayment dates and obtaining returns to the farm.	Egyptian agriculture Bank	100	100
❖ Prevent the imported and circulation of pesticides, seeds and fertilizers of unknown origin, and provide proof of their origin and specifications, and the need to obtain the approval of the Ministry of Agriculture and Land Reclamation.	Ministry of Agriculture and Land Reclamation "Agricultural Quarantine" and the Ministry of Foreign Trade.	100	100
❖ Creating marketing organization for greenhouse products, to reduce the control of intermediaries and brokers, and spread the culture of marketing from producer to consumer directly, to reduce the number of intermediaries and marketing costs.	Agricultural Extension Service and contract farming	100	100
❖ Providing energy to farmers and organizing their receipt times.	(MALR) & petroleum.		
❖ Provide seedlings such as high productivity and disease resistance in time for planting, at affordable prices.	Ministry of Agriculture and Land Reclamation (MALR)	100	100
❖ Activating the role of agricultural cooperatives in providing production requirements, and marketing of agricultural products of greenhouses.	Ministry of Agriculture and Land Reclamation (MALR)	80	80
❖ Reduce the price risks of greenhouse products, through applied contract farming in the marketing process of greenhouse products.	Ministry of Agriculture and Land Reclamation (MALR)	95	95
❖ Activate the role of the Agricultural Union for help & protect farmers through agricultural insurance.	Ministry of Agriculture and Land Reclamation (MALR)	65	65
❖ Provide fertilizers and pesticides at reasonable prices and at the appropriate times.	Ministry of Agriculture and Land Reclamation, agricultural cooperatives	92	92
❖ Development of varieties resistant to soil diseases, and high productivity at reasonable prices.	(MALR),Research centers, & universities	93	93
❖ Activate the role of agricultural extension and conduct training programs for workers in greenhouses at affordable prices.	Ministry of Agriculture and Land Reclamation (MALR)	65	65
❖ (GAP) should be implemented.	Ministry of Agriculture and Land Reclamation (MALR)	86	86
❖ Established a vegetable exchange such as the poultry exchange and others, to reduce the control of brokers and brokers	Ministry of Agriculture and Land Reclamation (MALR)	70	70

Source: Collected and calculated from the data of the research sample for the agricultural season 2018/2019.

Summary and Conclusions

The agricultural production, productivity and quality of produce depend upon the cultural practices; this study was conducted 2018/2019, under conditions of plastic greenhouse at Dakahlia Governorate, to evaluate the performance of grown Cucumber in Protected Agriculture Technology, and in open Field Production. Conducting this study to identify if greenhouse Can used as a solution of problems that are exposed to or lead to the cultivation of the open field? in addition to achieving a surplus for export as well as improving the trade balance, The research also aims to monitoring and evaluating the cucumber greenhouse, to maximize the productive, marketing, financing and export capabilities, especially for small farmers, who represent the majority of agricultural producers, to guide policy makers and decision makers in the

development of special agricultural policies to increase efficiency. Productions under protected agriculture technology, optimizing water and soil resources, increase agricultural production and improve farmers' standard of living to achieve sustainable agricultural development. The research used statistical descriptive and quantitative analysis, to calculate the production costs and return, for the financial evaluation of the cucumber crops, the research also relied on secondary data published and unpublished from the official authorities concerned, in addition to primary sources through a random sample, consisting of (100) A sample questionnaire was designed specifically for this purpose, questionnaires for (producer, wholesaler, retailer) direct interview), during the agricultural season 2018/2019, where the sample included Small model of greenhouses with an

area of 240 m² (6 m X 40 m), which is the most common area in the province of Dakahlia.

- Farmers depend on vegetable crops to increase their income, in addition to their nutritional and cash importance, which made them the most consumed among other agricultural crops, and the option is considered one of the most important vegetable crops grown in plastic greenhouses, not to compete with open crops for this product during the production period inside the greenhouse, This leads to increased returns and availability of the product through producing offseason agricultural products.

- using plastic greenhouse, led to increase the productivity of cucumber crop, about 12.44 kg/m², compared to agriculture in the open field, and the expected water savings due to protected agriculture "greenhouse" about 63.23 million m³ water / season In 2017, if the cultivated areas in the open field are replaced, the greenhouse system is protected.

- The net return was about 13.88 LE / m², and the benefit/ cost ratio about 1.37, while the return on the invested pound was about 0.37 LE, which means that there is economic efficiency in producing cucumber under greenhouse, due to the ratio value is greater than the whole one. The project for the capital investment costs has reached about 2 years and 9 months. It also shows the sensitivity of the project to high production costs.

- There are some independent factors has statistical significance and positively affect the productivity per square meter of cucumber under plastic greenhouses such as the cultivated area, the number of control times, the quality of seeds used, and the number of workers used.

- Most of the respondents in the study sample confirmed that the protected agriculture "plastic greenhouse" suffers from many problems, the most important problem which are high construction costs for greenhouses, high costs of production requirements, difficult of marketing their products, and control of intermediaries and brokers.

- In the light of the findings, the research recommends the following:

- Expansion in protected agriculture and increase investment to achieving sustainable agricultural development.

- Providing seeds and seedlings that have disease resistance and high productivity.

- applied contract farming to reduce the price risks.

- Provide the requirements for the establishment of greenhouses, especially plastic specifications and standard at reasonable prices.

- Preventing the circulation of pesticides, seeds and fertilizers of unknown origin, and providing proof of their origin and specifications, and the need to take the approval of the Ministry of Agriculture and Land Reclamation.

- Providing loans to greenhouses at appropriate interest rates, coordinating the repayment dates and obtaining the return.

- Activating the role of agricultural cooperatives in providing production requirements, in addition to marketing of greenhouses products.

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Appendix

Table (1) Vegetable and Cucumber Crops Production Indicators in the Open Field During the period (2005-2017)

Years	vegetable crops		cucumber crop		
	area Million fadden	production Million tons	Area "Thousand Fadden"	productivity Ton / fadden	production Thousand tons
2005	1.5	17.1	71	9.2	650
2006	1.6	18.0	84	9.5	803
2007	1.6	18.1	72	9.3	671
2008	1.6	17.9	68	8.8	596
2009	2.2	23.2	65	9.3	600
2010	2.1	21.3	67	9.4	631
2011	2.1	21.2	69	9.1	630
2012	2.1	22.5	62	9.5	588
2013	2.0	21.1	53	9.4	497
2014	2.1	21.8	50	9.2	457
2015	2.1	21.3	56	8.9	496
2016	2.0	20.0	52	9.3	484
2017	1.9	19.5	44	9.0	393
المتوسط	1.9	20.2	62.4	9.2	576.6

Source: Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Agricultural Statistics Bulletin, (2005-2017).

Table (2) Vegetable and Cucumber Crops Production Indicators in the in greenhouses During the period (2005-2017)

Years	Vegetable crops			Cucumber crop				Relative importance of cucumber crop		
	Number of greenhouses " Thousand	area Million / m2	production Thousand tons	Number of greenhouses " Thousand	area Million / m2	productivity Ton / fadden	production Thousand tons	%Number of greenhouses " Thousand	%Area Million / m2	%production Thousand tons
2005	48	189.	178	22.1	8.3	10.1	87.1	47	43.7	49.0
2006	86	19.7	157	24.6	9.1	11.4	110.1	28	46.1	70.0
2007	57	25.7	295	25.5	11.7	13.8	167.2	45	45.5	56.8
2008	66	32.7	361	31.9	15.2	13.0	201.7	48	46.5	55.8
2009	56	22.6	256	29.4	11.1	12.6	141.4	53	49.4	55.2
2010	66	25.2	257	37.5	12.7	11.7	149.6	57	50.6	58.1
2011	63	28.5	245	36.4	12.9	11.0	130.5	58	45.2	53.2
2012	69	34	310	36.9	14.9	11.0	159.4	54	43.8	51.4
2013	70	24.6	279	41.4	12.7	12.4	163.4	59	51.8	58.6
2014	68	23.9	285	38.3	12.9	12.3	172.0	56	54.1	60.4
2015	54	21.6	233	24.7	9.2	11.7	115.0	46	42.6	49.4
2016	67	28.5	267	31.5	12.9	9.9	128.9	47	45.2	48.3
2017	70	27	263	35.5	11.7	10.9	125.6	51	43.2	47.7
المتوسط	65	25.6	261	32.0	11.9	11.7	142.4	50	47	55

Source: Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Agricultural Statistics Bulletin, (2005-2017).

1/30/2020