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Economic Study of the Use of Renewable Energy and Technology in Growing Summer Tomatoes

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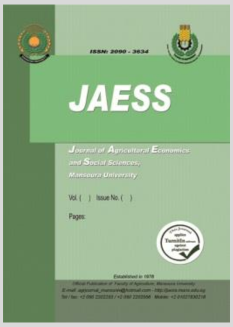

ABSTRACT

The agricultural sector occupies an important place among the sectors of the national economy, which necessitates work to increase the per-acre yield of agricultural crops through the use of what was developed in the field of modern technology and renewable energy. It was found through the estimation of the production functions of the summer tomato crop using solar irrigation during the season 2019 that the model used is significant at the probability level(0.01)and it was found that there is a statistically positive positive relationship between the quantity of production(y)per ton and each of the total human labor (Q1) and the total Automated working hours per hour/acre(Q2),the amount of nitrogen fertilizer per unit(Q5)and the amount of potassium fertilizer per unit (Q7), as by increasing the previously mentioned independent factors by(1%), it leads to an increase in summer tomato production by about 0.328%, 0.320% 0.595, 0.452 On the order, the significance of the staged logarithmic model for the production of the summer tomato crop using irrigation with solar energy during the season 2019 was also confirmed at the probability level (0.01), as it was found that there was a statistically positive positive relationship between the production quantity (y) in tons and each of the total automatic working hours per hour / acre) Q2) and the amount of municipal fertilizer (Q4)and the amount of potassium fertilizer per unit (Q7) as the increase in the previously mentioned independent factors by(1%)leads to an increase in summer tomato production by about 0.746%, 0.119% and 0.879% respectively.

Keywords: Renewable Energy ,Technology , Summer Tomatoes , Questionnaire and averages of production

INTRODUCTION

The agricultural sector occupies an important place among the sectors of the national economy, as it is an important source for generating national income as it bears a great burden in the process of economic development, and the agricultural sector derives its importance from being the main source for providing food needs, and also the burden of providing the industrial needs of agricultural raw materials. Many industries depend on it, in addition to being a source of foreign currencies, so the success of the agricultural sector in carrying out the tasks referred to is considered at the forefront of the factors that provide the appropriate climate to ensure the achievement of economic development, which require giving a strong impetus to the agricultural sector, whether in the field of agricultural resources development. The current state is known as vertical agricultural development or adding new agricultural resource energies and is known as horizontal development. In view of the difficulties facing horizontal agricultural development because it requires large capital investments, our greatest concern will be directed to vertical agricultural development, that is, increasing the average yield per acre of agricultural crops, by using what was developed in the field of modern technology, so renewable energy and technology is the most Appropriateness in all these current Egyptian economic changes, as talking about economic development through the economics of oil and natural gas is no longer acceptable. Therefore, Egyptian experts have realized that agricultural development policies and mechanisms must adopt the concept of renewable energy and modern technology, especially after the trend of developed countries.

Research Problem:

The problem of the study is to reach the best methods and means that work to increase agricultural production at the lowest possible costs in light of this great technological progress that the world has witnessed during the last ten years in addition to providing a natural and permanent source of energy in the border and desert regions instead of total dependence on oil. This led to an increase in the cost of reclamation in all regions, which led to the reluctance of farmers and producers from some crops that require a large amount of water, especially in the summer, in addition to the great hardship of providing the required maintenance for generators and providing their spare parts.

Research Objective:

The research aims to confirm the importance of using renewable energy and modern technology in Egyptian agriculture. Especially solar energy due to the high insulation rates of about 2.3 kilowatts / square meter, which coincides with the decrease in energy sources of natural gas and petroleum in Egypt. Therefore, it is necessary to rely on solar energy in development plans, especially in the field of agriculture, and to study the most important production problems that Facing tomato farmers in Minya, and studying the production problems facing Minya tomato growers.

Data Sources and Research Method:

The research generally relied on obtaining data from a group of sources, the first of which is the secondary data published on the primary data, which was collected from the

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field study sample data for the 2019 agricultural season, in addition to some published scientific research and studies and some Arab and foreign references closely related to the study. One of the methods of descriptive and quantitative statistical analysis that is appropriate with the data available for research.

Selection and Description of the Field Study Sample:

In order for the research objectives to be achieved, it was necessary to obtain detailed data at the farm level related to production requirements, which required the necessity of conducting a field study on 30 farms from the farmers of Minya Governorate. Therefore, it was taken into account that the study sample is in line with the statistical principles, as it is a multi-purpose sample. It was intended when selecting tomato farms, while it was random when selecting farmers.

First: Estimation of a T-test among the physical averages of production requirements per summer tomato feddan in Minya Governorate:

The production of summer feddans of tomatoes varies for irrigation farmers using solar or using solar energy irrigation, and by studying whether there is a difference between the physical averages used in the production process for summer tomato production in Minya, the (T) test was used, which shows in Table (1) the presence of significant differences between The two irrigation methods used, whether solar irrigation or solar energy irrigation, at a significant level (0.001) and at a significant level (0.005) between the average summer tomato crop production averages in Minya for the 2019 agricultural season.

Table 1. The physical average of the requirements for the production of the summer tomato crop for irrigation farmers using solar and solar energy in the study sample during the season (2019).

Production requirements	Irrigation using	the number	Average	standard deviation	"T" value
Total human work (Man / acre)	Diesel	30	213	13.017	3.72**
	Solar energy	30	198	18.005	
Total automated working hours	Diesel	30	202.98	6.175	1.77
	Solar energy	30	195.85	21.196	
(Hour / acre)	Diesel	30	153.30	2.693	3.04**
	Solar energy	30	185.17	8.355	
(Number of irrigation)	Diesel	30	7.15	0.141	4.05**
	Solar energy	30	7.31	0.159	
The amount of seedlings (In a thousand seedlings)	Diesel	30	17.94	3.025	2.58*
	Solar energy	30	15.83	3.287	
Manure	Diesel	30	39.08	7.930	2.35*
	Solar energy	30	43.83	7.686	
(Cubic meters)	Diesel	30	26.31	2.098	1.75
	Solar energy	30	25.05	3.339	
Nitrogen fertilizer (Effective unit)	Diesel	30	50.80	12.447	*2.43
	Solar energy	30	42.52	13.851	
Phosphate fertilizer	Diesel	30	4.30	0.428	**4.19
	Solar energy	30	11.82	9.816	
(Effective unit)	Diesel	30	28.88	8.149	**3.78
	Solar energy	30	36.63	7.734	

**** Significance at 0.01 level**

***Significance at 0.05**

Source: - It was collected and calculated from field research data with the study sample for the 2019 agricultural season.

Second: the statistical estimation of the production functions:

The logarithmic stage model shows that Equation No. (1) in Table No. (2) the effect of the aforementioned variables on the production of the summer tomato crop using solar irrigation during the season 2019, that the model used as a whole is significant at the probability level (0.01) where it was found that there is a statistically significant positive positive relationship. Between the quantity of production (y) per ton, and each of the total human labor (Q1), the total automatic working hours per hour / feddan (Q2), the amount of nitrogen fertilizer per unit (Q5), the amount of potassium fertilizer per unit (Q7), as it increases the previous independent factors Mentioning it by 1% leads to an increase in summer tomato production by about 0.328%, 0.320%, 0.595%, and 0.45%, respectively, and the total elasticities of the model amounting to about 1.69 indicate that the productive function of the study sample is a function of increasing returns, meaning that all An increase of about 1% in the quantities used from the independent variables, leading to an increase in the final product quantity of the quantity of the summer tomato crop by more than 1.69%, assuming the stability of the other variables at their arithmetic averages, and the value of the modified determination coefficient (R -2) indicates that a group Variable variables The decrease included in the model is responsible for about 87.3% of the changes in the summer tomato yield using solar irrigation. The statistical significance of the model as a whole was proved at a significant level (0.01).

The staged logarithmic model also shows that Equation

No. (2) in Table No. (2) The effect of the aforementioned variables on the production of the summer tomato crop using solar energy irrigation during the season 2019, that the model used as a whole has a meaning at the probability level (0.01) where it was found that there is a positive direct relationship. Statistically significant between the quantity of production (Y) in tons, and each of the total automatic working hours per hour / feddan (Q2), the amount of municipal fertilizer (Q4), and the amount of potassium fertilizer per unit (Q7), since by increasing the previously mentioned independent factors by 1%, it leads to an increase in production Summer tomatoes are about 0.746%, 0.119%, and 0.879%, respectively, and the total elasticities of the model amounting to about 1.74 indicate that the productive function of the study sample is a function of increasing returns, meaning that each increase is estimated at about 1% in the quantities used from

The independent variables lead to an increase in the final product amount for the quantity of the summer tomato crop by more than 1.74%, assuming the stability of the other variables at their arithmetic averages, and the value of the modified determination coefficient (R-2) indicates that the set of independent variables included in the model is responsible for about 84.3. % of the changes in the production of the summer tomato crop using solar irrigation, and the statistical significance of the model as a whole was proved at a significant level (0.01).

Third: Estimate the significance of the difference (T) test between the average cost items per acre of summer tomato crop in Minya Governorate.

The cost items of summer tomato production vary between irrigation farmers using solar or using solar energy, and by studying whether there is a difference between the averages of the cost items used in the production process for summer tomato production in Minya, the (T) test was used, which shows in Table (3) the presence of significant differences Irrigation farmers using solar and solar energy.

Table 2. The quantitative production function in the double logarithmic form of the summer tomato crop for irrigation farmers using solar samples for the study season (2019)

Category	Used form	Equation		R-2	P	Overall flexibility
Irrigation using diesel	Logarithmic model Staging (1)	Lot ^ = -3.14 + 0.328 lo x1 + 0.320 lo x2 0.595 +LX 5 + 0.45 LX 7*(2.53)	**(3.83) **(3.59) *(2.15)	0.873	**59.64	1.693
Irrigation using solar energy	Logarithmic step model (2)	0.746 + 2.59- =lo x2 + 0.119 lox 4 لو س7 0.879 + *(2.31)	**(3.23) **(3.11)	0.843	**67.22	1.744

** Significance at 0.01 level *Significance at 0.05

Source: - It was collected and calculated from field research data with the study sample.

Table 3. Average cost items for the summer tomato crop for irrigation farmers using solar and solar energy for the study sample during the season (2019)

Cost items	Category	the number	Average	standard deviation	Values"T
The total value of human labor	diesel	30	19819.13	1453.93	0.743
	Solar energy	30	19500.41	1843.69	
The total value of automated work	diesel	30	8077.13	522.03	**54.824
	Solar energy	30	2341.12	236.41	
Total operating costs	diesel	30	27896.26	1931.02	**11.833
	Solar energy	30	21841.53	2031.31	
Seed value	diesel	30	6720.00	222.58	**4.015
	Solar energy	30	6513.66	172.27	
The value of municipal fertilizer	Diesel	30	2669.65	439.07	**2.970
	Solar energy	30	2317.07	479.73	
The value of nitrogen fertilizer	Diesel	30	575.00	109.66	*2.138
	Solar energy	30	637.58	116.94	
The value of phosphate fertilizer	Diesel	30	249.13	21.42	0.872
	Solar energy	30	243.97	24.30	
The value of potassium fertilizer	Diesel	30	933.75	228.71	*2.204
	Solar energy	30	795.44	256.49	
The value of a balanced fertilizer	Diesel	30	1830.75	199.20	**7.517
	Solar energy	30	940.12	617.64	
Pesticide value	Diesel	30	1109.00	133.37	1.320-
	Solar energy	30	1262.35	622.19	
The value of production requirements	diesel	30	14087.28	588.92	**6.954
	Solar energy	30	12710.19	910.75	
Total costs	Diesel	30	41983.53	2338.74	**11.220
	Solar energy	30	34551.72	2773.43	
Unit cost produced	Diesel	30	1546.05	374.68	**7.733
	Solar energy	30	971.65	158.62	

**Significance at 0.01 level * Significance at 0.05

Source: - collected and calculated from the questionnaire form.

At a significant level (0.01) and at (0.005) level among the average cost items for the summer tomato crop for irrigation farmers using solar and solar energy in Minya for the 2019 agricultural season.

Fourth: the statistical estimation of cost functions:

It was possible to estimate the productive cost function of the summer tomato crop in the study sample by using productivity as a dependent variable, and total production as an independent variable. Which maximize profit, and the optimal size of the civilian production of costs, through the total costs function.

For irrigation farmers using diesel:1 -

TK indicates in Table (4) the total costs, while Y denotes the volume of production in tons, and it becomes clear that the estimated function is statistically significant, and the value of (R-2) the modified determination coefficient 0.456 indicates that about 45.6% of the changes in the total costs are it is due to the change in production.

The volume of production, which maximizes the net return, was estimated by finding the cost function and equating it with marginal revenue, which is the average selling price per ton of summer tomatoes, which amounts to EGP 1,870. By finding the first derivative of the total cost function, marginal costs were obtained, where T. The marginal, y denotes the volume of production. As the volume of production, which maximizes the yield, reached about 50.41 tons, and none of the irrigation farmers using diesel irrigation achieved this volume of production.

The volume of production which lowers the average costs to the lowest point around can be obtained by equating the marginal cost function with the average cost function, hh = mt.

As the volume of production with the lowest average costs reached 3 farmers, at a rate of 10% of the total farmers who used solar irrigation.

To obtain flexibility, the marginal costs are divided by the average costs, so the elasticity is estimated at about 0.840. The significance of this value for the flexibility of costs indicates that summer tomato producers work in the first stage of the law of diminishing returns, which is the rational phase.

2- For irrigation farmers using solar energy:

TK indicates in Table (4) the total costs, while Y indicates the volume of production in tons, and it becomes clear that the estimated function is statistically significant, and the value of (R-2) the modified determination coefficient, 0.727, indicates that about 72.7% of the changes in the total costs are it is due to the change in production.

The volume of production, which maximizes the net return, was estimated by finding the cost function and equating it with marginal revenue, which is the average selling price per ton of summer tomatoes, which amounts to

EGP 1,870. By finding the first derivative of the total cost function, marginal costs were obtained, where T. The marginal, y denotes the volume of production. As the volume of production, which maximizes the yield, reached about 42.20 tons, and none of the irrigation farmers using solar energy irrigation achieved this volume of production.

The volume of production which lowers the average costs to the lowest point around can be obtained by equating the marginal cost function with the average cost function, hh = mt. As the volume of production with the lowest average costs reached 8 farmers, accounting for 26.7% of the total number of farmers who used solar irrigation.

To obtain flexibility, the marginal costs are divided by the average costs, so the elasticity was estimated at about 0.895. The significance of this value for the elasticity of costs indicates that summer tomato producers work in the first stage of the law of diminishing returns, which is the rational stage.

Table 4. The cost functions of the summer tomato crop for irrigation farmers using solar and solar energy with the study sample during the season (2019)

Category	Function	Adjusted coefficient of determinationR-2	Values P	Flexibility	The number of farmers in the sample	The size Which Magnifies Profit per acre (In tons)	Sample growers who achieved this acre size		The volume is the lowest cost Per acre (In tons)	Sample growers who achieved this scale	
							Number	٪		Number	٪
Irrigation using diesel	(1) ت ك =41347+ 3.96 ص – 55.59 ص^{2}+0.98 ص^{3} (1.39) (1.56-) (1.74) (2) ت ح = 3.96 – 111.17 ص + 2.94 ص^{2} (3) ت م = 41347 / ص + 3.96 – 55.59 ص + 0.98 ص^{2}	0.456	*6.27	0.840	30	50.41			40.94	3	10٪
Irrigation using energy Solar	(4) ت ك = 12800.54+2157.60 ص – 57.47 ص^{2} + 0.854 ص^{3} **(3.56) *(2.45-) (1.37) (5) ت ح = 2157.60 – 114.94 ص + 2.562 ص^{2} (6) ت م = 12800.54 / ص +2157.60 – 57.47 ص + 0.854 ص^{2}	0.727	**23.05	0.895	30	42.20	2	٪6.7	38.66	8	26.7٪

Tk, tm, th refer to the total, median and marginal costs respectively, the numbers in parentheses refer to the calculated value of the (t) test.
****significant at 0.01 level, * significant at 0.05 level of significance**
Source: - collected and calculated from the questionnaire form.

Fifthly: the economic efficiency of summer tomatoes in Minya Governorate:

production quantity

I t is evident from Table No. (5) that the summer tomato growers who used solar irrigation have achieved a greater production quantity of about 36.63 tons, while the amount of production for irrigation farmers using solar irrigation was about 28.88 tons.

Price per ton:

It is clear from Table No. (5) That the price per ton of summer tomatoes for irrigation farmers using both solar and solar energy amounted to about 1870 pounds.

Table 5. Indicators of the economic efficiency of the summer tomato crop for irrigation farmers using solar and solar energy with the study sample during the season (2019)

Pointers	Category	the number	Average	standard deviation	Values"T"
The amount of production is in tons	Diesel	30	28.88	8.15	**3.78
	Solar energy	30	36.63	7.73	
Price per ton	Diesel	30	1870.00	94.32	–
	Solar energy	30	1870.00	94.32	
Total revenue	Diesel	30	53949.00	15345.31	**3.78
	Solar energy	30	68398.17	14219.24	
The net return	Diesel	30	11965.47	15282.24	**6.12
	Solar energy	30	33846.45	12232.74	
The ratio of total revenue to total costs	Diesel	30	1.29	0.36	**8.04
	Solar energy	30	1.97	0.30	
The profitable pound invested	Diesel	30	0.29	0.36	**8.04
	Solar energy	30	0.97	0.30	
The profitability of the productive unit	Diesel	30	323.95	369.21	**7.66
	Solar energy	30	898.35	179.97	

Source: - collected and calculated from the questionnaire form.

Total revenue:

I t is evident from Table No. (5) that the total revenue reached its maximum with the summer tomato growers using solar energy irrigation, reaching about 68.40 thousand pounds, while the data of the same table indicate that the summer tomato growers using solar irrigation achieved a lower total revenue, as it amounted to about 53.95 thousand fairy.

Net Return:

I t is evident from Table No. (5) that the farmers who used solar energy irrigation outperformed the highest net return of the summer tomato crop, which amounted to about 33.85 thousand pounds, while the irrigation farmers who used solar irrigation achieved the lowest net return of the tomato crop, which amounted to about 11.97 thousand fairy.

Ratio of total revenue to total costs:

It is evident from Table No. (5) That the summer tomato growers who used solar irrigation had the highest percentage of total revenue to total costs, about 1.97, and the data of the same table indicated that the ratio of total revenue to the total costs of summer tomato growers who used solar irrigation was about 1.29.

Profit of the investor pound:

Table No. (5) Shows the superiority of tomato growers using solar energy in achieving the highest return on the invested pound for the summer tomato crop, which amounted to about 0.97 pounds, while the irrigation farmers who used solar irrigation achieved the lowest return on the invested pound, reaching about 0.29 pounds.

Profit of the productive unit:

Table No. (5) Show the superiority of tomato growers by using solar energy in achieving the highest profit for the unit producing the summer tomato crop, which amounted to about LE 898.35, while the irrigation farmers who used solar irrigation achieved the lowest profit on the productive unit, reaching about LE 323.95.

Sixth: Indicators of productive and economic efficiency of the water unit used to grow the tomato crop in the study sample:

Physical and value averages of irrigation sample for tomato crop irrigation 1-- Automated work and human labor for irrigation of feddans.

It is evident from Table No. (6) That the automatic work used in irrigation of feddans in the case of using solar irrigation and solar energy irrigation, which amounted to about 199.73 and 193.17 hours / feddan, respectively, while the amount of human labor used in irrigation of the feddan was in the case of solar irrigation. And the solar irrigation is about 28 and 18 men / day, respectively.

Table 6. Physical and value averages of the irrigation process for the summer tomato crop for irrigation farmers using solar and solar energy in the study sample during the season (2019).

The type of underground wells		Diesel	solar energy
Physical averages	Automatic irrigation work (hour / acre)	199.73	193.17
	Irrigation human work (man / acre)	28	18
	The amount of water is 3 m in the irrigation	29.35	28.44
	Number of irrigation	153	158
	The amount of water needed to ripen the crop (Thousand cubic meters)	4.49	4.49
Value averages	The value of automatic irrigation work (Pound)	6378.38	965.87
(In pounds)	The value of human action for irrigation	2765.00	2041.35
	Total irrigation costs	9143.38	3007.22

Source: - collected and calculated from the questionnaire form.

The amount of water in a single lung and the number of irrigation:

Table No. (6) Shows that the amount of water in a single irrigation per feddan in the case of solar irrigation and solar energy irrigation was 29.35 m3 and 28.44 m3, respectively, while the number of irrigation in the case of solar irrigation was about 153, while in the case of solar energy it reached about 158. Reh.

The amount of water needed to ripen the crop:

It is clear from Table No. (6) That the amount of water needed per acre for the crop to mature was about 4.49 thousand cubic meters in the case of solar irrigation, while also in the case of solar energy irrigation about 4.49 thousand cubic meters.

The value of mechanical work and human labor used in irrigation:

It is evident from Table No. (6) That the value of the automatic work used in irrigation of feddans in the case of solar irrigation and solar energy irrigation amounted to about 6378.38 and 965.87 pounds on

The arrangement, while the value of human labor in the case of solar irrigation was about 2765 pounds, while in the case of solar energy it was about 2041.35 pounds, respectively.

Total cost of irrigation:

It is evident from Table No. (6) That the total cost of irrigation per feddan has reached about 9143.38 pounds in the case of solar irrigation, while the total cost of irrigation in the case of solar energy is about 3007.22 pounds, which shows that solar energy irrigation achieves a much lower cost than solar irrigation.

2- Indicators of efficiency of the irrigation water resource used to produce tomato crop in the study sample.

This concept of efficiency is concerned with how to maximize the utilization of the water unit used to cultivate the crop in order to achieve the optimal use of that resource, which is characterized by relative scarcity. The efficiency of using the water resource can be measured according to the type of irrigation used, whether irrigation using solar or irrigation is using solar energy, through several criteria as follows:

Productivity of the water unit:

Table No. (7) Shows that the productivity of the irrigation water unit in the case of using summer tomato growers solar or solar energy irrigation was about 6.43 and 8.16 tons / thousand cubic meters, respectively.

Net revenue from the water unit:

It is evident from the data of Table No. (7) that the yield of the water unit used in the cultivation of the summer tomato crop in the case of irrigation farmers using solar and solar energy amounted to about 2664.91 and 7538.18 pounds / thousand cubic meters, respectively.

Irrigation cost of the production unit:

I t is clear from the data of Table No. (7) that the cost of irrigation of the unit produced from the summer tomato crop was about 316.60 EGP / ton, and irrigation using solar energy was about 82.09 EGP / ton, as it is clear that irrigation using solar energy is the cost of unit irrigation. It is produced much less than irrigation using diesel.

The amount of water needed to produce the unit of output:

It is evident from the data of Table No. (7) that the amount of water needed to produce a unit of output from the summer tomato crop in the case of irrigation farmers using diesel or using solar energy, which amounted to about 0.155 and 0.123 thousand cubic meters per ton, respectively.

Ratio of irrigation costs to total costs:

Where it is also evident from the data of Table No. (7) that the ratio of irrigation costs to the total costs per acre of the summer tomato crop for irrigation farmers using solar energy was about 21.78%, and by using solar energy it reached about 8.70% of the total costs per acre, as it became clear that the farmers who used irrigation With solar energy, they achieved a much lower cost ratio for irrigation than those who used solar irrigation.

Table 7. Indicators of efficiency of using irrigation water to produce the summer tomato crop for irrigation farmers using solar and solar energy in the study sample during the season (2019)

Categories	Water productivity per unit ton (1)	Net revenue from the water unit in pounds (2)	Irrigation cost per unit of production in pounds / ton (3)	The amount of water needed to produce a unit of output in thousand cubic meters (4)	Ratio of irrigation costs to total costs %(5)
Irrigation using diesel	6.43	2664.91	316.60	0.155	21.78
Irrigation using solar energy	8.16	7538.18	82.09	0.123	8.70

Source: - collected and calculated from the questionnaire form.

1- Productivity of a unit of water in tons = the amount of physical output in tons ÷ the amount of water needed to mature the crop, in thousand cubic meters.

2-Net revenue from a unit of water in pounds = net revenue per feddan in pounds ÷ the amount of water needed to mature the crop in thousand cubic meters.

3-The cost of irrigating the production unit in pounds / ton = costs of irrigation per feddan in pounds ÷ the amount of physical production per feddan.

4-The amount of water needed to produce a unit of output in thousand cubic meters = the amount of water needed to mature the crop in thousand cubic meters ÷ the amount of physical production per feddan in tons.

5-Ratio of irrigation costs to total costs = irrigation costs ÷ total costs x 100

Seventh: the production problems facing tomato growers in Minya Governorate.

A - For irrigation farmers using diesel:

By studying the production constraints faced by the tomato growers in the sample of the study, it became clear that these constraints differ in the degree of their importance and their impact on production, and consequently on the yield obtained by the farmer, and these obstacles were arranged in descending order according to the relative importance of the percentage of the farmers 'opinions as shown in the table. No. (8) The problem of high fixed production costs (X13) came in first place, with a rate of about 96.67%, and the problem of irregular irrigation shifts, poor drainage and high salinity ratio (X9) came in the first place at a rate of about 93.33%. They are the lack of a binding agricultural cycle for farmers (X5) and the problem of having a previous crop that has not yet matured (X6), as they accounted for about 80%, and in the fourth place the problem of high costs of mechanized service leased from the private sector (X11) by about 76.67%, and the fifth is a problem of low The efficiency of agricultural extension in the village agricultural association (X7) by about 73.33%, and in sixth place is the problem of the large spread of weeds in agricultural lands (X8), where it reached about 63.33%. Reach (X3) ranked seventh with a rate of about 53.33%, and the problem of unavailability of many modern agricultural machinery in the association and the machine service center (X2) ranked eighth with a rate of about 40%, and the problem of severity of infection with fungal and insect diseases and the high costs of resistance (X4) In the ninth place with a rate of about 36.67%, and the tenth is the problem of high workers 'wages and low efficiency (X10) by a rate of about 66.67%, and the problem of high irrigation costs in the region (X12) came in eleventh place with a rate of about 16.67%, and finally in the twelfth place And the last problem is the high prices of agricultural production inputs and their unavailability (X1), as it reached about 13.33%.

Table 8. The relative importance of the productive problems of the summer tomato crop for irrigation farmers using diesel in the study sample for the 2019 season.

number	the problems	Found		Not found		Arrangement	Ca 2
		number	%	number	%		
X13	High fixed production costs	29	96.67	1	3.33	1	**26.13
X9	Irregular watering shifts, poor drainage, and high salinity	28	93.33	2	6.67	2	**22.53
X5	The absence of a binding agricultural cycle for farmers	24	80.00	6	20.00	3	**10.80
X6	The presence of a previous crop that has not yet ripened	24	80.00	6	20.00	3 Duplicate	**10.80
X11	High costs of automated service leased from the private sector	23	76.67	7	23.33	4	**8.53
X7	Low efficiency of agricultural extension in the village agricultural association	22	73.33	8	26.67	5	*6.53
X8	The large spread of weeds in agricultural lands	19	63.33	11	36.67	6	2.13
X3	Reduced feddan yield of the crop	16	53.33	14	46.67	7	0.13
X2	The lack of many modern agricultural machines in the association and the automatic service center	12	40.00	18	60.00	8	1.20
X4	The severity of fungal and insect diseases and the high costs of resistance	11	36.67	19	63.33	9	2.13
X10	High workers' wages and low efficiency	10	33.33	20	66.67	10	3.33
X12	High irrigation costs in the region	5	16.67	25	83.33	11	**13.33
X1	The high prices of agricultural production inputs and their unavailability	4	13.33	26	86.67	12	**16.13

Tabular Ca value at 5% significance level = 3.81, tabular Ca value at 1% significance level = 6.64

. **Significance at 1% level of significance . Significance at 5%

Source: Collected and calculated from: the questionnaire data of the study sample.

B - For irrigation farmers using solar energy:

By studying the production constraints faced by the tomato growers in the sample of the study, it became clear that these constraints differ in the degree of their importance and their impact on production, and consequently on the yield obtained by the farmer, and these obstacles have been arranged in descending order according to the relative importance of the percentage of the farmers 'opinions as shown in the table. No. (9), where two problems were ranked first, namely the presence of a previous crop that was not yet mature (X6) and the problem of high irrigation costs in the region (X12), where they accounted for about 93.33%. The problem of high fixed production costs (X13) came in second place with a rate of about 83.33 The problem of irregular irrigation shifts, poor drainage and high salinity ratio (X9) is in the third place with a rate of about 80%, and in the fourth place is the problem of unavailability of many modern agricultural machinery in the Society and the Automatic Service Center (X2) by about 53.33%, and the fifth is a high problem Mechanized service costs leased from the private sector (X11) by about 50%, and in sixth place is the problem of lack of a binding agricultural cycle for farmers (X5), with a rate of about 46.67%, and the problem of low feddan productivity came to the surveyor For (X3) is ranked seventh with a rate of about 40%, and also in this rank there is a problem of low efficiency of agricultural extension in the village agricultural association (X7) by about 40%, and the problem of large spread of weeds in agricultural lands (X8) is ranked eighth by a rate of about 36.67 The problem of high prices of agricultural production inputs and their lack of availability (X1) came in the ninth place, at a rate of 33.33%, and the tenth was the problem of severity of fungal and insect diseases and the high costs of resistance (X4), at a rate of about 23.33%, and the problem of high wages of workers and a decrease in Their efficiency (X10) is ranked eleventh, with a rate of about 16.67%.

Table 9. The relative importance of the productive problems of the summer tomato crop for irrigation farmers using solar energy in the study sample for the 2019 season.

S.	the problems	Found		Not found		Arrangement	Ca 2
		number	%	number	%		
X6	The presence of a previous crop that has not yet ripened	28	93.33	2	6.67	1	**22.53
X12	The high costs of irrigation in the region	28	93.33	2	6.67	1 Duplicate	**22.53
X13	High fixed production costs	25	83.33	5	16.67	2	**13.33
X9	Irregular watering shifts, poor drainage, and high salinity	24	80.00	6	20.00	3	**10.80
X2	The lack of many modern agricultural machines in the association and the automatic service center	16	53.33	14	46.67	4	0.13
X11	The high costs of the automated service leased from the private sector	15	50.00	15	50.00	5	—
X5	The absence of a binding agricultural cycle for farmers	14	46.67	16	53.33	6	0.13
X3	Reduced feddan yield of the crop	12	40.00	18	60.00	7	1.20
X7	Low efficiency of agricultural extension in the village agricultural association	12	40.00	18	60.00	7Duplicate	1.20
X8	The large spread of weeds in agricultural lands	11	36.67	19	63.33	8	2.13
X1	The high prices of agricultural production requirements and their unavailability	10	33.33	20	66.67	9	3.33
X4	The severity of fungal and insect diseases and the high costs of resistance	7	23.33	23	76.67	10	**8.53
X10	Higher workers' wages and lower efficiency	5	16.67	25	83.33	11	**13.33

Tabular Ca value at 5% significance level = 3.81, tabular Ca value at 1% significance level = 6.64

Significance at 1% level of significance. ** *Significance at 5%

Source: Collected and calculated from: the questionnaire data of the study sample.

The research recommended the following:

1-Motivating investors to implement projects in the production of clean and renewable energy by supporting electricity producers with renewable energy by granting soft loans to support the construction phases before the start of operation, provided that they are repaid upon the start of operation of the project.

2-Providing direct subsidies for every kilowatt / hour of actual production of clean energy that is fed and connected to the electric grid and making long-term agreements to purchase the clean energy produced.

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دراسة اقتصادية لاستخدام الطاقه المتجدده والتكنولوجيا فى زراعة الطماطم الصيفى

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يحتل القطاع الزراعي مكانة هامة بين قطاعات الاقتصاد القومي لذلك يستوجب علينا العمل علي زيادة متوسط الغلة الفدانية من المحاصيل الزراعية وذلك عن طريق استخدام ما استحدث في مجال التكنولوجيا الحديثة والطاقة المتجددة وهي الاكثر ملائمة في كل هذه المتغيرات الاقتصادية المصرية الجارية . حيث توضح دوال الإنتاج باستخدام النموذج اللوغاريتمي المرحلي ان أنتاج محصول الطماطم الصيفي باستخدام الري بالسولار خلال الموسم2019 ان النموذج المستخدم ككل معنوي عند المستوي الاحتمالي (0.01) حيث تبين وجود علاقة طردية موجبة معنوية إحصائيا بين كمية الإنتاج (ص) بالطن وكل من اجمالي العمل البشري (س 1) واجمالي ساعات العمل الالي ساعة / فدان (س2) وكمية السماد الازوتي بالوحدة (س5) وكمية السماد البوتاسي بالوحدة (س7) حيث انه بزيادة العوامل المستقلة السابق ذكرها بمقدار (1%) يؤدي إلي زيادة إنتاج الطماطم الصيفي بحوالي 0.328% ، 0.320 % 0.595 ، 0.452 علي الترتيب كما يوضح النموذج اللوغاريتمي المرحلي ان المعادلة بالجدول رقم (2) تأثير المتغيرات سابقة الذكر علي إنتاج محصول الطماطم الصيفي بأستخدام الري بالطاقة الشمسية خلال الموسم 2019 وان النموذج المستخدم ككل معنوي عند المستوي الاحتمالي (0.01) حيث تبين وجود علاقة طردية موجبة معنوية إحصائيا بين كمية الإنتاج (ص) بالطن وكل من اجمالي ساعات العمل الالي ساعة / فدان (س2) وكمية السماد البلدي (س4) وكمية السماد البوتاسي بالوحدة (س7)حيث انه بزيادة العوامل المستقلة السابق ذكرها بمقدار (1%) يؤدي إلي زيادة إنتاج الطماطم الصيفي حوالي 0.746% ، 0.119% 0.879 % علي الترتيب .حيث أتضح ان تفوق المزارع اللذين استخدموا الري بالطاقة الشمسية في تحقيق أعلي صافي عائد لمحصول الطماطم الصيفي حيث بلغ حوالي 33.85 الف جنية بينما حققت المزارع اللذين استخدموا الري بالسولار قد حقق أقل صافي عائد لمحصول الطماطم بلغ حوالي 11.97 الف جنية