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ORIGINAL ARTICLE

AN ECONOMIC ANALYSIS OF THE PRODUCTION COSTS OF PEPPER (*CAPSICUM ANNUUM* L.) CROP UNDER THE GREENHOUSES IN ANBAR GOVERNORATE FOR THE AGRICULTURAL SEASON 2019-2020

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Abstract: The research aimed to analyze the costs of producing pepper crop under the greenhouses in Anbar governorate for the agricultural season (2019-2020) based on the field data for 16 random samples of pepper farms under the greenhouses of Anbar Governorate. The analysis results showed that the fixed costs constituted about (38.77%), while the variable costs constituted about (61.23%) of the total costs, and the average production costs in the research sample amounted to (101178) dinars/ton. The long-run cubic function was the best among the functions that express the relationship between production costs as a dependent variable and production. Besides, the number of greenhouses on the farm independent variables, due to their similarity with the logic of the economic theory. The adjusted R squared (R^2) in it reached (0.87), while the value of F reached (0.362704), which is not significant at the level of 5%. On the other hand, it was found that the optimal size of the farm represented by the number of greenhouses in it is 6 greenhouses, where it achieved the optimum production size of (59.3) tons/farm, with an average cost of about (35000) dinars/ton. Moreover, (37.5%) of the farmers in the study sample achieve an economy of scale, while (18.75%) do not achieve any economies of scale. However, the percentage of farmers who achieve low rates of economic efficiency is about (43.75%). Finally, the supply function shows that the elasticity of supply decreases with the increase in production, which means that the farms have great difficulty controlling production if prices change.

Key words: Capsicum annuum L. ,Vegetables consumption, Economic feasibility, Protected agriculture.

Cite this article

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1. Introduction

Protected agriculture is the production of vegetables at times other than their productive seasons, as it is based on providing suitable temperatures and humidity for the growth of plants in greenhouses [Slomy *et al.* (2019)]. The great challenge facing Iraq at present and in the coming years is to provide the necessary food and narrowing the gap between the production and consumption of vegetables that ranked the second after grain crops, which is one of the main components of food. Vegetable crops suffer from large and sharp fluctuations in prices, whether the prices of the product itself or competitive prices, which is directly reflected in the areas cultivated in the following season [AL-Taey *et al.* (2019)] . Both sweet and chili pepper crop belongs to the nightshade family, and it is one of the important marketing and export vegetable crops [AL-Taey (2017)]. It is distinguished from both tomato and potato crops by its high nutritional value because it contains vitamin C [Moslem and Rasool (2018)]. Furthermore, Capsacine which is used in the form of plaster to treat bone pain resulting from rheumatism is extracted from the chili variety of pepper crop. Also, fluorine is extracted from pepper, which protects the teeth from decay. Both types of pepper are used in the manufacture of pickles, sauces, spices, and it is used

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as a powder instead of chili as an appetizer besides food, especially in hot and tropical regions. South America is the original home of the pepper, as it was found on the wild condition of its various types and then spread to India and the hot and tropical regions in all continents of the world, such as the islands of eastern India, China, Spain, Greece, and Africa. The pepper plant needs a long, warm growing season free from frost, where the most appropriate temperature for germination of pepper seeds ranges between 20-30°C where germination takes place within ten days [Aljalaly *et al.* (2018) and AL-Taey (2018)]. But the plants do not tolerate extreme cold in the stage of vegetative growth, and they are resistant to temperatures and drought. Thus, the most appropriate temperature for the fruit set ranges between 30-35°C [Al-Aloosi *et al.* (2020)]. The debate continues over the fact that determines the optimal size of production, which the product requires to reach it by adhering to the optimal areas that will be determined. Otherwise, it must be committed to the minimum costs that will be achieved through the study to achieve the optimum size, and by converting the relationship from the reality of hypotheses to the actual application. This operation should reinforce by the quantitative results that will confirm that the most optimal size of profit depends on the necessary space that must be adhered to achieve the greatest products at the lowest cost in the long run because the land will introduce a variable element in the function, and this cannot be done in short-run [Pension (1980)].

Research problem

The research problem is represented in the low levels of production of pepper crop in greenhouses and poor competitiveness, which reflects the inefficiency in using the economic resources allocated optimally, increasing the average production cost of the producing unit under the greenhouse. In addition to the lack of sufficient experience among farmers for achieving the optimum size.

Research hypothesis

1. The research is based on the hypothesis that production costs are affected by the quantity of output on the one hand and the number of greenhouses in the farm on the other hand.
2. The study also assumes that the majority of pepper farmers in the greenhouse do not achieve the optimum size of production, which led to rising production costs of the pepper crop in the research sample.

Research importance

The research importance is through the economic and nutritional importance of the pepper crop in general, and due to its frequent use in the Iraqi tables, where the demand for this crop for food and industrial uses is constantly increasing. Therefore, it requires in increasing its production. Also, the high costs of production and the factors affecting it necessitated conducting a study to determine the optimal size of production that minimized costs and then it can achieve economic efficiency and its impact on the production process. As well as, identify the optimal levels that pepper farmers achieve to reach the highest possible economic efficiency in using available resources and setting a minimum price that pepper farmers would get to continue the production process.

The research aims

The research aims at the following

1 Production costs tabulation according to various bases and calculating their contribution to the formation of the total cost.

2 Estimating and analyzing the long-run cost function and its economic derivatives.

3 Determining the optimal size of the greenhouse farm and determining the optimum production level that minimized costs.

4 Derivation of the long-run supply function of the pepper crop.

5 Proposing recommendations that would expand the field of greenhouses to cultivate pepper crops, raising the efficiency of agricultural resources, and increasing agricultural production.

2. Materials and Methods

2.1 Data sources

The research relied on primary data obtained through a field survey in the study area, where the data were collected through a statistical questionnaire prepared for this purpose. This survey included cross-section data for (costs of producing vegetables under greenhouses in Anbar Governorate for the 2019-2020 agricultural season). A sample that included 9 districts

Table 1: The costs of tradable and local production inputs and their Materiality from the total costs of the pepper crop under the greenhouse for the agricultural season (2019-2020).

	Cost Paragraph	Cost (dinars / ton)	Materiality %
Tradable input	Compound fertilizers	38773	42.65
	Seeds	22708	24.98
	Herbicides	15290	16.82
	Depreciation	7158	7.88
	fuel	3900	4.29
	Peat moss	1538	1.69
	Dishes	1538	1.69
	Total	90905	%100
Local input	Family manual labor	78950	40.40
	Hired manual labor	39020	19.97
	Interest on capital	24895	12.74
	Marketing operations	19490	9.97
	Organic fertilizers	12030	6.16
	Mechanical work	8955	4.58
	Irrigation	6450	3.30
	Other expenses	5625	2.88
	Total	195415	%100
Total summation		286320	

***Reference:** The researcher data based on the statistical form.

Table 2: Fixed and variable costs and the Materiality of the total costs of pepper crop under the greenhouse for the 2019-2020 agricultural season.

Cost Items	The Amount of Costs is Thousand Dinars/ton	Materiality %
Fixed costs	111003	38.77
Variable costs	175317	61.23
Total costs	286320	100%

* **Reference:** prepared by the researcher based on the statistical form.

and their sub-districts was selected by the random sample method, as the study sample included pepper corps farmers under greenhouses (Anbar Governorate), and their numbers reached 16 farmers. The statistical and economic analysis was conducted after checking the data and tabulating it based on the commercial Eviews 10 program.

2.2 Method of analysis

The study depends on

1 Descriptive analysis of the data obtained through a description of production costs and their materiality, which is based on the concepts of economic theory in line with the research objective and hypothesis.

2 Quantitative analysis, which is based on econometric methods, in which the functions of production costs and their derivatives in long run are estimated according to several models (linear, quadratic, cubic). Utilizing the Ordinary Least Squares (OLS) method because of the advantage of this method is that it gives linear unbiased estimator with a minimum variance of estimated constants of the economic model parameters and select the best among them, in line with the logic of the economic theory.

3. Results and Discussion

3.1 Production costs

The production costs of one **ton** of pepper crop production under the greenhouse are divided into several items, including the cost of tradable inputs and the other local inputs as shown in Table 1. The costs of tradable production inputs were distributed among several items and the costs of compound fertilizers ranked the first in terms of Materiality and reached (38773) dinars/ton, constituted about (42.65%). The costs of seeds ranked the second, as their value amounted to (22708) dinars/ton, which constituted about (24.98%), followed by the costs of herbicides, as their value amounted to (15290) dinars/ton, which constituted about (16.82%) and ranked the third. On the other hand, the costs of depreciation ranked the fourth, as it amounted to (7158)

Table 3: The independent variables and their estimated parameters for pepper crop using the OLS method before performing the heterogeneity of variance test.

Independent Variables	Estimated Parameters	Calculated T
Q	165026.6	(6.728907)**
Q^2	54617.49	(2.627218)**
Q^3	37.05350	(2.641313)**
AQ	–1093301.	(–2.947767)**
A^2	5063898.	(2.942938)**
R^2	0.905001	
$R\text{–}^2$	0.870456	
D.W	1.716586	

* **Reference:** Prepared by the researcher using Eviews 10 program.
** Indicates the level of significance 1%.

Table 4: Average costs, marginal costs and elasticity of costs for pepper farmers in the research sample

Production (Tons) (Dinar)	Average Costs (Dinar)	Marginal Costs	Elasticity of Costs
6	139999.5	116303.5	0.83
10	124796.7	88267.4	0.71
15	107460.5	58224.05	0.54
20	91976.8	33738.2	0.36
25	78345.6	14809.85	0.19
52	36748.32	8630.36	0.23
59.3	34690.79	34790.46	1.00
72	40762.52	108534	2.66
80	50667.4	173393	3.42

***Reference:** calculated by the researcher based on the average costs equation, marginal costs equation, and elasticity equation.

dinars/ton, which constituted about (7.88%), and fuel costs ranked the fifth and reached (3900) dinars/ton, which constituted (4.29%). However, the costs of peat moss and dishes ranked the last, reaching about (1538,1538) dinars/ton, which constituted about (1.69 and 1.69%), respectively, of the costs of tradable production inputs. Local production inputs were also distributed among several items, as the costs of family manual labor ranked the first of the local production inputs, reaching about (78,950) dinars/ton, which constituted about (40.40%). The cost of hired manual labor ranked second, reaching about (39020) dinars/ton, which constituted about (19.97%). The interest costs on the capital ranked the third, as it amounted (24,895) dinars/ton, which constituted to about (12.74%), while the costs of marketing operations ranked the fourth, reaching about (19,490) dinars/ton, which constituted (9.97%). Whereas the costs of organic fertilizers amounted to about (12030) dinars/ton, which constituted (6.16%) and ranked the fifth, though the costs of mechanical work ranked the sixth, as their value amounted to about (8955) dinars/ton, constituted (4.58%). Irrigation costs ranked the seventh, reaching (6450) dinars/ton, which constituted about (3.30%), and finally the costs of other expenses, reaching about (5625) dinars/ton, which constituted (2.88%), from the local production inputs of the research sample.

3.2 Total cost

It is the sum of fixed and variable costs, and it is also equal to fixed costs when production is equal to zero, and it increases as the production increases due to the increase in variable costs [AL-Wadi *et al.* (2007)].

$$T.C = T.F.C + T.V.C$$

Since the total costs of the pepper crop under the greenhouses in Anbar governorate for the agricultural season (2019-2020) amounted to about (286320) thousand dinars/ton. Besides, the fixed costs constituted (38.77%) of the total costs, as it amounted to about (111003) thousand dinars/tons, while the variable costs constituted (61.23%) of the total costs, reaching about (175317) thousand dinars/ton, as shown in Table 2.

3.3 Estimation of cost functions

Total cost

Production costs are defined as the sum of what the production facility spends to obtain the resources that are used in the production process [Heady and John (1961)]. Production costs are defined as the amount of money that projects incur in order to obtain the services of the production elements necessary to achieve the production of a specific good or service during a specific period. The productive cost function of the pepper crop in the greenhouse was formulated from the data of the pepper farmers sample in the study area. Several models were adopted in estimating the total cost function of the pepper crop using three forms of the cost functions (linear, quadratic, cubic). It was found that the cubic model is the most appropriate for the relationship adopted in the study because of its

Table 5: The number of the assumed greenhouses, the output achieved, the average cost, the relative average cost, and the economic efficiency of the pepper crop in the research sample.

Assumed Area	Output Achieved	Average Cost	Relative Average Cost	Economic Efficiency
1	9.26	127519.8	94.98	6.78
3	27.78	71567.99	53.30	63.02
6	59.3	34778.6	25.90	100
8	74.07	42870.62	31.93	91.86
10	92.59	75859.61	56.50	58.71
12	111.11	134264.2	100	0

***Reference:** Prepared by the researcher using greenhouses located within the study area.

similarity with statistical, economics, and standard tests. Based on economic theory, the short-run cubic total cost function takes the following form.

$$TC = b_0 + b_1Q + b_2Q^2 + b_3Q^3 + b_4AQ + b_5A^2 + ui$$

where, *TC*: The dependent variable that expresses the long-run total costs (Dinar).

b_0: The constant represents the total fixed costs TFC.

b_1, b_2, b_3, b_4: Represent the regression coefficients.

Q: An independent variable expressing the quantity of output (tons).

Q^2, Q^3: The square of the quantity of output and the cubic of the output are related semantically to the output *Q*.

A, A^2: Represents the area and the square area.

ui: Represents the random variable that reflects the effect of other related variables that were not included in the estimated model.

By estimating the above function using the Eviews 10 program, the estimation results listed in Table 3 show the parameters of the estimated function, as well as the values of statistical and standard tests of the constants and the estimated function.

3.4 Statistical analysis

The T-test proved the significance of the parameters estimated at 1% level of significance using the OLS method, as the values of T were (6.728907, 2.627218, 2.641313, –2.947767, and 2.942938) for the estimated parameters (*Q*, Q^2, Q^3, *AQ*, A^2), respectively, as shown in Table 3. The adjusted *R* square was (87.04%) and this indicates that (87.04%) of the changes in the level of production costs (the dependent variable) are caused by the factors included in the model (explanatory variables). Besides, 12.96% of those variables are caused by other factors not included in the model, such as environmental conditions and other factors.

3.5 Standard analysis

In order for the model to be acceptable and reliable in the interpretation of the studied phenomenon, it is necessary to conduct the necessary standardized tests related to the standard problems represented by the problem of Autocorrelation. It was found that the data analysis using the OLS method that the Durbin Watson DW value reached (1.716586), which is smaller than the du value of (1.66) and greater than 4-du, which is (2.34) with a significant level 5%, and degrees of freedom n = 16. Meaning that (du < d < 4-du) in the range of (1.66 < 1.716586 < 2.34), from which it can be concluded the absence of the autocorrelation problem between residual [Koutsoyiannis (1977)]. The model also fulfilled the assumption that there is no multiple linear relationships between the independent variables (Multicollinearity) because the model is non-linear in terms of the variables. Since, the variables are the square of output (Q^2), the cube of output (Q^3), related semantically to the variable (*Q*), but the relationship is non-linear [Gujarat (1978)]. Because research relies on cross-section data, it is necessary to detect the Heteroscedasticity problem. The Breusch-pagan-Godfrey test was used to detect the Heteroscedasticity problem, and it was found from this test that the value of (*f*) reached (0.362704) It is not significant at the level of significance (5%) meaning that the model does not suffer from the presence of a heteroscedasticity problem.

3.6 Derivation of the long-run cost function of the pepper crop under the greenhouse for the 2019-2020 season

Table 6: Prices, the expected quantities of the pepper crop, and the price elasticity of supply for the research sample.

Price (thousand dinars / ton)	Quantity (Tons)	Elasticity of Supply
35	59.3	–
150	77.3	0.09
300	92.2	0.19
450	103.8	0.26
600	113.4	0.27
750	122.2	0.32
900	129.9	0.30
1000	134.8	0.36

***Reference:** Prepared by the researcher based on the estimated supply function of the pepper crop.

The estimated function can be adopted in the economic analysis to determine the optimum size of a greenhouse farm, average production cost, marginal costs, cost elasticity, and deriving supply equation for those farms from them, as below:

$$LTC = 165026.6Q + 54617.49Q^2$$

$$+37.05Q^3 - 1093301AQ + 5063898A^2$$

the function is derived w.r.t. to A and set equal to zero, we get

$$\frac{\partial LTC}{\partial A} = -1093301Q + 10127796A = 0$$

$$A = 0.108Q \quad (1)$$

Substituting the value of A into the original costs function, we get

$$LTC = 165026.6Q + 54617.49Q^2 + 37.05Q^3$$

$$-1093301(0.108Q)Q + 5063898(0.108Q)^2$$

Thus, we can get the equation of costs in the long run as a function of production only.

$$LTC = 165026.6Q - 4393.71Q^2 + 37.05Q^3 \quad (2)$$

3.7 Long-run average total cost function

Average total cost is defined by dividing the total costs *TC* by the total units of output *Q* over a given period. Besides, it uses a measure to calculate the cost of one unit of output (unit cost) or the share of one unit of output from the total costs in the organization and can be expressed in the following equation.

$$LRATC = \frac{TC}{Q} = 165026.6 - 4393.71Q + 37.05Q^2 \quad (3)$$

where,

LRATC: The long-run average total cost.

T.C: The total costs.

Q: The quantity of output.

To get the average costs at any level of output, that level is substituted into the average cost function.

3.8 Marginal cost

Marginal costs are defined as the amount of increase in the total costs resulting from the increase in production by one unit, in other words, it is the costs of producing an additional unit of output. The marginal cost function can be obtained by deriving the total costs function as in the following equation:

$$LRMC = \frac{\partial LTC}{\partial Q}$$

$$LRMC = 165026.6 - 8787.42Q + 111.15Q^2 \quad (4)$$

where

LRMC: The marginal costs.

∂TC : The change in total costs.

∂Q : The change in output.

To obtain marginal costs at any level of output, that level is substituted into the marginal cost function.

3.9 Elasticity of costs

It can be found by dividing the long-run marginal costs (LRMC) by the long-run average costs (LRAC) as in the following formula [Doll (1979)]:

$$EC = \frac{LRMC}{LRAC}$$

where, EC: The elasticity of costs.

LRMC: Long-run marginal costs.

LRAC: The long-run average costs.

The relationship between the long-run average cost curve and the marginal cost curve can be illustrated, as shown in Fig. 1 that both curves begin to fall from the top to down and the marginal cost curve is below the average cost curve. Along with, the marginal cost curve

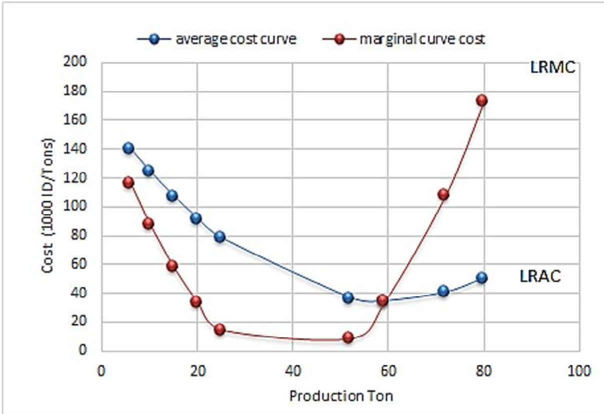

Fig. 1: The long-run average cost curve and the long-run marginal cost curve

***Reference:** Prepared by the researcher based on the data of Table 4

reaches its lowest end before the average cost curve reaches its lowest end achieving economies of scale. Then, the marginal cost curve starts to rise and intersects with the average cost curve at the lowest point, after that, the average cost curve starts to rise, and after the intersection point of the two curves, the marginal cost curve is higher than the average cost curve, achieving diseconomies of scale.

3.10 The optimum size of production and area (greenhouse)

The optimum size of the production of pepper crop is achieved when the average cost curve is at its lowest point, and it is obtained by equating the first derivative of the average cost function with zero as follows [Peter and Waugh (1979)].

$$\frac{\partial LRATC}{\partial Q} = -4393.71 + 74.1Q = 0$$

Q (Optimum size of production) = 59.3 tons

As for the optimum size of the farm, expressed by the number of houses in it, it can be found by substituting the value of output Q in Equation (1).

$$A = 0.108Q$$

$$A = 0.108(59.3)$$

(Optimum greenhouse size $A \cong 6$)

3.11 Economic efficiency

The primary objective of the product is to achieve economic efficiency, which is the ratio between the value of the output achieved in relation to the value of the inputs used. Meaning that maximizing the ratio between the outputs and the inputs, and the most efficient use of available economic resources to achieve the maximum possible output [Steven (2008)]. Since the efficiency is relative and varies according to the size of the farm, it can be estimated based on the highest average cost achieved in the study sample and assuming the number of greenhouses starting from 1 and ending with 12 houses, which represents the highest number of greenhouses. By substituting the numbers of houses in Equation (1), we can obtain the production size associated with each size of greenhouse sizes based on Equation (3). Thus, we can obtain the average cost of production per ton as shown in Table 5, where it becomes evident that the long-run average cost starts to decline and reaches its lowest value of (34778.6) dinars/ton at the 6 houses, which represents the optimum houses for production. On other hand, the long-run average cost returns to rise and reaches the highest long-run average cost at the assumed houses, which amounts to (134,264.2) dinars / ton.

$$\text{Relative average cost} = \frac{\text{average cost}}{\text{highest average cost}} \times 100$$

As for economic efficiency, it was obtained through the following law [Ferguson and Gould (1985)]:

$$E.C = \frac{H.A.C - R.A.C}{H.A.C - M.A.C} \times 100$$

where, H.A.C: The highest average cost.

R.A.C: The cost of the designated farm.

M.A.C: The minimum average cost.

It is evident from Table 5 that the economic efficiency starts from (6.78) and begins to rise until it reaches the percentage of economic efficiency of 100% at the optimum houses for production, which amount to 6 greenhouses. This value corresponds to the lowest average of production cost of (34778.6) dinars / ton. Then, after that, the economic efficiency begins to decline until it reaches zero at the assumed houses 12 a greenhouse.

Through Fig. 2, economies of size can be identified through the relationship between the size of greenhouses (houses planted with pepper crops) and the average total cost. It can be observed that economies of scale reduce the average cost per unit of production as the number of cultivated houses increases. Economies of size (100%) are achieved at the optimum

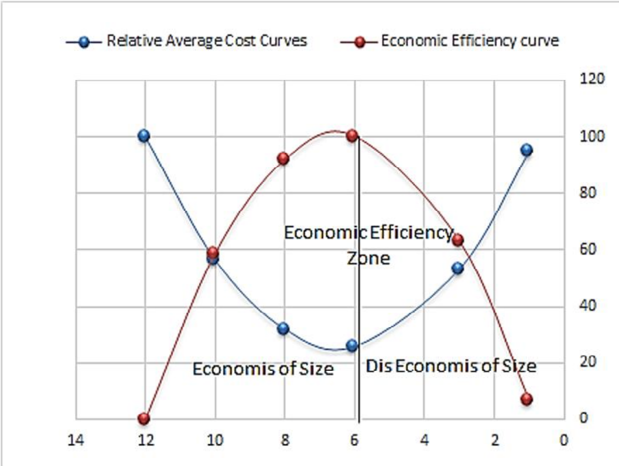

Fig. 2: Economic efficiency and relative average cost curves.

***Reference:** Prepared by the researcher based on the data of Table 5.

size of production, which corresponds to the lowest average cost. The increase in the number of houses after this size leads to an increase in production at a lower percentage than increasing costs, which leads to an increase in the average total cost curve. This makes the farmers work within the area of diseconomies of size, and that 37.5% of the farmers in the research sample achieved economies of size. However, the percentage (18.75%) does not achieve any economies of size, whereas, the percentage of farmers who achieve low rates of economic efficiency reached about (43.75%) of the total farmers.

3.12 Supply function of pepper crop in the long run

To find out the reaction of the pepper farmers in the greenhouse to the changes that take place in the price of the output. The supply function was derived by equating marginal costs with the price of the product, meaning that the supply function can be derived from the necessary condition of the profit function as follows [Henderson and Quant (1980)]:

$$\pi = TR - TC$$

$$\frac{\partial \pi}{\partial \pi} = P - LMC = Min\, LRATC = 0$$

$$LRMC = P = Min\, LRA\, LRAT$$

By substituting the above marginal cost equation derived from the estimated long-run total cost function, we can obtain the following:

$$165026.6 - 8787.42Q + 111.15Q^2 = P \tag{5}$$

$$111.15Q^2 - 8787.42Q + 165026.6 = P$$

$$111.15Q^2 - 8787.42Q + 165026.6 - P = 0$$

$$111.15Q2 - 8787.42Q + 165026.6 = P$$

$$111.15Q2 - 8787.42Q + 165026.6 - P = 0$$

$$a = 111.15\ ,\ b = -8787.42\ ,\ c = 165026.6 - p$$

and by using the quadratic formula

$$Q = S = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$Q = S = \frac{8787.42 \pm \sqrt{(8787.42)^2 - 4(111.15)(165026.6 - p)}}{2(111.15)}$$

$$Q = S = \frac{8787.42 \pm \sqrt{77218750.25 - 73370826.36 + 444.6P}}{222.3}$$

$$S = \frac{8787.42 + \sqrt{(3847923.89 + 444.6P)}}{222.3} \tag{6}$$

From the supply function of the pepper crop, and to study the farmers' response to the different price levels of the green pepper crop, several price levels were imposed for the crop, taking into consideration setting the minimum price of the output that the farmer would accept, which represents the lowest average total costs in the long run. This value amounted to (35000) (dinar / ton), and from it can get the quantity supplied, which amounted to about (59.3) tons, but if the output price falls below the minimum price (35000) dinars/ ton), there will be a loss that leads the farmer's stopping production, but if the price is higher from (35000) dinars/ ton, the quantity supplied is appropriate with the price of output. The output supply function represented by the pepper supply curve can be illustrated as shown in Fig. 3, which is the rising portion of the long-run marginal cost function (LMC) curve, starting from the lowest point on the long-run average total costs curve (LATC).

3.13 The price elasticity of supply

The price elasticity of supply for the pepper crop was calculated, which is one of the most important indicators that can be estimated from the computed supply function by applying the price elasticity law [Nicolson and Christoph (2008)]:

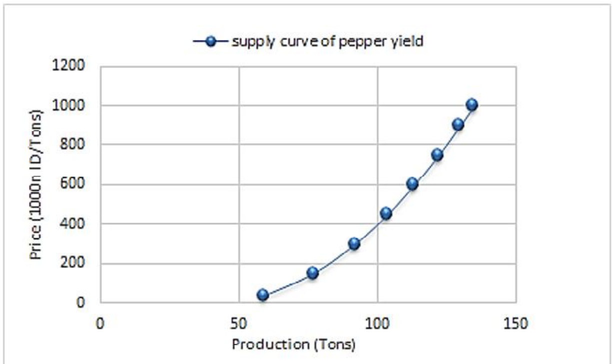

Fig. 3: Curve of the long-run supply function of pepper crop for the research sample

***Reference:** Prepared by the researcher based on the data of Table 6.

$$E\,S = \left(\frac{\partial QS}{\partial P}\right)\left(\frac{P}{Q}\right)$$

By reviewing the data in Table 6, it appears that the minimum price that farmers will accept is 35,000 dinars/ton, as the quantity supplied by the farm of the pepper crop at this price is about (59.3) tons, and the quantity supplied of pepper increases to (134.8) tons, when prices rise to approximately (1,000,000) dinars/ton. Fig. 3 shows the relationship between the quantity of production and the price of pepper crop. When farm prices increase by (10%) above their minimum limit, the quantity supplied in the market increases by (1.6%), and this means that the farms have great difficulty controlling production if prices change, and this is mainly due to the low response of production to productive resources used as well as farmers do not want to take risks.

4. Conclusions

1 The average cost of producing a ton of pepper under the greenhouse is higher than the optimum average cost, which indicates the possibility of reducing production costs.

2 By analyzing the cost structure of the research sample, it was found that the fixed costs formed a percentage (38.77%), while the variable costs formed a percentage (61.23%) for the pepper crop. Thus, the largest part of the fixed costs is manual family work, while the largest part of the variable costs is the compound fertilizers.

3 Through the study, it was found that the cubic functions are the best functions used in the study of the pepper crop for the research sample, due to their similarity with the economic logic and the compatibility of the estimated parameters in terms of statistical, economic, and analogy.

4 The study showed that the cost elasticity, in the long run, amounted to about (0.49) for the pepper crop, and this means that the pepper farmers produce in the first stage, which is the stage of increasing the yield, that is, when the costs is increased by a certain percentage, then it can get a greater production.

5 It is evident through the supply function that there is a positive relationship between the offered quantities and the selling price when the price is higher than (35000) dinars/ton. However, the elasticity of supply is low, which indicates the difficulty of responding to the farm supply vertically.

5. Recommendations

1 Paying attention to providing certified seeds to farmers, and good compound fertilizers, and controlling the quality of effective herbicides. Supporting the prices of production requirements for the pepper crop and providing them in sufficient quantities to contribute to reducing production costs.

2 Raising the marketing efficiency of the agricultural sector products and protecting the local product to help the Iraqi farmer attain competitiveness.

3 Holding seminars and training courses and distributing extension brochures to farmers to raise the technical and administrative competence required by protected agriculture.

4 Enabling and directing farmers to achieve optimal sizes that achieve economic efficiency, by increasing the number of houses on the farm towards the optimum size.

5 This study was for a specific period and in a specific governorate, and its results and findings express that period and, in the site, concerned. Therefore, it is recommended to continue economic studies on the production of the pepper crop inside the greenhouse, to diagnose the obstacles facing farmers and find solutions

to them to improve the optimum production level.

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