Economic analysis for the factors affecting the production of cucumber crops in greenhouses in Diyala province for the autumnal season (2017-2018)

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ABSTRACT

The research dealt with studying the production function for the Cucumber crop cultivated in greenhouses (a private sector in Diyala province for a random sample from crop farmers that included (38 farmers) from the study community that amounted to (151 farmers), a private sector for the production season (2018 autumn season), Where 38 greenhouses were studied and the Multiple Regression Analysis for the main elements involved in the production process was conducted and the function was analyzed by taking the Natural logarithm for production as a dependent factor and the natural logarithm for each element of the production elements as independent factors. It became clear through the analysis that a portion of these elements is not optimally exploited, through indicating their parameters that represented by the productive elasticities where they were negative, this means that their production occurs these elements in the third stage from the law of diminishing returns, which is the work variable, the cost of the peat moss, dusting and cost of the Seeds. As for the other factors, they came with positive elasticities, which means that they occur in the rational production stage, where they are optimally employed and these resources include maintenance costs, fuel costs, oils for the watering pump, fertilizer and control costs. Regression was also analyzed by taking the natural logarithm for both work and capital in order to find total production elasticity using the Cobb–Douglas production function and it became clear that the elasticities of these elements are positive and have achieved the optimum combination for production due to the cooperation of production resources in this model so that additional units can be exploited in desire for vertical expansion of production. It was recommended to use the available resources based on the results of scientific research or Agricultural departments Bulletins as well as the expansion of the project by using additional areas to cultivating cucumber crops in greenhouses.

Keywords: greenhouses, influencing factors, the yield of cucumbers, autumn season.

تحليل اقتصادي للعوامل المؤثرة على إنتاج محصول الخيار في البيوت البلاستيكية في محافظة ديالى للموسم 2018- العروة الخريفية

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الخلاصـة:

تناول البحث دراسة دالة الإنتاج لمحصول الخيار المزروع في البيوت البلاستيكية – قطاع خاص في محافظة ديالى لعينة عشوائية من مزارعي المحصول شملت (38) مزارع من مجتمع الدراسة البالغ (151) مزارع - قطاع خاص للموسم الانتاجي 2018 - العروة الخريفية, حيث تم دراسة 38 بيت بلاستيكي و جرى تحليل الانحدار المتعدد للعناصر الرئيسية الداخلة بالعملية الانتاجية وتم تحليل الدالة بأخذ اللوغارتم الطبيعي للإنتاج بصفة عامل تابع و اللوغارتم الطبيعي لكل عنصر من عناصر الإنتاج بصفة عوامل مستقلة و اتضح من خلال التحليل ان جزء من هذه العناصر لا يستغل بالشكل الامثل و ذلك من خلال اشارت معلماتها التي تمثل المرونات الانتاجية حيث كانت سالبة و هذا يعني وقوع انتاجها هذه العناصر بالمرحلة الثالثة من قانون تناقص الغلة و هي متغير العمل و كلفة البتموس و التعفير و كلفة البذور, اما العناصر الاخرى فقد جائت بمرونات موجبة و هذا يعني وقوعها بمرحلة الانتاج الرشيدة و تم توضيفها بالشكل الامثل و هذه الموارد تكاليف الصيانة و تكاليف المحروقات و الزيوت لمضخة مياه السقي و تكاليف الاسمدة والمكافحة , كما تم تحليل الانحدار بأخذ اللوغارتم الطبيعي لكل من العمل و رأس المال بهدف ايجاد المرونة الكلية للإنتاج بإستخدام نموذج كوب-دوجلاص و اتضح ان مرونات هذه العناصر موجبة و حققت التوليفة المثلى للإنتاج وذلك بسبب تعاون الموارد الانتاجية في هذا

النموذج ما يمكن استغلال وحدات اضافية منها في حالة الرغبة بالتوسع العمودي للإنتاج, و تمت التوصية بإستخدام الموارد المتاحة اعتماداً على نتائج البحث العلمي او نشرات الدوائر الزراعية كذلك توسعة المشروع بإستغلال مساحات إضافية لزراعة محصول الخيار في البيوت البلاستيكية.

الكلمات مفتاحية: البيوت البلاستيكية, العوامل المؤثرة, محصول الخيار, العروة الخريفية.

1. INTRODUCTION

The importance of the cucumber crop is increasing, where it is cultivated in the spring and autumn seasons, it is characterized by its rapid growth and frequent demand for it, and the percentage of loss in it is low so the interest in this crop has a good economic production and farmers must be supported to grow it and One of these forms is its cultivation in greenhouses to provide it in scarcity times. Among the advantages of planting in greenhouses is the ability to control the crop, which is better in terms of quantity and quality (Youssef and Kareem., 2017). Cultivation in greenhouses is considered an intensive farming pattern that works to protect crops from external factors and providing appropriate environmental conditions to increase production per unit area. This pattern of agriculture has many advantages, including providing agricultural products throughout the year, thus achieving an increase in the income of the farmer and reducing Water consumption, intensive exploiting for capital, and protecting crops from agricultural pests and the possibility of controlling them (Abu Dhabi Food Control Authority., 2011, p. 5). Cultivation of the cucumber crop in greenhouses requires a large amount of light for growth and flowering and regular temperatures of no more than 35 ºC and no less than 10 ºC. There is also a set of procedures that the farmer must take into account to produce an excellent crop (quantitative and qualitative) such as cleaning the land, removing the waste of the previous season and harmful weeds and burning them, sterilizing agricultural equipment and stirring the soil to a depth of (30 - 40 cm) in order to be dry and also floating the soil with water to leaching it from the salts. It is necessary to spread the floor of the greenhouse with a substance (Black Mulch) before the transplant, where it helps to control weeds and reducing evaporation, as well as drying the injury that grows with high air humidity (Field Manual for Cucumber Growing in Lebanon., 2012. p. 13).

The problem of research

The beginning of the year 2011, The cultivation of protected vegetables (greenhouses) was introduced to Diyala province widely and It achieved satisfactory results for the farmer on the level of the quantity and the quality of the yield and satisfying the requirement of the local market, but most farmers without sufficient knowledge about the impact of the available production resources on production, therefore the study examined this aspect.

The aim of Research:

The effect of productive inputs on the production amount through measuring the degree of response between the inputs and the amount of output in the greenhouse by the estimated function in the case of differentiating production resources and the status of their collection.

The importance of research :

The study of an important crop for the product, especially after going to grow vegetables in greenhouses to know the optimal use of productive resources and benefit from the results later.

2. MATERIALS AND METHODS

1- In February, a questionnaire was conducted for a number of cucumbers farmers in greenhouses in the Diyala province by means of a questionnaire prepared for this purpose. Initial data was obtained that included the cost of seeds, the cost of peat moss, the amount used, the cost of oils, fuels, control, the costs of flipping and smoothing the soil and laying Irrigation network, greenhouse costs, drip system,

irrigation pump cost, piping and nylon costs, and the knowledge aspects of the farmer, such as the level of experience, academic achievement, and practice for this work.

2- The areas from which the samples were taken, as well as the farmers, were identified in order to communicate with them to obtain the remaining data.
3- In April, data for the second part of the questionnaire was obtained, it included the cost of fertilization, the costs of leased work, family work, and the number of daily work hours for the farmer.
4- At the end of May, the last part of the data was obtained, which included the amount of production for a single greenhouse during the season, it became clear that the cultivated cultivars gradually reduced their production, until the plant mortality in the period from the end of May to the beginning of June, meaning that the period actually produced is five to six months.
5- Questionnaires were inserted in tables and tabulation of data and analyzed using the programs (Excel and Evieos) to get the results.

The characteristics of the studied research sample:

The samples were randomly chosen in (Baladrooz, Canaan, Al-Wajieehiea, Al-Miqdadiyah, Bani Saad). The sample made up the percentage of the study community (25.17%) and the characteristics of the studied sample were as shown in Table (1):

Table 1: Characteristics of the random sample for research.

No	Academic achievement		Years of Experience	
1	Primary	21.62%	13 years	21.62%
2	Secondary	43.24%	4 - 6 years	64.86%
3	preparatory	16.22%	7 years	13.51%
4	University	18.92%	--------	-------
5	Total	100%	Total	100%

Reference: questionnaire.

3. RESULTS AND DISCUSSION

Production function: It is a mathematical relationship that describes to us the average at which the production elements are used to convert them into a product. The simplest forms of production functions that link a variable production component to the output are the following (Abu Shawar, et al., 2011)

$Y = f (X1, X2, X3 .... Xn)$

Production (Y) was a dependent factor and variables (Xi) were independent factors which are the main production resources that the producer used it in cultivating the greenhouse during one season and in the autumn season, which was as follows:

Y = Total production during the season

X1 = number of hours worked during the season (one worker per greenhouse)

X2 = the cost of the peat moss and dusting

X3 = the cost of seeds

X4 = the cost of fertilizer

X5 = control cost

X6 = maintenance, oil and fuel costs

The work was chosen as a number of hours because each sample represented one greenhouse in which the farmer and his family worked and do not require leased labor. Therefore, the work variable was calculated in the form of a number of hours to know the extent of the possibility of expansion in production and the exploitation of another greenhouse and the area of one house (500 m2). As for peat moss and dusting, the

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quantities of their use varied from one sample to another, meaning that one roll of peat moss amounted to (80 kg). It may not use all of its quantity for a single house, and it is added once as well as the dusting and these materials are the syndrome of use for the soil of the greenhouse. That is, the farmer uses them in all circumstances and it is more appropriate to add the cost of these two materials into one variable and the seeds are taken in the form of costs and not a quantity because the envelope is sufficient to grow a limited number of lines within the area of one greenhouse, but the origins, prices and cultivars of these seeds differ. As well as, the cost of fertilizers and control varies the quantities of their use and the number of control times according to the need of the soil with respect to fertilization and according to the presence of agricultural pests in the region with respect to pesticides, so it was calculated in the form of costs, The maintenance costs for the greenhouse structure, the drip system, and the irrigating water pump, along with the oils and fuel costs for the water pump, are periodic costs, and It is considered a periodic cost, and the damages that need maintenance are often shown with irrigation, so it was calculated as one independent variable. The function was analyzed in several formulas of the linear model, semi-logarithmic model, double-Logarithmic models, and the inverse-logarithmic model. The double-logarithmic model was chosen as the best function, where it became clear that the model's signals were consistent with the logic of the economic theory, and the results were as follows:

Table 2: The estimated production function for the cucumber crop in greenhouses for the 2018 season

Function / The estimated parameters	**Marginal logarithmic Y = F (X)**	**Semi-Logarithmic Y = FLn (x)**	**Double Logarithmic LN (Y) = FLN (X)**	**Inverted logarithmic Y = FLN (X)**
Constant	5231.472	7.08305	9.229999	10965.185
X1: working hours (t)	- 11334.578 (-2.976145)	(- 0.43049 (-2.763663) *	- 0.0012117 (-3.217389)	- 33.3018 (-3.775030)
X2: cost of peat moss and dusting (t)	- 17850.429 (-1.761079)	- 0.67682 (-1.632580) **	- 0.002651 (-0.490402)	- 62.4371 (-0.497741)
X3: seed cost (t)	- 19282.468 (-0.832162)	- 0.451678 (-0.476586)	0.0026708 (1.037995)	42.7424 (0.732314)
X4: cost of fertilizer (t)	10812.486 (2.876716)	0.51031 (3.319527)*	0.0016944 (-0.393030)	50.45797 (-0.502626)
X5: control cost (t)	20524.896 (5.726021)	0.67627 (4.612782)*	0.0035489 (4.643884)	74.8038 (4.178035)
X6: Maintenance and fuel cost (t)	22517.692 (1.326188)	0.983 (1.415872)***	0.0071336 (4.699938)	236.6192 (6.707487)
R2	0.953038	0.959781	0.976841	0.974563
Adjusted R	0.943949	0.951996	0.972210	0.969639
F	104.8519	123.2959*	210.9018	197.9467
D.W	1.297057	1.472400 *	1.872506	1.540166

** significant at 0.05 * significant at 0.01 *** significant at 0.10

Double-logarithmic model:

Ln(Y) = 7.0830 - 0.4304ln(X1) - 0.6768 ln(X2) - 0.4516 ln(X3) + 0.5103 ln(X4)+ 0.67621 ln(X5) + 0.9832 ln(X6)

Statistical analysis:

The T-test demonstrated the significance of the estimated parameters for the cucumber crop, where it became clear that the value of the calculated T-test is greater than the tabulated T

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for the estimated parameters at the significant level of 0.01, the X1 variable is the number of working hours during the season, the X4 variable is the costs of fertilizers, as well as the X5 parameter, is control costs. As for the X2 parameter is the costs of peat moss and dusting have been proven it's significant at the level of (0.05). As for the X6 variable is the costs of maintenance, fuel oils, and irrigating pump oils, which proved the significance of this variable at the level of (0.10). The significance of the function as a whole was proven through the F-test at the significant level of (0.01) which amounted to (123.29), and the R2 coefficient showed that 95% of the variable related to the dependent factor (production) was caused by the independent factors involved in the model and the remaining 5% were due to factors that did not Subject to measurement by function, As for the X3 variable is the cost of seeds, it has not proven significant at the acceptable levels. The reason may be due to the interacting the factors of the function with each other, where this variable proved its significance at the level of (0.01) when estimating the simple regression equation for the X3 variable (the cost of seeds with the quantity produced from the crop), which indicates Its importance in relation to the production process, as shown by the following function:

The production (Y) is a dependent factor and X3 is the cost of seeds (in thousand dinars) is an independent factor.

LnY = -237584.583729 + 51083.6165245 LnX3

t (-12.92587) (14.11880 *)

D.W (0.198467) F (199.3406)

Standard analysis:

The model showed that there is no self-correlation problem by Durbin-Watson Test which amounted to (1.47) at the significance level of (0.01) and degrees of freedom (K = 1) and it is greater than the value of (du and dL) which amounted to (1.33, 1.23), respectively. We conclude that there is no problem of self-correlation between the rest. As it was clear from the Park test, which included estimating the regression equation of the error square as a dependent variable and the production (Y) as an independent variable, the absence of the Heteroscedasticity phenomenon and the function was as follows:

$Log(ei)^2$ = -2.90629665346 + 0.12362856623 Log(Y)

T (-0.197101) (0.083577)

R^2 (0.000194) F (0.933856)

Where it was found that the parameters of the estimated function were not significant at the level (0.05), and this indicates that there is no problem of Heteroscedasticity phenomenon that usually appears in the data of the cross-section.

Economic analysis:

Production elasticity: It is a concept that measures the degree of response between production and the quantities of production elements where this elasticity changes with increasing the use of production elements. Accordingly, the production stage can be determined by the value of production elasticity (Abu Shawar et al., 2011. p. 139).

First: Production resource elasticities (partial elasticities):

The values of the estimated function parameters refer to partial productive elasticities (elasticities of productive resources), and it has been clear from the analysis that each the number of working hours for the season (X1), costs for peat moss and dusting (X2), and seeds costs (X3) have come with negative signals, this means that its production occurs in the third stage of the law of diminishing returns. The third stage of the law of diminishing returns is an irrational stage of production in which total production decreases as a result of factors created due to the use of productive resources without knowing their costs (Al-Maksous, 2007. p. 43). As for the values of other parameters: fertilizer costs X4,

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control costs (X5), maintenance costs, fuels, and oils (X6), they came with positive signals, through these values of elasticities we can determine the occurrence of the production for these elements in the second production stage for the law of diminishing returns. At this stage, the possibility of profit for the product is available as long as the total production is in an increasing state and this means the possibility of continuing production in relation to the costs of these resources or the exploitation of additional units of them in the case of the goal of increasing production with vertical expansion method (Abu Shawar et al., 2011. pp. 137-138). Singh et al., (2017.P.2304-2323) also concluded that in addition to labor, fuel and fertilization costs, there are other factors that affect the amount of cucumber production inside greenhouses, such as the duration of leaf moisture, irrigation and disease control.

Second: The total elasticity of production:

Total elasticity of production was found using the Cobb-Douglas model by analyzing the multiple regression for both labor and capital as independent factors and the amount of production as a dependent factor:

The Cobb-Douglas function can be written in the following formula:

$Y = A L^{b1} K^{b2}$

Where:

Y = quantity produced from cucumber crop per kg

A = function constant

L = number of working hours during the season (one worker per greenhouse)

K = capital invested during the season / thousand dinars

b1 and b2 = labor and capital elasticities, respectively

The elements of labor and capital were entered in the following way, where working represented by (number of hours during the season), each farmer exploits one greenhouse and he only performs the work and does not need rented labor, and knowing the possibility of the farmer to add other hours of work in the case of using another greenhouse. As for the capital (one thousand dinars for the season for one greenhouse), it included the costs of renting the land, the annual destruction rates for the greenhouse structure, the nylon, the drip irrigation system, and the irrigation pump (after finding the destruction rate, it is divided into 2, meaning two seasons for the requirements that are used for two productive seasons) and Labor costs and costs of purchasing seeds, peat moss, fertilizers, pesticides, fuel and oils for the irrigation pump. The function gave the following results:

LnY = 6.1678 + 0.3346 LnL + 0.4643 LnK

Table 3: The estimated Cobb-Douglas production function for the cucumber crop

Estimated function parameters	
Y t	6.16781582 (11.36698)*
L t	0.334671577 (2.847824)*
K t	0.464394972 (6.480415)*
R^2 Adjusted R	0.803928 0.792394
F	69.70280 *
D.W (du= 1.52و dl =1.07) (K=4)	1.4669 *

* At the significant level of 0.01

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Where the function passed the statistical and standard tests and this was proven through the T-test, which proved the significance of both work and capital at the level of 0.01. The F-test also demonstrated the significance of the function as a whole, which amounted to (69.70) at the significant level of 0.01, and the DW-test demonstrated that there was no problem of self-correlation between the remaining values which amounted to (1.466) whose value is limited (dl = 1.07> DW = 1.46> du = 1.52) at the significant level of 0.01 and degrees of freedom (K = 4). The R2 coefficient of value (0.803) also showed that 80% of changes in production are caused by labor and capital, while the remaining 20% is due to other factors that are not subject to measurement by function, and when writing the function in its exponential form, it is as follows:

$$Y = 6.1678 + L^{0.3346} + K^{0.4643}$$

It is clear from the productive function (Cobb - Douglas) that the elasticities of both work and capital were positive signals, and this means that production in the second stage of the law of diminishing returns where total production increases, with lower the level of costs. The production function, which contains two variable productive components, is subject to substitution between production resources in order to reach the optimal combination of resources. This production situation indicates the optimal economic method for choosing the least cost-production method (Al-Maksawi. 2007 p. 46). This indicates that there are still possibilities to increase the production of these resources in proportion to the area specified for a single greenhouse, and The values of these elasticities mean that if there is a change in these resources (0.01 units), this leads to an increase in the quantities produced of the cucumber crop (0.01 units). Through the price ratio between production inputs, the product can determine the optimal quantities of these inputs to obtain the optimal mix that achieves the same amount of production at lower costs (Al-Samurai., 2008 p. 75).

CONCLUSIONS:

1- The farmers, who each used one greenhouse to cultivate the cucumber crop and added part of the production resources in an optimal way that achieves good production from this crop and the other part of these resources was not used optimally according to scientific guidelines in order to achieve good productivity at low costs. During the multiple regression analysis of the elements for the production function.

2- It became clear from the values of the estimated parameters, which represent the elasticities of production resources, that the costs paid for each of the peat moss, dusting material and seeds costs, as well as the number of working hours spent during the production season, their production occurred in the third stage of the law of diminishing returns, which means lower production and higher costs because their elasticities are negative sign.

3- As for the costs of fertilizers, control, maintenance, and oil and fuel expenses for the irrigation water pump, they were with positive elasticities, indicating that they occurred in the second stage of the law of diminishing returns, that is, in the rational production stage. This means that these resources were added in a way that gives the optimal combination that achieves good productivity and the possibility of adding units of these resources in the event of a desire for vertical expansion of production. It was clear from the analysis of the Cobb-Douglas function that the overall elasticities of production are positive signs, that is, they are exploited in a way that achieves acceptable productivity at low costs, where this was shown by the labor and capital parameters in the estimated function.

4- It became clear through the questionnaire that none of the sample farmers used the (Black Mulch) substance that is used to cover the cultivated lines and prevent the growth

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of thickets and keeping the amount of moisture available from irrigating.

RECOMMENDATIONS:

1- Rationalization in the use of productive resources depending on the results of scientific research or the adoption of programs developed by the agricultural extension departments or the exploitation of another greenhouse to add whatever available resources that remain in excess of use such as peat moss, as well as the regular use of working hours.
2- An awareness program for farmers, especially the farm management process, in terms of organizing work and mixing productive resources with the aim of achieving the optimal combination of all available resources for the production process at the lowest cost to achieve the highest production.
3- The departments of the Ministry of Agriculture should support the cultivation of vegetables in greenhouses, especially the cucumber crop, and provide an explanatory program for all agricultural operations inside the greenhouse so that farmers can know the quantities and prices appropriate for productive inputs.

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