Economic analysis of the factors affecting the production of Tomato crops for open cultivation with surface irrigation for the season 2018

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Abstract

The production function of Tomato was studied in the open cultivation irrigated with surface irrigation in Diyala governorate in 2018 through a questionnaire of (45) random sample selected from (244) farms out of the total population of the study. The sample area was (185.4) dunem (2500 m²). The analysis was done by taking the natural logarithm of the production as a dependent factor and for each resource of production as an independent factor. The half- logarithmic model was chosen as the best model. It is clear from the analysis that some of these resources have been exploited optimally through the positive singles to the resource parameters in the function. This means that the production of these resources was in the second stage of the law of decreasing yields. (The number of labor hours per day, the amount of animal manure used and the number of irrigations during the season). The quantity of chemical fertilizer was found to be a negative impact on production because the elasticity signal was negative. And the regression analysis was achieved by taking the natural logarithm of both the labor and the capital in order to achieve the overall elasticity of the production using the Cobb-Duglas model. It became clear that the elastic ties of these resources were positive and this means that the combined production resources achieve high productivity due to their cooperation this resource and the efficiency of the mixing process. What can from the exploitation of additional units in the desire to expand production, and was recommended to follow the agricultural guidelines and the adoption of the results of scientific research in the use of resources, especially the amounts of fertilizer and farm management in order to continue these projects to achieve self-sufficiency of Tomato.

Keywords: Tomato crop, open cultivation, Elasticity production, production resources.

Introduction:

Tomato (*Lycopevsicon eseulentum*) is commonly known as a tomato plant. It belongs to the Solanaceae family. It is one of the most common crops in the world and is widely cultivated in many countries. The original habitat of the tomato is Peru and Bolivia Ecuador, in south America. Is one of the most ancient crops. It is known to have recently entered Iraq through Syrian Aleppo in the 19th century. The tomato has a high nutritional value, although the fresh fruits contain about 94 % of its weight. It has significant amounts of carbohydrate, protein and fatty substances, as well as a significant amount of mineral materials needed to build the human body and maintain its health such as calcium, phosphorus and iron(7), and the juice of the tomato easy absorption and enter the blood circulation is loaded with nutrients such as phosphorus and iron, as well as alkaline salts, which are equivalent to acidity of the stomach and blood and rid the body of uric acid, in addition to the peel of the fruits of the tomato facilitates the work of the bowel and movement of the worm, which helps to remove waste form the body and intestinal cleansing and treatment of constipation(3), Tomato is a heat- loving plant where it grows well at temperature range. The seeds are best germinated at (20-25ºC), while the temperature reaches (30ºC) causes slow germination. The fruits are the night temperature and the optimum temperature rang is between (15-20ºC) (4), The tomato is a summer crop whose growth requires a warm, frost- free atmosphere for at least two to four months to grow and obtain ripe fruits (7). The tomato crop is one of the vegetative vegetables the production of tomato crop is influenced by a number of economic factors, such as the cost of digestion, which indicates the amount of the tomato cultivar spends on the inputs of the process productivity (6). The importance of the economic and food crops for the purpose of achieving self-sufficiency, reducing imports, filling needs of the consumer and helping the farmer achieve good productivity. decline in the production of the tomato crop and the control of the importer on the market, especially the areas of open cultivation irrigation surface, which still exist in the province of Diyala. There for, the research aims to measure the effect of the productive resources on the production through the measure of the degree of response between the productive resources and the quantity of the output through the estimated function that case dispersion of the productive resources and the state of collection.

Materials and Methods

1 – In the period from the end of April to the beginning of May , a group of farmers of the open cultivation tomato crop was interviewed and randomly selected in the Diyala region, especially the areas where the cultivation of this crop is intensive and the studied sample included the areas (Baldrouz, Khalis, Bani saad, Wajihia and Kanaan), The first part of the data was obtained, which is the cost of land rent, the costs of planting the sludge, tillage, soil preparation, in addition to the quantity and price of animal manure.

2 – The areas from which the samples were taken, as well as the farmers, identified and to communicate with them to obtain the remaining data.

3 – In the period from the end to June to the beginning of July, the second part of the data was obtained which included the price of the seeds, the price the quantity of the chemical fertilizers and the fixed labor wages, as

The areas where the cultivation open farms of the Tomato crop were distributed were very large and included the areas of (Beldrooz, Kanaan, Alwajihia, Khalis and well as part the expenditures of the spent fuel.

4 – In the period from late July to early August, the last part of the data was obtained, including the number of irrigation during the season, the number of fixed labor hours, the number of times of control of the price of the control materials, The quantities of production were obtained during the season, The tomato is almost out of production so the farmers starts to get rid of them and prepare the soil for the next season.

5 –The cultivated areas were obtained with the crop of the open cultivation and irrigated surface from the Directorate of Agriculture in Diyala governorate – the plant production department and the areas where it is heavily distributed.

6 – The frames were empty in tables and data entered and analyzed using Excel and Evieus software to obtain the results. Characteristics of the studied research sample:

Bani saad), which constituted 18.4% of the study population. The most important random samples were studied as shown in Table(1).

Table 1. Characteristics of the research sample

Number of crop producers in Diyala governorate	244 Farmers	Total sample research	45 Farmers
Total area of crop in Diyala	3374 Dunum	Total sample area	185.4 Dunum
S Academic achievement		Years Experience	
1 Primary	23.62 %	1-3 Years	12.62 %
2 Middle school	41.24 %	4-6 Years	64.86 %
3 Preparatory study	21.22 %	9 and more	22.51 %
4 University study	13.92 %	----	----
Total sample	100 %	Total	100 %

Source : Questionnaire

Results and discussion :

Production function : A mathematical relationship that describes the rate at whichthe resources of production are used to convert them into product . The

$$Y = f (X_1, X_2, X_3 .... X_n)$$

(Y) was selected as a dependent variable and the variables (Xi) were independent resources and represented simplest forms of output function that link a variable output resources to output are the following form (1)

the main production requirements used by the producer in the cultivation of the tomato crop during the one season and were as follows:

$Y =$ Production during season. Kg^{-1}

$X1 =$ Number of labor hours

$X2 =$ Quantity of animal manure used. Kg^{-1}

$X3 =$ Quantity of chemical fertilizers used (Kg).

$X4 =$ Number of irrigation applications over the total growing season.

The production of Year (Kg), was determined, the cultivated areas were different in size, as for the   labor the number of hours per day was calculated because the vegetable crops need periodic the week such as harvesting, control weeding, irrigation and other service and operations. As for the amount of animal manure was calculated by(Kg). Animal manure is important for the farmers of vegetables, so the emphasis was on the calculation of quantity, and calculated the number of irrigation during the season of farms investigated for the introduction of the equation and the amount of the chemical   fertilizers such as urea was measured in Kg according to the quantity was used and often used twice during for one season. The function was analyzed in several   models   of   the   liner   models

logarithmic half model, the double logarithmic model, and the inverse logarithmic models. The logarithmic half model was chosen as the best function. It

was found that the models signals were consistent with logic of the economic theory and the results were shown in the Table(2).

Table 2. Estimated production function of tomato crop for season 2018

Models function Estimated parameters	Linear function Y=F(X)	The function half log. Ln (Y)= F(X)	Double log. function Ln(Y)=F Ln(X)	The inverse log. function Y=F Ln(X)
Constant	- 1.764322	0.719311	- 0.20478	-10.3651
Number of hours labor (X1) (t)	1.00274 (57.152)	0.1142932 (19.918)	0.9954 (62.35)	8.1879 (29.98)
Quantity of animal manure (X2) (t)	0.139788 (-3.015)	0.03230133 (**2.1307)	– 0.07431 (-2.63)	– 3.01251 (-6.245)
Quantity of chemical fertilizer(X3) (t)	0.209653 (-1.77)	0.080 9913- (*-2.098)	– 0.097315 (-1.436(	1.28628 (1.109)
Number of irrgation for season (X4) (t)	0.162084 (3.031)	0.162084 (***1.580)	0.3768841 (2.593)	3.76200 (1.513)
R^2	0.998621	0.990947	0.998783	0.994201
Adjusted R	0.998483	0.990042	0.998662	0.993621
F	7243.05	1094.60 *	8208.61	1714.49
D.W	2.296	1.485 *	2.189	1.276

*Significance level   0.01 ** Significance level 0.05   * Significance level   0.10**

The logarithmic half model:

Ln(Y) = 0.71931109+ 0.114293251 X1 +0.0323013341 X2 − 0.0809913049 X3 + 0.16208429 X4

Statistical Analysis of Productivity Function The (T. Test) showed the significance of the estimated parameters of the tomato yield, where it was found that its calculated value was greater than the table value of the estimated parameters at the acceptable levels shown in the Table(2). The statistical analysis showed that the variable(X1) number of hours labor duringthe day is significant and

positive for this productive resource(0.01), while the variable(X2)means that the quantities of animal manure have been shown at significance level(0.05), and positive effect and variable(X3) the quantities of chemical fertilizer have also been significant at(0.05), and negative effect, variable(X4), and mean number of irrigation during the season this productive resource has been significant at(0.10), and

has positive effect. The test(F) showed that significance of the whole function, which was (7243) at a level of(0.10)the (R^2)coefficient of determination showed that(99%) the changes in the dependent element (Y= production) were caused by the independent factors(X_i) and the remaining(1%)were due to the other factors that did not measured the function. The quantity of chemical fertilizer(Urea) Econometric of the estimated productivity function:

Park test)which included estimation the regression equation of the error square as a dependent variable and the production (Y) as an independent variable. There is no (Heterogeneousasticity) phenomenon. The function is as follows:

(variable X3) has a negative effect on production. The reason may be that the farmer does not comply with a specific fertilization program and know the extent of soil needs. Where the roots are generally large and small elements that can be absorbed by the plant, and thus put the farmer program of fertilization and appropriate dates to add it and to know that must analyze the growth environment(9).

The model showed the absence of auto correlation problem by means of the Drben Wattsen Test(D.W) which reached (1.485) at the level of(0.01) and the degrees of freedom (K=4),We conclude that there is no problem of auto correlation between the residues, as showed by (the

Log $(ei)^2$ = 0.00920154872397 + 4.0602235903 Log (Y)

T (1.070846) (0.037837)

R^2 (0.000033) F (0.001432)

It was found that the parameters of the estimated function are not significant at acceptable levels. This indicates that there

is no problem of Heteroscedasticty of the variation that usually appears in the cross section data.

Economic Analysis of Productivity Function**:**

Elasticity Production: It is a concept that measures the degree of response between production and the quantities of production

resources. This elasticity changes by increasing the use of production resources.(1).

First: The slopes of the production resources (partial slopes):

The estimated parameters of the function indicate the partial production slopes analysis showed that each (X1) number of

labor hours and(X2)quantities of the animal manure and(X4)number of irrigation application during the production

season came with positive signals. Through this parameters, we can determine the production of these resources in the second production stage of the law of diminishing yield, which is the stage of increasing production. At this stage there is a possibility of profit for the product as because the total production is increasing(1). This means that there is a degree of responsiveness between production and productive resources. As for the variable(X3), the amount of chemical fertilizer, the value of the elasticity was shown by a negative signal. This is a clear indication that the production of this resource in the third

stage of the law of decreasing yields(2). Therefore, the farmer should be directed to rationalize the use of these resources in the optimal manner, especially the fertilization programs based on scientific research. That is the formation of elasticities for the production resources in the second production stage indicates the possibility of continuing production for the quantities of resources (labor hours and number of irrigation and quantities of animal manure),or the exploitation of additional units of them in the case of the aim of increasing the productivity of the crop of Tomato, especially vertical expansion.

Second: Total Elasticity of the Production Function:

Because of the small fixed capital costs, capital costs were considered variable costs and ended during the productive season (8). Therefore, the elasticities of the productive factors were found in the capital of the production project. For the purpose of finding the elasticity of the

production resources, the total capital and the number of labor hours as independent factors were used the function of production Cobb-Douglas was used for easy conversion to linear from by putting the function in logarithmic form(5).

The Cobb- Douglas function can be written as follows:

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

Where parameters are represent:

Y = The quantity produced from the tomato crops \Kg

A = constant function

L = Number of hours labor

K = Capital invested during the season / thousand dinars

b1 and b2 = business labor and capital elasticities, respectively

The labor included (the number of labor hours during the day). The capital included rent of the land, and the labor wage, the cost of plowing and preparation for agriculture, as well as the expenses of

seeds, fertilizers, pesticides and all other agricultural inputs, also service and preparation of soil for sowing and other agricultural inputs, the function has given the following results at

Table (3): $Ln(Y) = 0.544967 + 1.69448 \ Ln \ (L) + 1.5417 \ Ln \ (K)$

Table 3. production function of the estimated Cobb- Douglasof tomato crop

Estimated function parameters	
A	0.544967393484
T	**(0.683610)
L	1.69448535333
T	*(6.016491)
K	1.5417551967
T	*(4.726896)
R^2	0.749897
Adjusted R	0.737696
F	61.46609 *
D.W (K=4) (du= 1.53وdl =1.16)	1.450740 ***

* Significance level   0.05   ** Significance level 0.25   ***Significance level 0.01

Where the test passed the statistical and economitricstests and proved this through the Test(t), which proved the significance of the labor and capital at the level of(0.05), and proved the Test(F) significance of the function as a whole where it reached(61.46) at the significance of(0.05), and proved the(D.W) Test proved that there was no problem of auto–correlation between the residues, which It is clear from the production function (Cobb- Douglas), that the elasticities of both the labor and the capital were positive signals, which is greater than the correct one. This means that the production did not exceed the first and second stages of production for the law of diminishing

were worth (1.45) and were between (dl = 1.16> D.W = 1.45> du = 1.53), and R^2 (0.7498) showed that 74% of the changes caused by the production were caused by labor and capital, while the remaining 26% is due to other factors that are not measurable by function When writing the function in exponential form, it is as follows:

$Y = 1.72455 + L^{1.69448} + K^{1.5417}$

yields and the stages of increasing production (5). Indicating that there are still possibilities to increase the production of these resources commensurate with the size of the farm. The increase in yields is due to the cooperation of productive resources in the agricultural production

process, which is more efficient if mixed

Conclusion:

showed that the amount of chemical fertilizer had a negative impact on the quantity of production and this means that it is not used depending on the specific fertilization program and the weakness of experience in mixing the quantities of productive resources.

4 – As shown by the analysis of function Cup-Dogalas that the overall elasticities of production came positive signals, where the cooperation of productive resources in this model, which gave the possibility to mix them optimally.

5 - The weak role of agricultural extension in guiding the farmer rationalize the use of productive resources and farm management and how to mix the quantities of resources.

units used from animal manure because its effect was evident in the statistical analysis of the sample and the need to provide programs to guide farmers on how to use animal manure and make it more effective and regulate the quantities of chemical fertilizer (Urea)to avoid pollution and to encourage producers to improve production quality and quality, and achieve self-sufficiency of this crop for the province of Diyala and Iraq as a whole.

with certain percentages (2).

1 - The research concluded that the producers did not take advantage of all the resources available in the optimally in the open cultivation and surface irrigation to achieve high productivity reduced costs.

2 - The analysis of the multiple regression of the productive function showed that the elasticity of part the productive resources was positive and this means that the production of the second stage of the law of decreasing yields, namely the quantities of animal manure and the number of labor hours and the number of irrigation application during the season, which means the possibility of adding units of these resources in case of expansion of production.

3. Multiple regression analysis also

Recommendations:

1. The study recommends continuing the work of these projects and expanding the production of the tomato crop by following the scientific methods based on the results of the scientific research to optimize utilization of available resources in terms of commitment to fertilization programs according to need.

2 - The study recommends increasing the

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تحليل اقتصادي للعوامل المؤثرة على إنتاج محصول الطماطة المكشوفة المروية سيحاً في محافظة ديالى للموسم الانتاجي 2018

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المستخلص:

تمت دراسة دالة الانتاج لمزارع محصول الطماطة في الحقول المكشوفة المروية بالري السطحي في محافظة ديالى للموسم الانتاجي 2018، من خلال استبيان (45) مزارع تم اختيارهم بشكل عشوائي من مجموع مجتمع الدراسة البالغ (244) مزارع . و بلغت المساحة للحقول المبحوثة (185.4) دونم و تم تحليل الانحدار المتعدد لمدخلات الانتاج الرئيسية وتم تحليل الدالة بالصيغة الخطية ونصف اللوغارتمية واللوغارتمية المزدوجة واللوغارتمية المعكوسة تم اختيار نموذج الدالة نصف اللوغارتمية كأفضل نموذج ، وتم التحليل بأخذ اللوغارتم الطبيعي للأنتاج كعامل تابع ولكل مورد من موارد الانتاج كعامل مستقل و اتضح من خلال التحليل انه تم استغلال جزء من هذه الموارد بالاسلوب الامثل وذلك من خلال الاشارات الموجبة لمعلمات الموارد في الدالة وهذا يعني ان انتاج هذه الموارد يتم في المرحلة الثانية من قانون تناقص الغلة و هذه الموارد شملت (عدد ساعات العمل باليوم و كمية السماد الحيواني المستخدم و عدد الريات خلال الموسم)، اما مورد كمية السماد الكيمياوي أتضح من التحليل ان هذا المورد كان تأثيره سلبي على الانتاج لأن اشارة المرونة كانت سالبة وهذا يعني ان انتاج هذا المورد يتم في المرحلة الثالثة من قانون تناقص الغلة، كما تم تحليل الانحدار بأخذ اللوغارتم الطبيعي لكل من العمل و رأس المال بهدف ايجاد المرونة الكلية للانتاج بإستخدام نموذج كوب- دوجلاص و اتضح ان مرونات هذه الموارد كانت موجبة و هذا يعني ان موارد الانتاج مجتمعة تحقق انتاجية عالية بسبب تعاونها وكفاءة عملية الخلط ما يمكن من استغلال وحدات اضافية عند الرغبة بتوسعة الانتاج ، كما تمت التوصية بإتباع الارشادات الزراعية واعتماد نتائج البحث العلمي في استخدام الموارد وخاصة كميات الاسمدة و ادارة المزرعة بهدف الاستمرار بهذه المشاريع لتحقيق الاكتفاء الذاتي من سلعة الطماطة .

كلمات مفتاحية : محصول الطماطة ، المزراع المكشوفة ، المرونة الانتاجية ، موارد الانتاج.