ESTIMATING OF PROFIT FUNCTION OF VEGGETABLE CROPS IN ALQOSH REGION FOR THE PRODUCTION SEASON 2019

S. F. Shaba   **D. S. Barbaz**
Lecturer   **Lecturer**
Dept. of Agric. Economics /Coll. of Agric. /University of Mosul
salahodesh@uomosul.edu.iq   dh_barbaz@coagri.uobaghdad.edu.iq

 ABSTRACT
The research aims to study the profit functions of vegetable crops. Cross-sectional data was used based on a random sample that included 200 farmers in Alqosh region within Nineveh Province for the 2018-2019 agricultural season. The results showed that there are vegetable crops which need a large amount of labor as labor costs amounted to about 71% of the total costs per acre in tomato production. It was also found that total costs were higher in tomato crop cultivation at the dunum level compared to other vegetable crops. In addition, profit function shows that the price of the product has a significant effect on profit compared to the rest of the independent variables in the functions of vegetable crops, as the parameter of tomato crop price was about 51603.22 and it was significant and approved according to the T-test at the level of 1%. The determination coefficient was about 79% in the function estimated by the OLS method. Problem of heteroscedasticity according to White's general test was significant, so the estimation was done by the robust regression method to avoid that problem. That led to a decrease of the determination coefficient to about 55%, While the determinant factor of the cucumber crop reached about 72%, to be reduced to about 56% after addressing the problem of variability instability. The research recommended that farmers should be encouraged to expand tomato cultivation instead of other vegetable crops.
Key word: Price, Revenue, Economic efficiency.

تقدير دالة ربح محاصيل الخضر في منطقة القوش للموسم الانتاجي 2019

ضرغام سلمان برباز   **صلاح فهمي شابا**
مدرس   **مدرس مساعد**

المستخلص

يهدف البحث دراسة دوال ربح محاصيل الخضر. استخدمت بيانات مقطعية في ضوء عينة عشوائية اشتملت 200 مزارع في محافظة نينوى في ناحية القوش للموسم الزراعي 2019، بينت نتائج البحث ان هناك محاصيل خضر من المشاريع التي تحتاج الى كمية كبيرة من مورد العمل اذ شكلت تكاليف العمل نحو 71% من اجمالي التكاليف الكلية في الدونم الواحد في مزارع الطماطم. كما تبين من خلال الدراسة ان محصول الطماطم يحتاج الى تكاليف اعلى على مستوى الدونم بالمقارنة بمحصول الخيار. كما تبين من خلال دالة الربح بأن سعر الناتج له أثر كبير في الربح بالمقارنة مع بقية المتغيرات المستقلة في دوال ربح محاصيل الخضر، اذ بلغت معلمة سعر محصول الطماطم نحو 51603.22 دينار وقد ثبتت معنويتها بحسب اختبارT عند مستوى 1% ، وقد بلغ معامل التحديد نحو 79% في الدالة المقدرة بطريقة OLS لكن ثبت وجود مشكلة عدم ثبات التباين بحسب اختبار وايت العام، لذ تم التقدير بطريقة الانحدار الحصين لتلافي مشكلة عدم ثبات التباين وقد ادى الى انخفاض معامل التحديد الى نحو 55%، بينما بلغ معامل التحديد لمحصول الخيار نحو 72% ، لتنخفض الى نحو 56% بعد معالجة مشكلة عدم ثبات التباين. وقد اوصى البحث بضرورة تشجيع المزارعين على التوسع بزراعة محصول الطماطم على حساب المحاصيل الخضر الاخرى.
الكلمات المفتاحية: الاسعار، الايراد، الكفاءة الاقتصادية.

INTRODUCTION

In general projects of all sizes and types are among the most important factors for the success of economic development plans (5). The process of developing agricultural production and developing human food in particular occupies a large part of the interests of agricultural economic policy planners especially in developing countries (6)(18). As agricultural production in the third world countries is characterized by low productivity and high production costs which is a result of limited ability to utilize farm resources successfully (16). Iraq is on of countries that suffers from a food shortage as the gap between its agricultural production and the actual needs has been increased over time. This is due to the population growth at rates that do not match rate of increase in agricultural production which leads to a food deficit (3). This requires paying attention at studies related to the economics of agricultural production through the optimal use of economic resources and achieving high rates of agricultural production and productivity because these studies illustrate the nature of the relationship between economic variables in agriculture (1) (2). Agricultural production also plays an important role in any country because it is related to the lives of its residents first (4). Growing vegetables is an important agricultural activity from an economic point of view, as the global tomato crop production in 2018 reached about 182 million tons, and the eggplant crop was 54 million tons, while Iraq's tomato production amounted to 266 thousand tons and about 113 thousand tons of eggplant. On the other hand, Iran's tomato production accounted for about 3.6% of the world's production (8)(12). The demand for food around the world is changing rapidly due to economic growth, rising incomes and urbanization. Demand is moved from traditional commodities towards high value food commodities such as fruits, vegetables, spices, fish, etc. We know that Iraq has a big population. So, food shortage has become a common problem in the country. Vegetables represent a main component of our daily food and contribute to more than 80% of our daily food system. Problem of malnutrition and lack of food may greatly put obstacles to build a healthy nation. An important way to help farmers face challenges in the era of the market economy is to reduce their production cost, so that the prices of locally produced vegetables become more competitive and profitable, By focusing on growing the most profitable vegetable crops. In spite of the economic and nutritional importance of vegetable crops in Iraq, local production is still below the level required to meet the local demand. Therefore, the research problem lies in the fact that despite the existence of arable lands, Iraq is still dependent on importing vegetable crops that deplete hard currency from the state treasury. Focusing on the cultivation of various vegetable crops due to the nature of the prevailing production in the agricultural area on the one hand, and in order to face the risks and the diversity of farm income sources on the other hand, which will lead to a decrease in total profits, due to the decrease in the profitability of some crops. Therefore, the study aims to analyze the current situation of vegetable production, especially winter vegetables. Although a lot of information is available from previous studies on the relative profitability of winter vegetables, but the current study is adding more information about the profit functions of winter vegetable crops in the study area, and therefore the results of the study may be useful in making the right decision among farmers, which will help them in The end result is to allocate their resources more efficiently, which can be a basic rule by which a farmer can determine the amount of production that he can produce and that leads to maximizing his farm profit in light of the market changes. Therefore, the research hypothesis came on the basis that the sample farmers can achieve efficiency in the use of available resources by focusing on planting the most profitable crops, which led to a decline of economic efficiency in the production of vegetable crops by estimating profit functions of the studied vegetable crops.

MATERIALS AND METHODS

This study relies on primary data at farm level that were collected from selected farmers through the agricultural survey method. The current study sites were chosen intentionally Alqosh district in Nineveh province. Five

villages are Jambur, Beban, Qasab Alqosh, Bozan and Derston were selected. Various winter and summer vegetables are grown in the region on the agricultural area of the district, which is about 122 thousand dunams. The number of farmers is about 1545 farmers in the whole district. The target vegetable crops in the study were tomato, and cucumber. Villages were intentionally selected to collect data from 200 farmers (100 farmers per crop) to estimate production cost, total income, and other factors. Selected farmers interviewed about the relative profitability of winter vegetables using a questionnaire to collect primary data on costs and returns for each vegetable for the 2018-2019 agricultural season. The study relied on a questionnaire form to collect data during the period of the 2018-2019 agricultural season. They were analyzed by using the computer by the statistical program Eviews, using the usual method of ordinary least squares (OLS).

Theoretical framework

Vegetable crop profit function: The profit function model was estimated based on the economic theory which states that profit equals total revenue (total revenue) minus total costs (17) as follows:

$\pi = TR - TC$ ………. 1

$TR = \sum P1 * Q1, \quad TC = Vi * Xi$

$\pi = P1*Q1 - \sum Vi * Xi$ .. 2

So that:

π: profit,

TR: total or total revenue includes (primary and secondary revenue).

TC: total costs.

P1: The price of the product.

Q1: Output quantity.

Vi: supplier price,

Xi: The amount of the resource.

Through equations 1 and 2, we obtain the profit function as in the following formula(13):

$\pi = F (P, C, Q)$

Based on that, the profit function model can be described (14) as in the following equation:

$\pi = B_0 + B_1 P - B_2 C + B_3 Q + Ui$

So that:

π: profit.

Py: the price of the crop (dinars),

ATC: average production costs (dinars/ton),

Y: Amount of output (tons),

B_0: Intercept,

Bi: represent the regression coefficients,

Ui: The random variable.

Descriptive analysis of the cost structure of vegetable production.

Production costs are one of the important and basic topics in economic studies, because production decisions depend primarily on the level of production costs as the volume of production is always linked to production costs. The importance of studying production costs is due to its importance in determining net revenue (10). Therefore, this aspect will be highlighted for its importance in the study. Table 1 shows that the variable costs of the cucumber amounted to about 2.8 million dinars, which is the highest rate of variable costs per acre, which constituted about 70% of the total costs, Tomato has the lowest cost rate. The variable costs amounted to 1.1 million dinars, and the fertilizer costs constituted about 21% of the average total costs per acre planted with the cucumber crop. The average fertilization costs for tomato decreased to about 336 thousand dinars per dunum, which constituted about 7%, while the highest average costs per acre for tomato were recorded at about 4.5 million dinars due to the length of the production season and the nature of the crop that needs greater labor costs compared to the rest of the vegetable crops. The total costs of the cucumber crop per acre are slightly less than it, and this large increase in costs has negatively affected the profits of cucumbert production during the 2018-2019 agricultural season. The highest productivity of the tomato crop was recorded at about 10 tons / dunum, which greatly contributed to maximizing profits, while the lowest productivity rate of about 9 tons / donum was recorded for cucumber farms. The production costs contributed to the pepper crop to reducing the losses achieved.

RESULTS AND DISCUSSION

Economic analysis:

Table 3. shows that all the variables in the tomato and cucumber crops profit function were consistent with the logic of economic theory.

Table 1. Cost structure in studied vegetable crop farms

Items	Tomato		Cucumber	
	Cost per dunum(ID)	Relative importance	Cost per dunum(ID)	Relative importance
Mechanical Labor	136157	3%	143611	3%
Fuel	220535	5%	49412	1%
Seeds	107417	2%	1098377	27%
Fertilizers	336929	7%	856795	21%
Pesticides	133811	3%	504462	12%
Marketing Costs	242535	5%	222312	5%
Variable Costs	1177386	26%	2874970	70%
Land Rent	15000	0%	9000	0%
Hand Labor	3267087	71%	1045233	25%
Interest on Capital	58869	1%	143748	3%
Depreciation	59055	1%	66647	2%
Fixed Costs	3400011	74%	1255629	30%
Total Costs	4577397	100%	4130599	100%

Source: Prepared by the researcher based on the questionnaire data.

Table 2. Total revenue and profit in studied vegetable crop farms

Items	Tomato	Cucumber
Land area (dunum)	317.5	246.5
Average costs (ID)	39706.57	43566.8
Production (Tons)	10925.98	9760.6
Total Revenue (ID)	5530110	4915476.7
Total cost (ID)	4577397	4130598.7
Profit (ID)	952713	784878

Source: Prepared by the researcher based on the questionnaire data

Table 3. The profit function of tomato crop in the research sample

Dependent Variable: PROFIT
Method: Least Squares
Date: 08/04/20   Time: 20:33
Sample: 1 100
Included observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-6645716	5394939	-1.23184	0.221
PY	30677.97	10970.37	2.79644	0.0062
ATC	-21580.7	1579.64	-13.6618	0.0000
Y	80.16616	9.898551	8.098777	0.0000
R-squared	0.691085	Mean dependent var		3072490
Adjusted R-squared	0.681432	S.D. dependent var		3685406
S.E. of regression	2080112	Akaike info criterion		31.97292
Sum squared resid	4.15E+14	Schwarz criterion		32.07713
Log likelihood	-1594.65	Hannan-Quinn criter.		32.01509
F-statistic	71.58841	Durbin-Watson stat		1.775206
Prob(F-statistic)	0.0000			

Source: Prepared by the researcher based on the results of the statistical program eviews 11

Table 4. The profit function of the cucumber in the research sample

Dependent Variable: PROFIT
Method: Least Squares
Date: 08/04/20   Time: 23:18
Sample: 1 100
Included observations: 100

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-6284189	3981950	-1.57817	0.1178
PY	28827.5	8121.718	3.549433	0.0006
ATC	-19854.2	1515.802	-13.0981	0.0000
Y	85.86934	8.480612	10.12537	0.0000
R-squared	0.723863	Mean dependent var		3076290
Adjusted R-squared	0.715233	S.D. dependent var		3305203
S.E. of regression	1763773	Akaike info criterion		31.64299
Sum squared resid	2.99E+14	Schwarz criterion		31.74719
Log likelihood	-1578.15	Hannan-Quinn criter.		31.68516
F-statistic	83.88431	Durbin-Watson stat		1.896386
Prob(F-statistic)	0.0000			

Source: Prepared by the researcher based on the results of the statistical program eviews 11

Statistical analysis:
All the parameters are significant at the level of 0.01 for the t-test. This shows their importance in estimating the relationship between profit and the mentioned independent variables, as it was found by comparing the calculated F for the estimated functions at the level of 1% significance all models are highly significant, which reflects the importance of the variables included in the functions on the one hand, and the functions reflects reality on the other hand. Also, the value of the coefficient of determination was 0.69 in the function, profit of tomato crop, which reflects the good fit of the regression line, while the value of the coefficient of determination was 0.72 in the function, profit of the option crop. It is evident from the above that there are other factors that also affect the profit function of vegetable crops, including the temperature, skill and knowledge available to the farmer and the extent to which modern technology is used in the production of improved seeds, fertilizers and pesticides, which is represented by the random factor.

Econometric analysis:
To show the efficiency of the estimates, econometric tests were conducted for the estimated models, and the results proved that the models were free from the problem of autocorrelation between the residuals, as the value of Durban-watson test was 1.77, 2.09, and 1.84 for tomatoes, and cucumber respectively. The DW value was 2.264 which is greater than du of 1.736 and smaller than du-4 at the level of 0.05. It can be concluded that there is no autocorrelation for the random variable in the research sample (14). As for the problem of multicollinearity between independent variables, it was not presented according to the Klein test which is based on the correlation matrix, and from it we conclude that the model correlation coefficients are greater than the simple correlation coefficient between the variables. This implies that the model is free from the multicollinearity. White test was also used. It contained the estimation of the error-squared regression equation as a dependent variable on the independent variables, their squares, and the limits of interference (9). That shows that there is a problem of heteroscedasticity in the estimated models according to the test results and then the robust regression model was used. All the parameters of the tomato profit function were significant at the level of 1% and confirm to the logic of economic theory(19), The price of the crop is the most influential independent variable, and the significance of the function as a whole was proven according to the f-test. The value of the determination coefficient in the new model is about 54%, which reflects the goodness of fit of the regression. That coefficient shows that 54% of the variation in profit are resulted by the price of wheat, the quantity of output and the average production costs only, and that there are many variables that affect the profitability of the tomato crop such as temperature and the type of technology used, as well as the knowledge and skills of the farmer. As for the estimated function of the cucumber crop, its parameters were found to be significant at the level of 1% according to the t-test, and it was consistent with the economic theory. The determination coefficient of the new function was 0.56, meaning that the independent variables explained 56% of the fluctuations in the profit function of the cucumber. The output price parameter outperformed the tomato profit function as it reached about 51 thousand, meaning that increasing the price of the tomato crop by one dinar, will increase the profits of the farmers who grow this crop by 51 thousand dinars when the rest of the variables remain constant at the average, while increasing the price of the option crop by one One dinar will increase farmers 'profits by 26,000 dinars, meaning that tomato farms will benefit and double the profits of cucumber farms when prices rise by the same amount, which draws farmers' interest in directing their resources to cultivating the tomato crop. While the parameter of average costs in tomato and cucumber farms was about 15 thousand, 16 thousand, respectively, which shows that the effect of reducing average costs in tomato and cucumber farms is close, as if the average costs decrease by one dinar, the profits of tomato farms will increase by 15 thousand dinars, while The profits of cucumber farms increase by 16 thousand dinars, which are comparable rates.

Table 5. Profit function of new tomato crop in the research sample

Dependent Variable: PROFIT				
Method: Robust Least Squares				
Date: 08/14/20 Time: 21:34				
Sample: 1 100				
Included observations: 100				
Method: S-estimation				
S settings: tuning=1.547645, breakdown=0.5, trials=200, subsmpl=4, refine=2, compare=5				
Random number generator: rng=kn, seed=1739267063				
Huber Type I Standard Errors & Covariance				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-1.9E+07	2371106	-7.95413	0.0000
PY	51603.22	4821.539	10.70265	0.0000
ATC	-15030.6	694.261	-21.6498	0.0000
Y	39.18286	4.35047	9.006581	0.0000
		Robust Statistics		
R-squared	0.542356	Adjusted R-squared		0.528054
Scale	1148988	Deviance		1.32E+12
Rn-squared statistic	505.9793	Prob(Rn-squared stat.)		0.0000
		Non-robust Statistics		
Mean dependent var	3072490	S.D. dependent var		3685406
S.E. of regression	2503570	Sum squared resid		6.02E+14

Source: Prepared by the researcher based on the results of the statistical program eviews 11

Table 6. the profit function of the new cucumber crop in the research sample

Dependent Variable: PROFIT				
Method: Robust Least Squares				
Date: 08/14/20 Time: 21:15				
Sample: 1 100				
Included observations: 100				
Method: S-estimation				
S settings: tuning=1.547645, breakdown=0.5, trials=200, subsmpl=4, refine=2, compare=5				
Random number generator: rng=kn, seed=556045147				
Huber Type I Standard Errors & Covariance				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-6420814	2300554	-2.79099	0.0053
PY	26439.03	4692.286	5.634574	0.0000
ATC	-16666.6	875.748	-19.0312	0.0000
Y	89.03587	4.899635	18.17194	0.0000
		Robust Statistics		
R-squared	0.561244	Adjusted R-squared		0.547533
Scale	1135723	Deviance		1.29E+12
Rn-squared statistic	636.1319	Prob(Rn-squared stat.)		0.0000
		Non-robust Statistics		
Mean dependent var	3076290	S.D. dependent var		3305203
S.E. of regression	1808387	Sum squared resid		3.14E+14

Source: Prepared by the researcher based on the results of the statistical program eviews.

As for the parameter of the production quantity in the two estimated functions, the analysis showed that the quantities produced in the cucumber farms have more effect on the profits compared to the tomato crop, since an increase in production by one kilogram will increase the profit of the cucumber farms by 89 dinars, while the profits of tomato farms will increase by 39 dinars when the production increases The same amount and when the rest of the variables are constant at the average, and here we notice the superiority of the cucumber crop in achieving greater profits through increasing the quantities produced compared to the tomato crop.

Table 7. Correlation Coefficients between variables of the Profit function of tomato crop

Covariance Analysis: Ordinary Date: 02/24/21 Time: 00:31 Sample: 1 100 Included observations: 100 Correlation Probability			
Cases	PY	ATC	Y
PY	1		
	100		
ATC	0.315985	1	
	0.0014		
	100	100	
Y	0.055671	0.231153	1
	0.5822	0.0207	
	100	100	100

Source: Prepared by the researcher based on the results of the statistical program eviews.

Table 7. Correlation Coefficients between variables of the Profit function of cucumber crop

Covariance Analysis: Ordinary Date: 02/24/21 Time: 00:39 Sample: 1 100 Included observations: 100 Correlation Probability			
Observations	PY	ATC	Y
PY	1		
	100		
ATC	0.273138	1	
	0.006		
	100	100	
Y	0.092637	0.117707	1
	0.3593	0.2435	
	100	100	100

Source: Prepared by the researcher based on the results of the statistical program eviews.

Conclusions and recommendations:

Conclusions:

1- The tomato farms will benefit and achieve double the profits of the cucumber farms when the prices rise by the same amount, which draws the farmers 'interest in directing their resources to cultivating the tomato crop.

2-The effect of reducing the average costs in tomato and cucumber farms is close, as if the average costs decrease by one dinar, the profits of tomato farms will increase by 15 thousand dinars, while the profits of cucumber farms will increase by 16 thousand dinars, which are close proportions.

3-The cucumber crop outperformed in achieving greater profits through increasing the quantities produced compared to the tomato crop.

4-It was found through the study that costs were high in tomato cultivation at the dunum level compared to other vegetable crops.

5- It is found through the profit function that the crop price has a significant impact on profit compared with the rest of the independent variables in the profit functions of vegetable crops.

6- It was found through the study that the eggplant and green pepper cultivation have suffered losses for the 2018-2019 production season, and this may be due to the weak price competition on the one hand and to the high costs of eggplant production in the research sample on the other hand. Therefore, the profitability functions of the two crops were not estimated, and the focus was on tomato and cucumber yields

7- It was found that there are other independent variables that greatly affect the

production of vegetable crops, including temperature, skills and experience.

Recommendations:

1- Encouraging farmers to expand their tomato cultivation instead of other vegetable crops.

2- The need to provide government support for vegetable production projects, in a way that ensures increasing their competitiveness by reducing the costs of production requirements.

3- The necessity of developing and providing modern ways and technologies that would raise the level of productivity and reduce costs in order to ensure optimal utilization of resources to achieve economic efficiency.

4- Paying attention to the role of extension in transferring information and scientific research results to farmers for adoption and raising their administrative capabilities, and then raising the productive level in farm work represented by achieving economic efficiency.

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