NTU Journal of Agricultural and Veterinary Sciences (2023) 3 (2) : 58-67
DOI: https://doi.org/10.56286/ntujavs.v3i2.526

IRAQI Academic Scientific Journals

JAVS NTU

P-ISSN: 2788-9890 E-ISSN: 2788-9904
NTU Journal of Agricultural and Veterinary Sciences
Available online at: https://journals.ntu.edu.iq/index.php/NTU-JAVS/index

Economics of Bee Honey Production in Nineveh Province for the Production Season 2021

1st Assad Ibrahim Alhayali[1]
1. Northern Technical University

Article Informations

Received: 07-06- 2023,
Accepted: 24-06-2023,
Published online: 01-08-2023

Corresponding author:
Name: Assad Ibrahim Alhayali
Affiliation : Northern Technical University
Email:
mti.lec149.assad@ntu.edu.iq

Key Words:
honey bee,
profit function,
economic efficiency,

A B S T R A C T

The weakness of technical and economic knowledge of beekeepers is one of the factors affecting profit as well as the optimum production volume achieved for economic efficiency, which led to economic problems, among those problems is the decrease in the quantities supplied from bee honey production. The research aimed at studying the most important factors affecting the profit function as well as estimating the function production costs. Cross-sectional data were used in the light of a random sample that included (120) beekeepers from Nineveh Governorate. The results of estimating the profit function showed that the parameters of the function agreed with the logic of the economic theory and the statistical and standard tests. It was shown by the size of the parameters of the function that the amount of output has a great importance in profit compared with the rest of the price variables and the average production costs. As for the ratio for estimating the function of total costs, the results of the study showed that the cubic model is the most suitable for the relationship adopted in the study according to economic theory and statistical and standard tests. Depending on the cost function only, the volume achieved for the economic efficiency of honey production was obtained at the level (10,386) kg / cell. The study also showed that the technical efficiency in honey production amounted to (86%), as well as the estimation of the maximum production volume for honey in the short term, which amounted to (13.885). We infer from the study that the economic resources used in the production process were not optimally invested, which led to a decrease in production efficiency. The results of the study recommend working to follow production policies aimed at increasing the economic efficiency of a single cell and achieving optimal use of available resources, which is reflected in an increase in efficiency in the use of productive resources and an improvement in the efficiency of honey production.

Introduction

The activity of beekeeping is one of the areas that can significantly contribute to the movement of economic and social development, through its contribution of food and medical products, as well as creating job opportunities due to its limited investments, and at the same time it produces quick returns (Mbah, 2012, 65), and beekeeping is one of the agricultural sector activities that make an effective contribution to increasing agricultural production and improving its quality, as studies have proven that bees are one of the most important aids in pollination of flowers of fruitful trees and some crops and vegetables, as it increases the amount of production by no less than about (25%), and this contributes to an increase in the production per unit area and achieves a profitable profit (Hasanawi, 2008, 45). Also, bees are economically important insects. They produce honey, royal jelly, wax, bee gum, bee venom, and pollen (or the so-called propolis, which is a source of plant proteins and is useful as a treatment for wounds and burns, and increases red blood cells) (Abo El-Nag, 2011, 14).). The most important of what was mentioned is the production of honey, as it enters into many medical and industrial uses (Mshelia, 2013, 142), and it is described as a treatment for many diseases, and therefore it is a healer and tonic for human bodies because of its carbohydrates, proteins, vitamins, enzymes and various mineral elements. The percentage of sugars is high (81%). Beekeeping is spread in most countries of the world and the most important producing countries are China, the United States of America, Canada, Argentina, Nigeria and Australia (Vural, 2010, 3003-3008), as the global production of honey reached about (1.9) million tons, and the number of beehives in the world reached (99.5) million cells for the year 2020, as for the productivity of one cell, it reached (19.09) kg. Australia achieved the highest honey productivity in the world, reaching (117) kg / hive. In the Arab world, natural honey production reached 39.7 thousand tons, while Iraq's honey production reached 900 tons. Before proceeding with the current study, it is useful to review the most important previous studies and research that dealt with the subject of the study. Devkota (2006) conducted a study entitled (Economic Analysis of the Costs of Bee Honey Production Projects in Chitwan / Nepal). The study aimed at determining the fixed and variable costs and the percentage of each contribution. In bee honey production projects, the study concluded that the variable costs (artificial nutrition, medicines and treatments, costs of transporting cells, wax foundations, labor) constituted (74%) of the total costs, while the fixed costs (parcels, cells, harvesting honey, barriers, Honey equipment) accounted for (26%), while the revenues were distributed between honey (66.6%), parcels (32%), and wax (1.4%). Odeh also presented in (2013) a study entitled (The Economics of Beekeeping in Al-Diwaniyah Governorate). Data were collected according to a random sample that included (25) beekeepers in the city of Al-Diwaniya. The results indicated that fixed costs constituted the highest percentage of the total costs, and that feeding costs constituted the highest percentage of variable costs, and the study proved that the apiaries included in the study were economically feasible through the economic criteria used, including (net income, economic profit, return on the invested dinar, honey hive yield, single hive productivity, simple return, average costs per hive, percentage productive profitability, and return on revenue). Al-Obeidi and Ahmed (2015) completed a study entitled (An Economic Study of the Factors Affecting Honey Production in the City of Tripoli), and it was found that the average production of one hive is (11) kg of honey. From honey production, the number of cells, and the profession of the breeder, and the degree of homogeneity of the production function was greater than the correct one in light of the increasing capacity returns, and by estimating the bee honey supply function in the city of Tripoli, it was found that the price elasticity of supply is equal to (0.44), less than the correct one, which means that the supply of honey is not fiexible, while the elasticity of costs was (0.075) less than the correct one, This indicates that the production of bee honey in the city of Tripoli takes place in the first stage of the production stages, and it was found that the maximum size of the profit is (1377) kg, and the minimum price that beekeepers accept to offer their production is estimated at (11.5) Libyan dinars. Despite the economic importance of honey bees and the increasing demand for their products, it faces many problems, including the lack of accurate information on factors affecting profits and how to determine the amount of production that beekeepers can produce that achieve the lowest possible cost which requires conducting more studies related to those problems. Nineveh Governorate was chosen as an applied model for this study. The research problem is the low quantities of honey production at the level of this governorate according to statistics (Beekeepers Association in the central Province Nineveh, 2021), which may be attributed to the poor technical and economic knowledge of beekeepers about the optimum production volume that achieves economic efficiency and that achieves the maximum possible profit. In addition to other technical reasons including those related to the environment, a good opportunity to research the hypothesis that natural production and the optimal model of success beekeepers are able to obtain supplies at low costs, production and costs. Thus, the current research aimed at studying the factors affecting the profit function, then estimating the size of the economic efficiency in the production of honey, measuring the technical efficiency in honey production, estimating the volume of production that maximizes profit, and calculating some economic indicators at the actual, optimal and maximal level of production for profit. The importance of the research comes from the fact that it is the economic study concerned with studying the factors affecting the profit function in the production of honey at the level of Nineveh Governorate short term in the light of the market change.

Materials & Working Methods

The study relied on a questionnaire for a sample of beekeepers in the Nineveh Governorate for the year 2021. 120 questionnaires were distributed to a random sample. Tthe sample represented (29.62%) of the total beekeepers from the study area, which included (Mosul, Tal-Afar and Hamdaniya districts). The personal data of the beekeepers was collected from the sample members which included various information about production, costs and the number of bee hives. The data were analyzed using the statistical program EViews 12.

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Descriptive Analysis of the Cost Structure of Honey Production

Table (1) shows that the costs of purchasing parcel boxes in honey bee production projects in Nineveh Governorate (the study sample areas) ranked first, and constituted a relative importance (27.28%) of the total costs, and the costs of other expenses ranked second, and the percentage of their contribution was (25.98%) of the total costs, and the cost of tires came in the third place with a contribution rate of (16.07%) of the total costs, and the costs of the land rent allowance came in the fourth place with a contribution rate of (10.65%), then came after (industrial feeding, transportation Cells, medicines and treatments, family work, and rented work) and their contribution percentage amounted to (8.22, 7.85, 1.86, 1.30, 0.74) %, in the same order. Table (1) shows the relative importance of the items of fixed and variable costs from the total costs.

Table 1. The relative importance of the fixed and variable costs items from the total costs

cost items	The value of the costs is estimated in (million dinars)	Relative importance (%)
land rent allowance	51	10.65
family business	7	1.30
interest on capital	3	0.56
annihilations	3	0.56
total fixed costs	64	11.96
hired work	4	0.74
cell transfer	42	7.85
Medicines and treatments	10	1.86
industrial feeding	44	8.22
parcel boxes	146	27.28
Tires	86	16.07
Other expenses	139	25.98
Total variable costs	471	88.04
Total total costs	535	100.00

Reference : Prepared by the researcher based on the personal interview, which is included in the questionnaire

Results & Discussion

The Ordinary Least Squares (OLS) method was used to estimate the parameters of the profit function and the short-run cost function. The profit function model was estimated. It was calculated based on the economic theory that states that the profit (net income) is equal to the total revenue minus the total costs (Khan, 2008, 45- 65) as follows**:**

$\pi = TR - TC$
$TC = Vi * Xi$
$TR = P * Y$
$\pi = P Y - \sum Vi * Xi$

π = profit , TR **:**total revenue , TC **:**total costs , P **:**production price , Y **:**production quantity , Vi **:**Supplier price , X_1 **:**supplier quantity

Through the above equation, we get the profit function as in the following formula:

$\pi = f(P, C, Y)$

Based on the foregoing, the profit function model can be described as in the following formula: (Qamar, 2006, 30-35)

$\pi = B_0 + B_1P - B_2C + B_3Y + Ui$

π =profit , P **:**production price , C **:**Average production costs , Y **:**production quantity , B0 **:**fixed limit , Bi **:**regression coefficients U_1 **:**random variable

After conducting the analysis, the results of the estimated function showed the following as in Table (2) and Equation (1)**:**

Table 2. The results of the estimated coefficients of the profit function for honey bee production projects in Nineveh Governorate

Independent variable	Coefficients	Estimator	Value-t
constant	B0	6.985	3.125
output price	P	420.265	13.658
average production costs	C	-269.365	-4.658
output quantity	Y	5341.226	16.954
R SYuare (R^2)		0.94	
Adjusted R^2 (R^{-2})		0.93	
D-W Test		1.825	
Test F		178.882	
N		120	

Reference: Prepared by the researcher based on the personal interview, which is included in the questionnaire

π = 6.985 + 420.265P – 269.365C + 5341.226Y ---- (1)

Statistical Analysis:

Statistical analysis proved that all the variables were significant at the level (0.01) and it can be relied upon in estimating the relationship between the traditional profit and the independent variables. The variables included in the function, on one hand, and the realism of the function, on another. The value of the coefficient of determination R2 reached 0.94 in the function, which reflects the quality of the reconciliation of the regression line that 6% of the changes in profit were the result of other factors not included in the model.

Standard Analysis:

To demonstrate the efficiency of the estimates, standard tests were conducted for the estimated model, as follows:

First: the problem of autocorrelation

It was clear from the results that the model was free of the problem of self-correlation between the residuals, as the value of DW reached (1.825), which is greater than du of (1.665) and smaller than 4-du of (2.335) at the level (0.01) and from it we conclude that there is no positive autocorrelation or negative autocorrelation for the random variable (Koutsoyiannas, 1977, 200-230) .

Second: The Auto Correlation Problem:

Table 3. shows a matrix of simple correlations between the explanatory variables of the traditional profit function for honey bee production projects

	Y	P	C
Y	1	0.016	-0.055
P		1	1.670*-
C			1

Reference: Prepared by the researcher based on the personal interview, which is included in the questionnaire

Third: The Heteroscedasticity Problem:

Using the Park test, which includes estimating the regression equation of the square of the error as a dependent variable of the independent variables (Ibrahim, 1996: 353-361). It was found that the model is free from the problem of inconsistency of homogeneity of variance, according to the relationship estimated by the following logarithmic formula**:**

1- Testing the square error test of the traditional profit function with the output price variable:

$\text{Ln}(ei)^2 = a + b \ln P$

$= -23{,}325 + 5.615 (\ln P)$

T = (-1.432) (1.157)

D-W = 1.436 F = 1.079 $R^2 = 0.036$

2- Testing the square of the error limits of the traditional profit function with a variable average production costs:

$\text{Ln}(ei)^2 = a + b \ln C$

$= 43{,}325 - 5.615 (\ln C)$

t = (1.553) (-0.897)

D-W = 1.131 F = 0.369 $R^2 = 0.029$

3- Testing the square of the error limits of the traditional profit function with the output quantity variable:

$\text{Ln}(ei)^2 = a + b \ln Y$

$= 30{,}435 + 0.985 (\ln Y)$

t = (9.365) (0.474)

D-W = 1.231 F = 0.789 $R^2 = 0.022$

Economic Analysis:

Through the traditional honey bee production profit function, it was found that the sign of all parameters agrees with the logic of the economic theory, as the output price and output quantity parameters were positive with the traditional profit, which indicates a direct relationship, while the average production costs parameter came with a negative sign with the traditional profit, which means the relationship is inversed. and this means that an increase in the price of the output by one dinar per kilogram while remaining the same will lead to an increase in profit by 420.265 dinars, and an increase in production costs by one dinar per kilogram while keeps other factors constant which leads to a decrease in profit by 269,365 Dinar. Likewise for the quantity produced, an increase in production by a kilogram of honey while remaining the same will lead to an increase in profit by 5341,226. This means, through the size of the variables parameters, the quantity of output has a significant impact on increasing the profit as well as the price of the product and the decrease in the average production costs**.**

As for the cost function, and based on the economic theory, total costs are a function of total production in the short-term period, that is, one or more of the production factors is fixed in this period and that the cost function can be linear or non-linear, and in our analysis we expect to obtain the model cubic based on the nature of the relationship between production and costs in the short run. The general form of the model can be written as follows (Doll, 1978, 25-48):

$$\mathbf{SRTC = b_0 + b_1Y + b_2Y^2 + b_3Y^3 + ui}$$

TC Represent the total costs (dinars),
Y Represents the total production (Kg)
$\mathbf{b_1, b_2, b_3}$ represent static model parameters ,
$\mathbf{b_0}$ The total fixed costs TFC

The production costs function of honey bee production projects was estimated from the reality of the research sample data, using three forms of cost functions (linear, quadratic and cubic), and it was found that the cubic form is the most appropriate to represent the relationship between the dependent variable (total cost) TC in monetary units (dinars) and the independent variable (production Y) in weight units (kg) based on statistical tests ((t, F, R^2, standard (Klein, Durbin - Watson, Park) and economic represented by the agreement of the signal and the size of its parameters with economic logic (economic theory) as in Table (4) as follows**:**

Table 4. Estimated coefficients of the short-run total cost function for honey bee production projects in Nineveh Governorate (study sample areas)

Independent variable	Coefficients	Estimator	Value-t
constant	b_0	29733.658	1.754
output	Y	24999.669	6.012*
output square	Y^2	-4.487	-4.012*
output cube	Y^3	216 .0	3.614*
R Square (R^2)		0.95	
Adjusted (R^{-2})		0.94	
D-W Test		1.947	
Test F		166.255	
N		120	

* Significant level (0.01)

* Reference: Prepared by the researcher based on the personal interview, which is included in the questionnaire

$SRTC = 29733.658 + 24999.669Y - 4.487\,Y^2 + 0.216\,Y^3$ -----(1)

SRTC = It represents the short-run total cost function of honey bee production projects

Statistical Analysis:

Based on the t-test, it was found that the estimated coefficients were significant at the level of significance (%1), and the F-test proved the significance of the function as a whole, and the coefficient of determination showed that (95%) of the changes in total costs were caused by changes in the total output and that (5%) of those changes. This is due to other factors that were not included in the model, and the effect of which was absorbed by the fortuitous factor**.**

Standard Analysis:

First: the autocorrelation problem:

The model showed that there was no autocorrelation problem because the calculated DW value is equal to (**1.977**), which lies between ($d_u<d<4-d_u$), meanings that (**1.665**<**1.977**<**2.335**) and it is located in the region acceptance of the null hypothesis which states that there is no autocorrelation problem among the residuals**.**

Second: The Auto correlation problem:

Such a model satisfies the assumption that there is no multiple linear relationship between the independent variables. It should be noted here that Y2 (the square of the output) and Y3 (the cube of the output) are functionally related to the variable Yi (the output), but the relationship is nonlinear, (Multicollinearity) (Koutsoyiannis, 1977: 200-230).

Third: The Heteroscedasticity Problem:

Because the research depends on cross-sectional data, it is necessary to reveal the problem of heteroscedasticity. The (Park) test was adopted, which includes estimating the regression equation of the square of the error as a dependent variable and the result as an independent variable, and the function estimated in the logarithmic formula is as follows:

$\text{Log}\,(ei)^2 = a + b\,\text{Log}\,(Y)$
$= -57.046 + 14.324\,\text{Log}\,Y$
t (-0.880) (0.892)
$R^2 = 0.008$ F = 1.045 D.W = 2.140

Since the estimated function is not significant under the 5% level according to the F test, and the calculated t value of the slope of the error regression equations is less than the tabular t value with a significant level of 1%, this indicates that there is no problem of heterogeneity of variance**.**

Economic Analysis:

Production costs represent one of the factors that can be studied to infer the extent to which the agricultural sector achieves productive and economic efficiency, either by achieving the largest possible amount of production with a certain amount of costs, or by achieving a certain amount of production with the lowest possible costs, and this is achieved by using agricultural economic resources are optimally used, and the efficiency of the use of economic resources can be identified by determining the two points of cost minimization and profit maximization using the economic analysis of cost functions (Abdul Rahman et al: 2016, 209)

A - Determining the optimum civil production volume for costs in honey bee production projects.

The optimum volume of production is intended to be the production volume at which the average total costs curve reaches its lowest point, and at which point the production unit reaches its maximum efficiency, i.e. achieving economic efficiency. 2014, 504-511

In order to know the optimal behavior of honey bee production projects in the short term, and then to identify the optimal volumes of production, the analysis was adopted based on two assumptions:

1- The market is a perfectly competitive market.
2- The objective of the product in the short run is:

A- Profit Maximization and obtaining economic profits.
B - Cost Minimization.

And the optimum size of the civil product of costs can be obtained by applying the first necessary condition for minimizing the function, which is to take the first derivative of the average variable cost function in relation to the output and set it equal to zero (Al-Hayali and Al-Ukaili, 2009, 9) as follows:-

$SRTC = 29733.658 + 24999.669Y - 4.487\ Y^2 + 0.216\ Y^3$

$VC = 24999.669Y - 4.487\ Y^2 + 0.216\ Y^3$

$AVC = \frac{VC}{Y} = 24999.669 - 4.487\ Y + 0.216\ Y^2$

$\frac{\partial AVC}{\partial Y} = -4.487 + 0.432Y = 0$

$Y = \frac{4.487}{0.432} = 10.386$

We get the optimum production volume at the lowest point of the average total costs of honey bee production projects, i.e. the optimum production rate, which amounted to approximately (10,386) kg / hive. (Gujarati, 2004,:569)

B- Level Profit Maximization Output

It was possible to obtain the level of maximum production for profit by equating the marginal cost function No. (2) with the average price at which beekeepers sold their production in the wholesale markets in the study areas, which amounted to about (25,000) thousand dinars, as follows:

$MC = 24999.669 - 8.974Y + 0.648Y^2 = 25000$ ---(1)

$25000 - 24999.669 + 8.974Y - 0.648Y^2 = 0$ ------ (2)

$0.331 + 8.974Y - 0.648Y^2 = 0$ ------ (3)

Arranging and multiplying by x -1 we get:

$0.648Y^2 - 8.974Y - 0.331 = 0$ ------ (4)

And using the Sports Constitution Law to solve equation No. (4), as follows:

$\mathbf{Y = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}}$

$\mathbf{Y = \frac{8.974 \pm \sqrt{(-8.974)^2 - 4(0.648)(-0.331)}}{2(0.648)}}$ **-----(5)**

$\mathbf{Y = \frac{17.995}{1.296}}$ **----- (6)**

Y = 13.885 kg/cell

This means that the level of production that achieves profit maximization is about 13,885 kg / cell

C - The minimum price that breeders will accept to offer their production of honey bees

The minimum price that breeders accept to display their production can be found or estimated by knowing the lowest point of average variable costs, that is, the product continues to produce honey bees, as long as the unit selling price of the product is greater than or equal to the lowest point of average variable costs (Henderson & Yuant , 1980, 147). This matter requires deriving the average variable cost function, making the first differentiation for it and equalizing it to zero as follows:-

$SRTC = 29733.658 + 24999.669Y - 4.487\ Y^2 + 0.216\ Y^3$

$VC = 24999.669Y - 4.487\ Y^2 + 0.216\ Y^3$

$AVC = \frac{VC}{Y} = 24999.669 - 4.487\ Y + 0.216\ Y^2$

In order to determine the optimal level of production that reduces costs, the first necessary condition for minimizing the function has been applied, which is to take the first derivative of the average variable cost function with respect to the output and set it equal to zero, as follows:-

$\frac{\partial AVC}{\partial Y} = -4.487 + 0.432Y = 0$

$Y = \frac{4.487}{0.432} = 10.386$

When we substitute the value of (Y) into the average variable cost function (AVC), we get the lowest price at which the producer offers the commodity (which represents the lowest value of the average variable costs), that is, the supply function can be illustrated through the part of the MC curve that is above the lowest point on the AVC curve through the intersection point of MC and AVC (MC = AVC), we get the lowest price (24976.366) dinars/kg that breeders can accept to display their production, and at the same point we get the lowest value of the average variable costs and the optimal production of (10,386) kg/cell.

P = 24976.366 dinars/kg of honey

D - Short-run supply function of the honey beekeeper

The supply curve of output is that part of the curve of the short-run marginal cost function (MC) starting from the lowest point on the short-run average variable cost (minAVC) (Henderson & Yuant, 1980, 142),. This ascending part of the marginal cost curve shows the different quantities offered by the production facility (beekeepers) at each price producing the quantity at which marginal cost is equal to this price in order to achieve the maximum profit possible (Henderson & Yuant 151,1980,).

$S_i = S_i(P)$ for $P >= \min AVC$

That is, when the unit price of output from honey bees is less than the lowest point of the short-run average variable costs (minAVC), the amount of output is equal to zero, which means that the product is not produced when the price is less than this level.

The honey beekeeper's supply function can be derived by equating the marginal cost function with the unit price of the output, that is, through the necessary condition of the profit function (MC=Py) and solving it for the quantity of output y, as follows:

π =TR- SRTC ------------------------------ (1)

SRTC = 29733.658 +24999.669Y – 4.487 Y^2 + 0.216 Y^3---------- (2)

$MC = \frac{\partial SRTC}{\partial Q}$ = 24999.669 - 8.974Y + 0.648Y^2-- (3)

by ordering of equation (3)

MC = 0.648Y^2 - 8.974Y + 24999.669 ------- (4)

MC = P_y ----------------- (5)

Substituting the value of MC into equation (5), we get:

0.648Y^2 - 8.974Y + 24999.669 = Py --------- (6)

0.648Y^2 - 8.974Y + 24999.669 – Py =0 ------ (7)

This equation is solved by using the constitution's law to find the output width function as follows-:

$$Yi = Si = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

α = 0.648 , b = -8.974 , c = 24999.669 – Py

$$Yi = Si = \frac{8.974 + \sqrt{80.532 - 2.592(24999.669 - Py)}}{2(0.648)} \text{ ----- (8)}$$

$$Yi = Si = \frac{8.974 + \sqrt{80.532 - 64799.142 + 2.592Py}}{2(0.648)} \text{ ------ (9)}$$

$$Yi = Si = \frac{8.974 + \sqrt{2.592Py - 64718.16}}{1.296} \text{ ------- (10)}$$

$$S = \frac{8.974 + (2.592Py - 64718.16)^{\frac{1}{2}}}{1.296} \text{ -------- (11)}$$

Py ≥ min SRATC

The output supply curve can be derived from the output supply function to represent the nature of the relationship between the price and the quantity supplied by the product of honey bees, by giving different values for the prices of the output, in order not to be less than the minimum price accepted by the breeder, which is (24976.366) dinars / kg, because there is a loss. Table (5) shows the function of supply for honey bee breeders in Nineveh Governorate (the study sample areas).

Table 5. Short-run supply curve of honey bees for the study sample

Price (dinars /kg)	Quantity supplied (kg)
24976.3	10.410
25000	13.911
25500	35.565
26000	46.823
26500	55.540
27000	62.916
27500	69.428
28000	75.322
28500	80.748
29000	85.801

reference: Calculated based on the estimated short-run supply function.

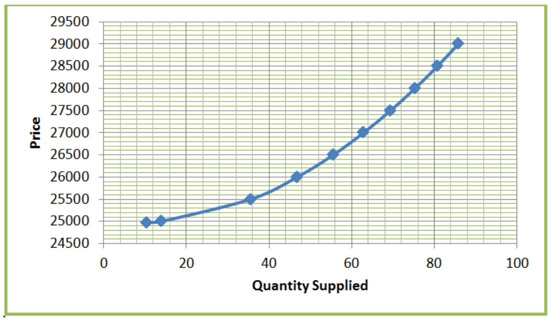

Figure (1) Short-term product width curve for honey bee breeders in Nineveh Governorate (study sample areas)

Reference: Prepared by the researcher based on statistical analysis data and using Microsoft Excel 2010

It is noticed from Table (5) and Figure (1) that there is a positive relationship between the quantity of production and the price of honey bees**.**

Calculation of Some Economic Indicators

1- Measuring the production capacity (number of cells) for honey bee production projects at the optimum production level and the maximum profit:

To calculate the production capacity (number of cells) that achieves the optimum production volume and maximizes the profit, it was be based on the production capacity equation in which the number of cells for each project was prepared as a dependent variable and the estimated production quantity (kg/cell) as an independent variable (Idris et al., 2014, 269). follows:M = b_0 + b_1Y

M :Production capacity for each project ,

Y :Production quantity in (kg/cell) ,

b_0 :Constant , b_1 :regression coefficient

Table 6. Estimated coefficients of the production capacity function of honey bee production projects in Nineveh Governorate (study sample areas)

Independent variable	Coefficients	Estimator	Value-t
Constant	b_0	35.125	2.789
output	Y	0.365	18.235
R Square (R^2)		0.89	
Adjusted (R^{-2})		0.88	
Test F		618.971	
N		120	

Reference: Prepared by the researcher based on the questionnaire.

M = 35.125 + 0.365 Y

By compensating the optimum civil production volume for costs and the volume of production maximizing the profit, which amounted to about (11.9, 13.885) kg/cell in order in the above equation, we get the optimum production capacity that costs low as it reached (39.468) cells, while the maximizing production capacity for profit amounted to (40.193) cell, and by comparing these capacities with the actual production capacities (the actual rate of cells) for the study area of (30) cells, it was found that this capacity is less than its optimal counterpart (9.468) cells.

It is also less than its counterpart achieved to maximize profit by approximately (10.193), which means that the efficiency ratio for the optimal production capacity ( ) and the maximization of profit amounted to (76.010%, 74.639%) in relation to the actual production capacity, and this was reflected in the decrease in actual production, and then the projects did not achieve the optimum volumes of production which affected the economic efficiency of honey bee production projects.

2- Estimating the profitability efficiency at the level of the actual production volume, the civil optimum costs and the maximum profit for honey bee production projects:

In general, profit efficiency is defined as the ability of a farm or facility to achieve the highest possible profit with given prices and quantities of fixed factors in that farm (Mulie, 2014, 110). The profit efficiency is estimated at the actual production level, the civil optimum of costs and the maximal profit by dividing the net income by the total costs (Adinya, 2009, 212-216). This means that we estimate the net income for all levels based on the profit function No. (3) at the level of each of The actual production rate, the optimum production volume and the maximum profit volume (10, 10,3 and 13.8) kg/cell, in the same order, bearing in mind that the average price of one kilogram of honey is 25 thousand dinars.

$\pi = TR - TC$ ---------------(1)

$\pi = P_y . Y - TC$ ------- (2)

$\pi = 25000 * Y -)29733.658 + 24999.669Y - 4.487 Y^2 + 0.216 Y^3)$--- (3)

π = profit (net income) , TR = total revenue ,
TC = total costs

P_y = Average selling price (the price of one kilogram of honey)

Y = The amount of production to be calculated net income

By substituting the values of these levels of production in equation (3), it becomes clear that the estimated net income for the three levels amounted to about (22.794, 39.599, 45,218) thousand dinars / cell sequentially, after the net income and total costs were obtained, it is possible to measure the profitability efficiency of the level of the actual volume of production and the civil optimization of costs and the maximal of the profit is about (0.079, 0.105, 0.145) in sequence. Based on the profit efficiency index, this means that the dinar that is invested on the actual production will achieve (79) fils, while the dinar that is invested from the optimal production will achieve (105) fils; whereas, the dinar that is invested from the most profitable production will achieve (145) fils.

We conclude from the profit efficiency measurement that the actual production level is less than the profit efficiency level for the optimum and maximal size of the profit by (26,66) fils per dinar invested, i.e. at a rate of (24.761%, 45.517%) sequentially.

Table 7. The profitability efficiency of the actual production volume, the civil optimum costs and the maximum profit for honey bee production projects in Nineveh Governorate (the study sample areas)

production volume pointer	Actual	optimum	Most
Production quantity (kg/cell)	10.3	11.9	13.885
Total costs (thousand dinars / cell)A	286.206	311.782	376.951
Total Revenues (Thousand Dinars / Cell)	309	357	416.55
Net income (thousand dinars / cell)B	22.794	45.218	39.599
Profitability Efficiency A ÷ B	0.079	0.145	0.105

Reference : From the researcher's work based on the cost function No. (2) and the profit function No. (3)

Measuring the Economic Efficiency of Honey Bee Production:

It means achieving the largest possible amount of profits with a certain amount of costs, or achieving the same amount of (income) profits with the lowest possible costs (Al-Ashaikh, 2011: 643) and it is measured according to the following formulas:

$$\textbf{Economic Efficiency} = \frac{Average\ cost\ for\ optimum\ production\ level}{Average\ cost\ to\ actual\ production\ level} \times \mathbf{100}$$

$$\text{Economic Efficiency} = \frac{141023{,}65\ \text{dinars/cell}}{151311{,}98\ dinars/cell} \times 100$$

Economic Efficiency = 93.2%(*)

It is clear in the light of measuring the economic efficiency of honey bee production projects (93.2%), which is less than the correct one, that producers can achieve the same level of production in light of reducing production costs or reducing the amount of resources used by (6.8%), that is, there is a relative increase (deviation).) in the average cost of the actual level of production increases the average cost of the optimal level of production by (6.8%) .

3- Estimation of technical efficiency in honey bee production projects

Sometimes the producer tries in the short run to continue producing even if he loses all fixed costs because he has to bear that cost even if he does not produce; so, the producer can accept the price that is the lowest point on the average variable cost curve as the lowest price he accepts in the short

(*)Prepared by the researcher through the law and based on the questionnaire form.

term (Doll, 1978, 64-68). Technical efficiency means producing the largest possible amount of output with a certain amount of resources, or achieving the same amount of output with the least amount of resources possible. Technical efficiency can be estimated as follows (Oyewo, 2011, 211-216):

$$\textbf{Technical Efficiency} = \frac{\textit{Actual production volume}}{\textit{optimum production volume}} \times 100$$

$$\text{Technical Efficiency} = \frac{10.3}{11.9} \times 100$$

Technical Efficiency = 86%

It is clear in the light of measuring the technical efficiency of the honey bee production projects (86%) that the producers can increase their production by (14%) without increasing any amount of economic resources used in the production process, that is, there are losses (waste) in the use of economic resources and then it bears additional costs equivalent to (14%) of the resource costs, and also means that the projects can produce the same previous output with less resources, approximately (14%) of the resources used.

4-Price Efficiency:

It is due to the selection of resources with the lowest cost, and the definition of price efficiency lies in relying on the factors that produce all quantities of goods and services in the light of appropriate costs resulting from the best uses of resources. It can be estimated as follows (The Elephant, 2013, 263-277**) :**

$$\text{Price Efficiency} = \frac{optimum\ price}{Actual\ price} \times 100$$

By the optimum price, it is meant: the price that is equal to the total average costs at its minimum end and the product achieves the normal profit under it, and it is estimated from the total average costs function as follows:

$$\text{Price Efficiency} = \frac{21730}{25000} \times 100$$

Price Efficiency = 86%

It is clear in the light of measuring the price efficiency of honey bee production projects (86%) that the producers can choose the resources with the lowest cost by (14%) or they can use the resources used optimally, which leads to an increase in their profits by (14%.(

5-Cost Efficiency:

The cost efficiency of any individual farm can be defined as the ratio of the total costs of the actual production volume to the total costs of the optimal production volume (Ogundari, 2006, 131). It can be calculated as follows:

$$\textbf{Cost Efficiency} = \frac{\textit{The total costs of the actual production level}}{\textit{The total costs of the optimum level of production}} \times \mathbf{100}$$

$$\text{Cost Efficiency} = \frac{7225311{,}54}{7987650{,}32} \times 100$$

Cost Efficiency = 0.90

This means that the cost efficiency of the producers of the study community amounted to (0.90), which is less than the correct one; viz. the resources used can be optimally exploited, meaning that the same quantity (actual production) can be produced with a cost savings of (10%) according to the formula](1 - efficiency Cost) * 100 ie (1 - 0.90) * 100] (Al-Qayyumi and Al-Kur, 2008, 26)

Conclusions:

1- That the amount of output has a significant impact on the profit function compared with the rest of the variables (price and average production costs).
2- That the economic resources used in the production process were not optimally invested, which led to low production efficiency and high costs honey productivity.

Recommendations:

1- The study recommends working to follow a production policy aimed at increasing the economic efficiency of a single cell
2- Achieving optimal use of available resources, which is reflected in an increase in efficiency in the use of productive resources and an improvement in the efficiency of honey production.

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