Optimal behavior of honey bee In Nineveh Province for the production season 2021

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Abstract

Nineveh Province was elected as an applied model for the study due to its relative importance in the production of bee honey. The data was obtained by designing a questionnaire using the random sampling method for honey bee production projects in the field. The sample size was determined according to its percentage in the community for (120) projects and the percentage was (29.62%) From the study community, the aim of the research is to estimate the production function and to know the optimum quantities of profit from farm resources and to estimate the level of maximum production for profits and the amount of the greatest profit achieved from the production of honey bees in the area of the study sample. The long-term production function was estimated through the contribution of (work and capital and cell number) as independent variables, the double logarithmic model was the best models used in the analysis to meet the economic, statistical and standard criteria, and the coefficient of determination R2 showed that (0.97) of the changes in the quantities produced by honey bees (Y) are explained by the changes in the independent variables included in the model and (3%). Of the changes of the dependent variable, their interpretation is attributed to other factors that are not included in the model, and the t-test proved that all the variables are significant, as it was shown through the significant F value of the function as a whole at the level (0.01), that the volume of production, the maximum profit, reached (9.143) kg / cell, And the optimal cell number is (70,007) cells, And the maximum profit capital amounted to (81,278) dinars / cell, while the maximum profit amounted to (11.248) workers / day, and the greatest profit amounted to (70112) dinars / cell, and the lowest cost that could achieve the maximum volume of profit amounted to (158468) dinars, and the study proved that investment in the field of honey bee production projects in Nineveh Governorate is rewarding and achieves great returns. Nineveh for the purpose of investing in honey bee production projects, as it achieves highly profitable projects and tops all agricultural investment projects.

Keywords: bee honey, Nineveh Province, productive season

Introduction

The issue of the optimal behavior of honey production projects in developing countries, including Iraq, is still a focus of controversy and discussion among many economic researchers, because the results of the studies conducted in this regard did not give a clear picture of the producers in terms of optimal quantities and the greatest size of profit and the greatest profit (Al-Samarrai, 2013, 177). - 179), and this difference in not adopting such studies may be due to the difficulty that researchers face in the case of taking three explanatory variables in the long-run production function, but most researchers tend to study the long-term production function for two explanatory variables. Which made studies in the behavior of the producer limited, and that the difference may depend on the agricultural nature in terms of the objective, environmental conditions and the level of technology adopted (Henderson, 1980, 68 - 69), as well as the nature of ownership, the level of support and the efficiency of the production elements used in the production process, and that most studies did not It takes into account the realized returns and the amount of capital required, and to determine the optimum size of the profit for the project, which is affected by the possibility of researchers, and the vast majority of them confine themselves to estimating the optimal volume of production, which can be defined as that volume that achieves the largest capacity savings or the lowest possible cost or the highest net return per unit Production (Al-Qaddo, 1999, 238), And that the production function in the long run is the influential and decisive factor in which is the change in the level of technology and the volume of invested capital, in contrast to the production function in the short run, in which the decisive factor is the size of the labor force (number of workers) and the number of working hours.The research problem lies in the neglect of investment in honey bee production projects by the people of the province and the failure to direct capital towards these projects, as it achieves high returns for the invested capital when compared to the returns achieved for the capital invested in other agricultural projects, and this is the result of the lack of awareness and experience of beekeepers In the governorate, where we notice the farmers' tendency to establish other agricultural projects that involve risk and uncertainty, unlike honey bee production projects that have limited impact on them.The research also aims at estimating the production function in the long run, knowing the optimum maximal amounts of profit from farm resources, estimating the maximizing level of profit production and the maximum profit amount achieved from honey bee production, and knowing the behavior of the product resulting from the different levels of production achieved in Nineveh Governorate.The research assumes that investing for capital in honey bee production projects is feasible and achieves large net returns compared to investing in other agricultural projects.

Materials and Methods

This was done using cross-sectional data for a random sample of honey bee production projects in Nineveh Governorate through a questionnaire prepared to collect information for the research sample, which amounted to (120) projects, representing (29.62%) of the study population of (410) projects, and four types of functions were used. To get the estimated results which are (linear, half logarithmic, half logarithmic inverse and double logarithmic), the double logarithmic function (Debertin, 2012, 110) of the Duclas Cobb function has outperformed the other functions used to meet the economic, statistical and standard criteria, The daily wage of the worker was considered (20) thousand dinars because the capital costs are completely transformed into final products during one production season, and due to the scarcity of the fixed capital resources, the capital costs were considered as variable costs and expire during the production season. The money is (1.1) for the dinar. As for the price of the product, it was (25) thousand dinars per kilogram, and the price of one cell is (150) thousand dinars. The function of producing a Duclas cup can be expressed in the following mathematical way:

$$\mathbf{Y = L^{b1}K^{b2}N^{b3}}$$

Y = total output (kg/cell)

A = (constant term) Factor proprotıonalıty

L = labor resource (man/day)

K = capital resource (thousand dinars)

N = cell number resource (cell)

b1, b2, b3 = the elasticities of production of each of the labor resource, capital and the number of cells in order, and they are positive more than zero and less than one.

It was estimated by taking the double natural logarithm of the dependent factor (Y) and the independent factors, work (L), capital (K) and the number of cells (N), and estimating the linear relationship between the natural logarithm of production (Y) and the natural logarithms of production factors (Koutsoyiannis, 1977, 123). According to the following linear form:

Y = LnA + b1LnL + b2LnK + b3LnN

And that is after converting it to the natural form of the Cobb-Duclas function by taking the inverse of the natural logarithm of both sides of the equation

Theoretical framework of optimal behavior of agricultural producers

Since the Cobb-Douglas production function consists of three elements, and in order to achieve the optimal behavior of the product, the producer must be rational when using economic resources and able to mix them in order to achieve the goal that the producer seeks to achieve by maximizing his profits as a result of mixing the available production resources, when These resources are indeterminate for each of (L, K, N). The goal of the product is achieved by maximizing its profits by equating the marginal product value of any resource with its price, using the profit function, as follows:

$\pi = P_y . Y - \sum Xi. Pi$ profit function

$\pi = P_y . (AL^{b1}K^{b2}N^{b3}) - \sum Xi\ (wL + rK + aN)$

In order to obtain the optimum quantities of the production elements that achieve the greatest profit, which often requires achieving through placing a constraint on the cost, because there is a limitation in the use of the elements, and to achieve this requires how to distribute them so as to achieve the greatest profit, and this is achieved by equalizing the first partial derivative (first differential) of the profit equation For the elements (L, K, N) and my agencies:

$\pi = P_y . (AL^{b1}K^{b2}N^{b3}) - \lambda(wL + rK + aN - C)$

By applying the condition of maximizing profits from the profit function (V.MPx = Px), it is necessary to derive the profit function for the factors of production (L, K, N, π) as follows:

$$\frac{\partial \pi}{\partial L} = \left(P_y.(A)(b_1)L^{b1-1}K^{b2}N^{b3}\right) - w\lambda = 0 \quad ----1$$

$$\frac{\partial \pi}{\partial K} = \left(P_y.(A)(b_2)L^{b1}K^{b2-1}N^{b3}\right) - r\lambda = 0 \quad ----2$$

$$\frac{\partial \pi}{\partial N} = \left(P_y.(A)(b_3)L^{b1}K^{b2}N^{b3-1}\right) - a\lambda = 0 \quad ----3$$

$$\frac{\partial \pi}{\partial \lambda} = (wL + rK + aN - C) = 0 \quad ----4$$

By converting the equations into the following form:

$$\frac{\partial \pi}{\partial L} = \frac{\left(P_y.(A)(b_1)L^{b1-1}K^{b2}N^{b3}\right)}{w} = \lambda \quad ----5$$

$$\frac{\partial \pi}{\partial K} = \frac{\left(P_y.(A)(b_2)L^{b1}K^{b2-1}N^{b3}\right)}{r} = \lambda \quad ----6$$

$$\frac{\partial \pi}{\partial N} = \frac{\left(P_y.(A)(b_3)L^{b1}K^{b2}N^{b3-1}\right)}{a} = \lambda \quad ----7$$

And by dividing equation 5 by equation 6 we get:

$$\frac{\frac{\left(P_y.(A)(b_1)L^{b1-1}K^{b2}N^{b3}\right)}{w}}{\frac{\left(P_y.(A)(b_2)L^{b1}K^{b2-1}N^{b3}\right)}{r}} = \frac{\lambda}{\lambda}$$

$$\frac{\left(P_y.(A)(b_1)L^{b1-1}K^{b2}N^{b3}\right)r}{\left(P_y.(A)(b_2)L^{b1}K^{b2-1}N^{b3}\right)w} = 1$$

$$\frac{b_1 rK}{b_2 wL} = 1$$

$$b_1 rK = b_2 wL$$

$$L = \frac{b_1 rK}{b_2 w}$$

When $\frac{b_1 r}{b_2 w} = V\ Posetive\ value$

L = V. K -------- 8

And by dividing equation 6 by equation 7 we get:

$$\frac{\frac{\left(P_y.(A)(b_2)L^{b1}K^{b2-1}N^{b3}\right)}{r}}{\frac{\left(P_y.(A)(b_3)L^{b1}K^{b2}N^{b3-1}\right)}{a}} = \frac{\lambda}{\lambda}$$

$$\frac{\left(P_y.(A)(b_2)L^{b1}K^{b2-1}N^{b3}\right)a}{\left(P_y.(A)(b_3)L^{b1}K^{b2}N^{b3-1}\right)r} = 1$$

$$\frac{b_2aN}{b_3rK} = 1$$

$$b_2aN = b_3rK$$

$N = \frac{b_3rK}{b_2a}$

When $\frac{b_3r}{b_2a} = V$ *Posetive value*

N = V. K -------- 9

Substituting Equation 8 and Equation 9 into Equation 4, we get:

When $w.V.K + a.V.K + rK - C = 0$

w(V.K) + rK + a(V.K)

When $w, r. a. V = V$

V.K = C

When *V equal positive value*

$\therefore K = \frac{C}{V}$ --------10

(Al-Samarrai, 2013, 177-179)

By substituting the value of K into equation 8, we get the value of L, which is the amount to be used by the producer so that he can maximize his profits.

By substituting the value of K in equation 9, we get the value of N, which is the amount to be used by the producer so that he can maximize his profits.

After the optimum quantities of the production factors were estimated, it became possible to estimate the volume of production maximizing profit, by substituting the optimum maximizing quantities of profit into the production function as follows:

$Y = AL^{b1}K^{b2}N^{b3}$

Y = ( ) Kg

The volume of production that maximizes the profit that the producer can achieve to maximize his profits.

By substituting the volume of production, maximizing profit, and optimum quantities of maximizing profits, in the profit function, we will get the amount of the greatest profit. My agency (Zanzl and Nassif Jassim Muhammad, 2017, 16-18):

$$\pi = P_y . Y - \sum Xi. Pi$$

Results and Discussion

The researchers used the multiple linear regression method in estimating the function of honey production for the sample projects through the paired logarithmic formula and based on the statistical tests (t, F, R2) and standard (park, Durbin-Watson) and under the level of significance (5%, 1%) and the agreement of signs The function of economic logic and the production function was estimated by (OLS) method and according to the double logarithmic formula, as in Table (1) and the following equation (8):

Table (1) The results of the estimated coefficients of the honey bee production function in Nineveh Governorate

Independent variable	Coefficients	Estimator	Value-t
constant	**A**	2.061	3.223*
labor resource	**L**	0.251	2.135**
capital resource	**K**	0.398	1.897**
cell number resource	**N**	0.351	2.658*
R SYuare (R^2)	0.97		
Adjusted R^2 (R^{-2})	0.96		
D-W Test	1.989		
Test F	123.255		
N	120		

*denotes a level of significance 0.01, **indicates a level of significance of 0.05.

Reference: Prepared by the researcher based on the questionnaire.

LnY= 2.061 + 0.251 Ln L + 0.398 Ln K + 0.351 Ln N --------- (8)

In order to derive some indicators of the economics of production for the economic resources used, the logarithmic function must be converted to the exponential form and in the following form:

$$\mathbf{Y = 7.853 L^{0.251} K^{0.398} N^{0.351}}$$

The above estimated functions are compatible with economic logic and have passed statistical and standard tests.

economic theory criteria

These criteria are determined by the economic theory, which is related to the sign and size of the parameters of the economic relations relations, and in an econometric formula, where it can be said that the economic theory imposes restrictions on the signals of the values of the parameters of the economic relations, when these values are not identical to the economic theory, we reject these estimates unless we have An essential reason to believe that the principles of economic theory are not realized in the special case we are studying, i.e. finding the appropriate economic justification.

Statistical Standards

Statistical analysis proved that all variables were significant for the t-test at the level (0.01 and 0.05), as the estimated parameter for the resource of cell number was statistically significant at the level (0.01) .

As for the estimated parameters for each of the labor and capital suppliers, they were also significant at the level (0.05) after comparing their calculated values with the tabular ones. (Koutsoyiannis, 1973, 16)

It was also shown through the calculated F value of the estimated function, which was (123.255) with the tabular F value at the statistical level (0.01), that the model is highly significant, which reflects the importance of the variables included in the function on the one hand and the realism of the function on the other hand.

Also, the value of the coefficient of determination R2 reached (0.97), which means that changes in the quantities produced by honey bees (Y) are explained by changes in the independent variables included in the model, and (3%) of the changes of the dependent variable are explained by other factors that are not included in it. The model or quality falls within the random variable.

econometric standards

To verify the validity of the assumptions that are required to apply the econometric method used in estimating the parameters of the studied relationship, it is necessary to conduct the necessary standard tests related to economic problems, which are: (Johnston, 1977, 67)

First: The problem of autocorrelation of the random variable:

This problem was revealed by the Durbin-Watson (D-W) test, which showed that the model was free from the problem of autocorrelation between random variables because the value of (D-W) was within the acceptance region of the null hypothesis and equal to (1.989).

Second: the problem of instability of homogeneity (Heteroscedasticity):

The absence of this problem was confirmed through the (Park) test by taking the regression of the logarithm of the produced quantity (as an independent factor) with the logarithm of the sum of squares of random error as a proxy dependent factor:

$\text{Log } e_{\imath}^2 = 0.073 - 0.954\text{LogY}$

$t \quad = (0.753) \quad (-0.955)$

$R^2 = 0.21 \qquad F = 2.142$

Since the estimated function is not significant under the level (0.01) and according to the F test, and just as the t value calculated for the slope of the above function is less than the tabular t value at a significant level (0.05) and the value of the fixed limit is also not significant because the estimated value is less than the tabular value, this indicates that there is no There is a problem of inconsistency of variance homogeneity.

Third: The Auto Correlation Problem:

To detect whether or not there is a multiple linear correlation problem among the independent variables, Klein's test was used, where it appeared that the square root is (0.735), which is greater than the simple correlation coefficient between the independent factors, which is (0.211). (Maddala, 1977, 141)

Economic Analysis:

To find the optimal quantities of resources used in order to reach the maximum production volume for beekeepers' profits and the greatest profit (Al-Aswadi, 2011, 60-66) and to reach the optimal quantities through the estimated production function and the cost constraint to obtain the target function (profit function), and by taking the first differential for each of (L, K, N, λ) and my agencies:

LnY= 2.061 + 0.251 Ln L + 0.398 Ln K + 0.351 Ln N

$$\pi = P_y . (AL^{b1}K^{b2}N^{b3}) - \sum Xi\ (wL + rK + aN - C)$$

$$\pi = 25\ (7.853L^{0.251}K^{0.398}N^{0.351}) - \lambda(wL + rK + aN - C)$$

$$\pi = 196.325L^{0.251}K^{0.398}N^{0.351}) - \lambda(20L + 1.1K + 150N - 897.639)$$

$$\frac{\partial\pi}{\partial L} = 49.277L^{-0.749}K^{0.398}N^{0.351} - 20\lambda = 0\ ----1$$

$$\frac{\partial\pi}{\partial K} = 78.137K^{-0.602}L^{0.0.251}N^{0.351} - 1.1\lambda = 0\ ----2$$

$$\frac{\partial\pi}{\partial N} = 68.910N^{-0.649}L^{0.251}K^{0.398}) - 150\lambda = 0\ ----3$$

$$\frac{\partial\pi}{\partial \lambda} = (20L + 1.1K + 150N - 897.639) = 0\ ----4$$

$$\frac{\partial\pi}{\partial L} = 49.277L^{-0.749}K^{0.398}N^{0.351} = 20\lambda$$

$$= 2.463L^{-0.749}K^{0.398}N^{0.351} = \lambda\ ----5$$

$$\frac{\partial\pi}{\partial K} = 78.137K^{-0.602}L^{0.0.251}N^{0.351} = 1.1\lambda$$

$$= 71.033K^{-0.602}L^{0.0.251}N^{0.351} = \lambda ----6$$

$$\frac{\partial\pi}{\partial N} = 68.910N^{-0.649}L^{0.251}K^{0.398} = 150\lambda$$

$$= 0.459N^{-0.649}L^{0.251}K^{0.398} = \lambda ----7$$

And by dividing equation 5 by equation 6 we get:

$$\frac{2.463L^{-0.749}K^{0.398}N^{0.351}}{71.033K^{-0.602}L^{0.0.251}N^{0.351}} = \frac{\lambda}{\lambda}$$

$$\frac{\mathbf{2.463K}}{\mathbf{71.033}} = \frac{\mathbf{1}}{\mathbf{1}}$$

$$\mathbf{2.463K = 71.033L}$$

L = $\frac{2.463}{71.033}$ K

L = 0.0346 K -------- 8

And by dividing equation 7 by equation 6, we get:

$$\frac{\mathbf{0.459N^{-0.649}L^{0.251}\ K^{0.398}}}{\mathbf{71.033K^{-0.602}L^{0.0.251}N^{0.351}}} = \frac{\boldsymbol{\lambda}}{\boldsymbol{\lambda}}$$

$$\frac{\mathbf{0.459K}}{\mathbf{71.033N}} = \mathbf{1}$$

$$\mathbf{0.459K = 71.033N}$$

N = $\frac{0.459}{71.033}$ K

N = 0.00646 K -------- 9

Substituting Equation 8 and Equation 9 into Equation 4, we get:
$\mathbf{20L + 1.1K + 150N - 897.639 = 0}$

20L + 1.1K + 150N – 897.639 = 0

(20)(0.0346K) + 1.1K + 150(0.00646K) – 897.639 = 0

0.692K + 1.1K + 0.969K – 897.639 = 0

2.761K – 897.639 = 0

2.761K = 897.639

K = 325.114 ⇒ K = $\frac{325.114}{4}$ = 81.278 (1)

One thousand dinars / cell (the optimal capital tha[2]t achieves the optimal volume of production and the maximum profit)
Substituting the value of K into equations 8 and 9, we get:

L = 0.0346K -------- 8

N = 0.00646 K -------- 9

L = 0.0346(325.114) = 11.248

[1])By dividing the capital (the K value of 325.114) by the life span (4 years) for each cell, we get 81.278, which is the optimal value of the capital resource that achieves the optimum volume of production

Worker/day (the amount of work that achieves the optimum volume of production and the most profit)

N = 0.00646(325114) = 2100

And by dividing the value of N by the average number of cells (30), we get:

N = 70.007

The optimum number of cells that beekeepers can raise in order to obtain the maximum volume of production for profit

And in order to reach the volume of production that maximizes profit by replacing the optimal quantities of (labor, capital and number of cells) from the estimated production function, I am as follows:

$\hat{Y} = \mathbf{7.852L^{0.251}K^{0.398}N^{0.351}}$

$\hat{Y} = \mathbf{7.852(11.248)^{0.251}(325.114)^{0.398}(70.007)^{0.351}}$

$\hat{Y} = 640.081 \quad \Rightarrow \quad \hat{Y} = \frac{\mathbf{640.081}}{\mathbf{70.007}} = 9.143$[3]

kg/cell (the optimum output level for each cell the maximum profit)

As for the maximum profit achieved, it can be calculated as follows:

$\boldsymbol{\pi} = \mathbf{P_y\,.\,Y - \sum Xi.\,Pi}$

$\boldsymbol{\pi} =$ 25(640.081) – [20(11.248) + 1.1(325.114)+150(70.007)]

$\boldsymbol{\pi} =$ 16002.025 – 11093.935

$\boldsymbol{\pi} =$ 4908.39 (1000)

$\boldsymbol{\pi} = 4908390 \quad \Rightarrow \quad \boldsymbol{\pi} = \frac{\mathbf{4908390}}{\mathbf{70.007}} = 70112.845$[4]

Dinars / cell (the maximum amount of profit realized from honey bee projects)

Table (2) The optimum quantities of farm resources, the volume of production, the maximum profit and revenue, and the maximum net profit of the profit for honey bee projects

Product type	Labor man/day	capital thousand dinars/cell	Optimal cell count	Most profitable production kg/cell	total revenue dinar/cell	output price dinar/cell	total costs dinar/cell	Net profit dinar/cell
Honey	11.248	81.278	70.007	9.143	228577	25000	158468	70112

[1]) By dividing the total output by the optimum number of cells (70.007), we get the optimum output level for each cell, maximizing the profit

[2]) By dividing the amount of profit achieved by the optimal number of cells of (70.007), we get the maximum amount of profit achieved from honey bee projects for each hive.

Reference : Prepared by the researcher based on the obtained results

Conclusions and Recommendations:

1- The optimum amounts of work, capital, and number of cells (11.248, 81.278, 70.007), respectively, and the level of maximum production for long-term profit (9.143) kg/cell, and the greatest profit (realized net income) 70112 dinars/cell.

2- Estimate the number of cells to be reared by beekeepers (70.007), which achieves the most profit

In light of the above results, it can be inferred that the exploitation of honey bee breeding projects in Nineveh Governorate is rewarding and achieves high profits when compared to other agricultural projects. Therefore, the study can recommend to encourage beekeepers (honey producers) who are important nutritionally, medically and economically and achieve great net returns if compared Other agricultural projects need to invest in these projects and encourage investors to enter this sector by providing facilities to them and overcoming the difficulties and problems they face when investing and providing the necessary loans.

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