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Estimation of honey production function and productivity of its factors in the Alborz Province of Iran

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Abstract

This study conducted to estimate the honey production function and calculate the productivity at Alborz province production factors in 2013. The data of this study was relating to agricultural year of (2012-2013) which is collected through completing 210 questionnaires and then the production function of Cobb-Douglas estimated. The Results showed that variables such as labor, capital, drug, nutrition (sugar) and energy (fuel) were statistically significant at the level 1, 5 and 10% confidence and had a direct positive correlation with honey production. The production elasticity of labor, capital, drug, nutrition (sugar) and energy (fuel) respectively estimated at the rate of 0.19, 0.35, 0.04, 0.07 and 0.13%. Results of this study showed that 1% increase in capital lead to growth of honey production about 0.35%. Also 1% increase in drug, nutrition (sugar) and energy (fuel) respectively enhance the production about 0.04, 0.07, and 0.13%. Increase in capital store caused to boost amount of production much rather than other elements. Variables such as labor, energy (fuel), nutrition (sugar) and drug were respectively the most important elements after capital variable. The average of marginal value of each inputs include drug, nutrition (sugar) and fuel was respectively equal to 251, 234 and 3.7 Kg. According to results it was founded that the productivity of all input was positive, which meant the little amount of used inputs at the economical area (first area). The results showed that there was no significant correlation between the level of literacy and the main job of beekeepers with productivity of the total production factors. Since the final production and productivity of capital is more than other factors, therefore capital increase in units of honey production of Alborz province is suggested from various ways such as facilities.

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Introduction

Nowadays most of countries are seeking to gain more achievement in the term of honey productivity and also marginal production with minimum energy waste and entities consumption to boost production yield. The honey production value in Iran approximately is about 3.5 tones according to FAO report (FAO, 2012). Increasing population and production resource scarcity made us to concern elements like the optimum resources utilization, increasing production efficiency and productivity as a crucial principle of producing management to response market demands (Kariminejad, 2006). Economical problems underlie many events or problems that seem to be hard to explain and solve. The efforts for economical development have become important in terms of salvation from poverty underdeveloped countries and securing future by maintaining power in developed countries Measurement of productivity and criteria to be used in such measurement seem to be a complicated task in the agricultural sector as in all other sectors of economy insufficient data that may be effective in determination of productivity and lack of techniques used in measurement are the significant problems in determination of productivity especially in developing countries. In this context, it is very difficult to find the criteria that are applicable to all countries and may be applied in agricultural sectors, while determining the criteria of productivity. This is because of the fact that labor, plot and capital capacities, which are taken as criteria in productivity, as well as the general agricultural policies are not institutionalized sufficiently as providing robust economical results in developing countries (Armagan & Ozden, 2007).

Beekeeping directly and indirectly is contributes to the incomes of households and the economy of the nation. The direct contribution of beekeeping includes the value of the outputs produced such as honey, beeswax, queen and bee colonies, and other products such as pollen, royal jelly, bee venom, and Propolis in cosmetics and medicine (ARSD, 2000; Gezahegn, 2001). It also provides an employment opportunity in the sector. The indirect, but very important contribution of beekeeping is through plant pollination and conservation of natural environment. Beekeeping is environmentally sustainable activity that can be integrated with agricultural practices like crop production, animal husbandry, horticultural crops and conservation of natural resources. Thus, it would be one of the most important intervention areas for sustainable development of poor countries like Iran (Gibbon, 2001).

Beekeeping is a non-farm business activity that has immense contribution to the economies of segments of the society and to a national economy as a whole. Productivity defined as a relationship between the specified amount of product and the specified amount of one or more productive factors or the rate of product, which each labor can be Product in the specified time. Generally the concept of productivity expressed the relation between amount of product and the produced utilities and the amount of used resources in production process of this products and utilities and this relation is quantitative and measurable (Amirtaymoori and Khaliliyan, 2007). The problems of agricultural part of Iran are the sign of low productivity in production (Heydari, 1999). Agriculture industry needs to increasing production to prepare food security and prepare initial inputs. Hence notice to productivity index and calculate which aimed to choose the effective method of confrontation with natural resources scarcity (Akbari & Ranjkesh, 2003).

Low quality and limited supply of honey are the most critical problems in the value chain, which is mainly caused by limited availability of bee forage (due to deforestation), shortage of honeybee colonies, backward technology, poor pre and post harvest management. Inadequate government support also resulted in poor extension services, lack of improved technologies, shortage of trained human power, lack of access to credit services and weak road and market infrastructures in production areas. The present

increasing use of pesticides and herbicides is severely threatening bee colonies implying conflicts of crop and honey production. Absence of organized market channel, lack of market information and poor access to international markets are also the other critical challenges facing the sub sector. Despite many brilliant studies, there is a few study about estimating honey producing function in Alborz province same as; the investigation of honey production situations by (Mahmmodi *et al.*, 2012); Investigation of honey production dilemmas by (Yarahmadi *et al.*, 2004); Evaluation of honey production management in Tehran province by (Entezary 2012) and so forth; hence due to importance of calculation and productivity analysis, the estimation of honey production function and calculating productivity of producing factors are the main aims of this study. To gain these goals calculating and gathering data could be effective to purpose a description and diagram from the existent situation of productivity and also suggestions to improve it.

Material and methods

Method of research and experimental factors

The method of research was exploratory and descriptive form. Statistical population of the article was from 485 beekeepers in the Alborz province in the (2013). The sectional data of this study based on sampling method of (Cochran's Test), 210 beekeepers randomly selected which filled the questionnaires, field operation done in July, August and September and required data collected at the same time. To estimating the productivity, the Cobb - Douglas production function selected. Economic model of honey production function is as follow:

$$LnY_i = C_1 + C_2 LnX_{1i} + C_3 LnX_{2i} + C_4 LnX_{3i} + C_5 LnX_{4i} + C_6 LnX_{5i} + C_7 LnX_{6i}$$
$$C_8 LnX_{7i} + C_9 LnX_{8i} + C_{10} LnX_{9i} + U_i$$

Y= honey production (Kg);
X1= Capital (Toman);
X2= Labor (Person-days);
X3= Sugar (Kg);
X4= Drug (g);
X5= Fuel (Lit);
X6= Count of migration in year;
X7= Experience of beekeeping (Year);
X8= Ages of beekeeper (Year);
X9= Literacy level of beekeeper (Year);
U= Refers to the error term in the formula and i is the observations.

Data analysis

The variables used in logarithmic status; data analyzed by Cobb-Douglas production function, and EVIEWS6 software. The evaluated model was considered by LM test from autocorrelation. Variance dissonance test was performed based on Mann-Whitney test since the data were sectional and SPSS18 software.

Results and discussion

Average of beekeepers age

The results showed that the age of 23.7% of beekeepers was less than 40 years old and 70% of them were between 40-60 years old; whereas 6.3% was more than 60 years old. The average age of beekeepers was 45. In view of age most of beekeepers was middle-aged. The average experience of them was about 14 years, the minimum beekeeping background was 2 years and the maximum range of this value was about 40 years old. The levels of education among beekeepers was about 9.8% irritate, 3.9% primary, 4.5% secondary school, 48/6% diploma, 18.9% upper diploma, 12.9% bachelor and 1.4% master. It could be note that generally 14% of beekeepers had a bachelor or higher degree.

Production rate

The yield showed that 12% of beekeepers produced 6 Kg honey from each beehive, 68% of them produced 10 Kg honey and 20% of them just produced more than 10 Kg honey from each beehive. The Average honey production was 10 Kg, although the minimum and the maximum rate of harvesting honey from each beehive were respectively about 6 and 20 Kg.

Production functions

The production function used to estimating the productivity. LM test showed any autocorrelation after the initial estimation of honey production function in Cobb - Douglas type. As data in this study was sectional, the heteroskedasticity test performed according to white test. Efficient estimation of GLS method was done to eliminate the heteroskedasticity (table 1).

Table 1. Estimation the honey produce function.

Variable Name	Intercept	Labor Logarithm	Capital Logarithm	Drug Logarithm	Nutrition Logarithm	Energy Logarithm
Amount	-0.74	0.19	0.35	0.04	0.07	0.13
	(-0.9)	(3.20)*	(7.46)*	(2.03)**	(1.27)	(3.03)*
The Statistic Amounts	Durbin – Watson (D.W) =1.58		R^2=98%		F= 29.8	

(Source: Field Survey, 2013).

**,* means within each column followed by same letter are not significantly different according to t test at the 1% and 5% probability level.

In the above model the numbers in the bracket shows the t statistic amounts of coefficients. Among the entered Variables, except the intercept all the variables have a positive coefficient. As the variables entered in logarithm form, the variable coefficients showed the elasticity of inputs. So the elasticity of the Labor showed a sort of increasing in labor variable at the rate of 1% and subsequently leaded enhancement in honey production at the rate of 0.19%. Honey production will increase at the rate of 0.35% if the capital increase occurred at the rate of 1%. Also, increasing entities like drug, nutrition (Sugar) and energy (Fuel) respectively at the rate of 1% leads to increase production just about 0.04, 0.07 and 0.13%. It can be indicated that by increasing amount of capital, the rather increase in production will occur; so the initial recommend is to increase the capital in the honey Production. Variables such as labor, energy (Fuel), nutrition (Sugar) and drug are the most important variables in honey production term; and calculated productivity of entities categorized in the next level.

The marginal productivity (MP) and average of productivity (AP)

The marginal productivity (MP) and average productivity (AP) calculated due to achieved data. The method of calculating marginal productivity (MP) based on a beneath formula:

$$MP_i = b_i \frac{\overline{Y}}{\overline{Xi}}$$

(b_i): achieved elasticity of each input in the Cobb - Douglas production function;

( ): average of honey production;

($_i$): average of inputs.

The average productivity (AP) is calculated by below equation:

$$AP_i = \frac{Y}{X_i}$$

Initially the productivity of each Producer separately was calculated and then the average of each entity under the total state and at different levels determined (table 2).

Table 2. The average value of productivity used inputs (Kg).

Item	Labor (Per person)	Capital (per million Toman)	Drug (per unit)	Nutrition (per Kg)	Energy (per 1000 Tomans)
The Average of Productivity	803.6	68.8	251.9	234.7	3.7
The Maximum of Productivity	3080	675	2175	1350	84
The Minimum of Productivity	200	18.1	7.5	50	0.8

(Source: Field Survey, 2013).

The average of production

The average production of each labor is equal to 800 Kg. The average of productivity of each million input unit is more than 68 Kg. Similarly the average of each drug, nutrition (Sugar) and energy (Fuel) inputs concerning to aforementioned units is equal to 251, 234 and 3/7 Kg.

Table 3. The Final productivity of used inputs (Kg).

Item	Labor (Per person)	Capital (Per million Toman)	Drug (Per unit)	Nutrition (Per Kg)	Energy (Per 1000 Tomans)
The Average of Productivity	164.1	24	10	16.4	0.48
The Maximum of Productivity	585.2	236.2	87	94.5	10.9
The Minimum of Productivity	38	6.34	0.3	3.5	0.1

(Source: Field Survey, 2013).

In the economical terms of agriculture, production elasticity is always the positive and bigger than 1 in the initial production area. This value is also positive in the second area, and it changes between 1 and 0; but in the third area this value is always negative. Accordingly elasticity of production is calculated. As table (4) shows all inputs are positive. It means that the use of each input was not much more and is in the economical area. Dividing the average productivity (AP) to the marginal productivity (MP) used to specify input place through the production area. If the achieved ratio is greater than 1, it means that the used input placed in the second area in the economical way. Since the result of division was greater than one, it could be concluded that using inputs in the second area is more economical. So based on the value of marginal productivity, inputs' priority is assessed and relevant formula is obtained:

$VMP = MP \times P_y = P_x$

VMP: Marginal value of input

MP: Marginal produce

Py: Price of production sale

Px: Price of buying products

Thus, how much the entity's production value was rather, therefore it's more valuable in this term. The marginal production value is presented in table 4.

Table 4. The Value of Marginal Productivity of used inputs (unit: 10 Rial).

Item	Labor (Per person)	* Capital (Per million Rial)	Drug (Per unit)	Nutrition (Per Kg)
The average value of marginal productivity (VMP)	308000	450000	1585000	56000
The Maximum value of marginal productivity (VMP)	1775000	4250000	1672000	404000
The Minimum value of final productivity (VMP)	68400	100800	4800	3800

(Source: Field Survey, 2013).

* Capital price equals to the annual interest bank rate and is considered about 17%.

According to the average of marginal productivity value, it is specified that capital input has a maximum final value, afterward labor, drug and nutrition categorized in the next level.

Level of studied beekeepers education

The correlation coefficient (Eta) is used to investigate the combination of the marginal product, beekeepers' jobs status (main and secondary occupation) and the level of education. According to this coefficient if the covering surface of X^2 is less than 5%, it means that there is a relation between two variables. However the greater value (x^2 >5%) meant that there is no relation between two variables. Thus according to the results (table 5) it is cleared that there was no significant relation between the levels of education and beekeepers' job (main occupation) with marginal product at 95% probability level.

Table 5. The Relation between Marginal Product and the main job and education level of studied beekeepers.

Correlation Coefficient	Marginal Product (MP)					
	Labor	Capital	Drug	Nutrition	Energy	Total
Level of Education	164/1 (0.065)	24 (0.177)	10 (0.199)	16/4 (0.117)	0/48 (0.095)	42/9 (0.118)
Main job	164/1 (0.130)	24 (0.051)	10 (0.069)	16/4 (0.052)	0/48 (0.087)	42/9 (0.077)

(Source: Field Survey, 2013).

The numbers in the bracket are the covering surface of amount (asymp.sig) x^2.

It's perceived from table (6) that the covering surface of x^2 (asymp.sig) is greater than 5%; so there is no significant relation between the level of education and beekeepers' job (main occupation) with the value of marginal production (VMP) at 95% probability level.

Table 6. The Relation between Value of Marginal Product and main job and Education level of beekeepers.

Correlation Coefficient	Value of Marginal Product (VMP)					
	Labor	Capital	Drug	Nutrition	Energy	Total
Level of Education	3.08 (0.061)	2.93 (0.104)	7.91 (0.189)	4.60 (0.117)	8.92 (0.107)	5.48 (0.115)
Main job	3.08 (0.130)	2.93 (0.051)	7.91 (0.069)	4.60 (0.050)	8.92 (0.087)	5.48 (0.077)

(Source: Field Survey, 2013).

The numbers in the bracket are the covering surface of amount (asymp.sig) x^2.

Recommendation

Since the marginal product and capital productivity has priority than other factors, dedicating the higher proportion of investment in to honey productive units of Alborz province is derived instead from giving more facilities, giving long term and short term

facilities for investment, development the beekeeping and revival the liquidity of beekeepers and investments in the bee part of country is suggested.

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