

## THE CAPACITY OF THE APICULTURAL PRODUCTION AND THE MARKET PULSE

Marian CONSTANTIN<sup>1</sup>, Raluca NECULA<sup>2</sup>,  
Mihai FRUMUȘELU<sup>2</sup>, Mihai-Alexandru COSTESCU<sup>3</sup>

**Abstract.** *The present study investigates the relation between production and market, at national level which is currently described as being marked by a growing number of bee families but also by an annual variation. The honey product also knows a growing trend, but at a considerably lower rate than the number of bee families. The adjustment of the functions and of the comparisons with the year 2014 reveals a favourable direct relation. The analysis of the influence of the number of bee families upon the honey product reveals that the growth in the number of bee families leads to an increase of the honey production, but at a considerably lower rate. On the other hand, a decline in the number of bee families leads to a decrease in the honey production (which is below the level of the year 2014, but in different ways). The level and the interpretation of the residual margin and of the correlation quotient revealed situations when the purchase price, honey purchasing and honey consumption are strongly correlated to the number of bee families. Such cases are regarded as frequent phenomena belonging to the pulses of the honey product market.*

**Abstract.** *Prezenta lucrare umărește o cunoaștere a necesității corelației producție piață, pentru care la nivel național este semnalată tendința de creștere a numărului familiilor de albine, dar și o variație anuală. La produsul miere se constată un ritm de creștere mult mai scăzut față de cel al numărului familiilor de albine, iar ca rezultat al ajustărilor funcțiilor și comparațiilor față de anul 2014, este semnalată existența unei relații favorabile directe. Din analiza influenței numărului de familii de albine asupra producției de miere, s-a putut constata pe de o parte că amplificarea numărului de familii de albine determină o creștere a producției de miere, dar cu un ritm mult mai lent, iar pe de altă parte diminuările numărului familiilor de albine provoacă o scădere a producției de miere (care se situează sub nivelul anului 2014, dar sub forme diferențiate). Nivelul și interpretare a valorilor abaterii reziduale și coeficientului de corelație a evidențiat situații prin care prețul de achiziție, cumpărarea și consumul de miere sunt foarte strâns corelate cu numărul familiilor de albine acestea fiind considerate fenomene frecvente ale impulsurilor pieței produsului mierii.*

**Keywords:** family of bees, apiculture, bee-keeping, purchase price (of honey), honey purchase/consumption, regression equation, adjusted value, market factor.

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<sup>1</sup>Prof., PhD, Faculty of Management, Economic Engineering in Agriculture and Rural Development, Bucharest, Romania.

<sup>2</sup>Lecturer, PhD, Faculty of Management, Economic Engineering in Agriculture and Rural Development, Bucharest, Romania.

<sup>3</sup>Assist., PhD, Faculty of Economics and Business Administration, Craiova, Romania.

## **Introduction**

Honey is one of the main products of the bee-keeping branch and one of the main components of the human consumption of food. At various stages of the economic development, honey was appreciated under its tri-dimensional form of food, natural cure and products obtained by processing it. The present study aims at highlighting the influence of the factors that influence both the production and the consumption of honey, pointing out the main stages of the market chain. The methodology used enabled a level of quantification suitable for understanding the variation of all indices by comparisons within the dynamics of the analysed interval of time. The results were structured in form of scenarios and aimed at knowing the presumptive possible levels of the factorial variations occurring on the market (price and demand) which influence the resulting element of the apicultural production (the capacity of production). The levels of the results of two statistical indexes — the residual margin and the correlation quotient — completed and, moreover, strengthened, by means of appropriate interpretation, the interactions which appear on the market of the honey product.

## **Materials and Methods**

Using a suitable methodology, the study aimed at identifying the main aspects of the relationship between the bee-keeping production capacity and the influence of the factorial elements and explaining this relationship. The statistical results refer to the interval 2003-2014, with the indexes expressed as both absolute and relative values, which enabled a suitable interpretation. The structure of the indexes covered levels represented by number of bees, production and market prices, and, respectively, the factors that influence the potential of apicultural production. In order to give an accurate account of the occurrence of annual variations, the calculation methodology started from identifying the comparative levels of the year of reference, i.e. 2003, using the regression square functions  $y=f(x)$ . These functions were used to an accurate approximation of the analysed phenomenon, by means of appropriate scenarios. The next step was the evaluation of the values adjusted for the resulting variable ( $y$ ) which resulted from the oscillations of the influence factors ( $x$ ). The variations of the influence factors were structured by means of scenarios and represented by simulations rendered by amplification/simplification forms in relation to the adjusted calculation reference of the year 2014. All this enabled the evaluation of the level of the results of the resulting variable (the theoretical variable  $Y_i$ ). The variation results were expressed both as absolute and as relative values, in order to find out the variation levels and to interpret them. The residual margin (which is a synthetic indicator representing the difference between what is empirical and real, choosing the function with the smallest value) and the correlation quotient are the foundation for the results obtained from the relations  $x/y$ .

I have constantly aimed at using the calculation methodology to get beyond the historical frame of knowing the approached problems, by means of scenarios meant to evaluate to presumptive levels (y) by calculating the oscillating forms of the factorial variables (x).

## Results and Discussions

The present study focuses on the problems related to the apicultural products and is centred on the quantitative dimension of the capacity of production, which, at national level, is represented by the number of bee families that determine the honey production. But these aspects, analysed in relation to quantity and value, are connected to the trivalence present on the market: consumption, price and purchase. The study analyses the annual evolution of the bee families and of the amount of honey produced by them, as well as the influence of the market factors on these primary quantitative factors.

### *1. - The evolution of the number of bee families and the honey production in Romania.*

The evolution of the number of bee families and honey production analysed at national level has various annual levels. The parameters are displayed in both absolute and relative forms in Table 1 and in graphical form in Figure 1, highlighting the following aspects:

- The number of bee families has a clear rising trend, but also annual variations. It is worth mentioning that the level reached in 2014 is +60.83% higher than the one of the year 2003;

- Similar annual variations also occur for the honey production, which has a maximum value in 2013 and a minimum one in 2007 (the productions being of 26,678 and 16,767 tons, respectively). The analysis compared to the reference year 2003 reveals a rising trend with significant annual variations.

**Table 1.-** The evolution of the number of bee families and of the honey production in Romania during the interval 2003-2014

Specification	UM	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of bee families	thousand families	840	888	888	891	982	998	1057	1257	1250	1254	1354	1351
	% compared to the year 2003	100	105.71	105.71	106.07	116.90	118.80	125.83	149.64	148.80	149.28	161.19	160.83
Honey production	tons (annual total)	17409	19150	17704	18195	16767	20037	<b>19937</b>	19924	24127	23062	26678	18040
	% compared to the year 2003	100	110.00	101.69	104.51	96.31	115.09	114.52	114.44	138.58	132.47	153.24	103.62

Source: Co-ordinates of the standard of living in Romania. Population incomes and consumption, INS, 2015.

The analysis of the variation of the number of bee families and of the honey production reveals annual variations, but at a different rate every year. Concerning the number of bee families, the growth is constant with relatively small variations every year, whereas the honey production has significant annual variations. One may even regard these variations as related to the season of the year.

**2. - The variation of the bee product output capacity (of the number of bee families) depending on the market.**

This variation was rendered by means of scenarios and aimed at knowing the factors that determine it. These factors play an important part on the market nowadays. The use of regression functions revealed the levels of these resulting variables (y), by modifying the influence factors (x). The adjusted values are shown in Table 2 and illustrated in Figure 2. These values render the variation levels of the number of bee families/of the honey production according to the evaluations made using the regression functions. These were expressed both in absolute figures and as percentage in relation to the value of the year 2014, which led to the following conclusions:

**Table 2.** The evaluation of the level of the number of bee families (y) influenced by the variations of the market factors (x), using the regression function

			The level of the results of the resulting variable Y results according to the variations of the influence factor x (5% ..... 50%) (UF/% versus 2014)							
			X5%		X10%		X15%		X50%	
The description of the relations and of the variables (y resulting; x factorial)	Function (regression equation) and the calculus reference level, the year 2014 [y(x)] Variations of the x factor [amplifying (+), diminution (-)]	UM	UF	%	UF	%	UF	%	UF	%
1.- The influence of the purchase price of the honey product (x) on the number of bee families (y)	(+)Y y(x) = 1.424 mil. bee families (value adjusted, the year 2014)	mil. bee families	1,4481	101.69	01.01.95	104.59	01.01.93	108.09	1,8340	128.79
	(-)	mil. bee families	1,3664	95.95	01.01.60	93.11	01.01.61	90.31	1,0166	71.39
2.- The influence of honey purchase (x) on the number of bee families (y million families)	(+) y(x) = 1.363 bee families (value adjusted, the year 2014)	mil. bee families	1,446	106.08	1,536	122.69	1,632	119.73	2,481	182.02
	(-)	mil. bee families	1,287	94.42	1216	89.21	1,152	84.51	0,883	64.78
3.- The influence of the honey consumption (x) on the number of bee families (y million bee families)	(+) y(x) = 1.255 (value adjusted, the year 2014)	mil. bee families	1,723	137.29	1882	149.96	2,051	163.42	3,538	281.91
	(-)	mil. bee families	1,438	114.58	1311	104.46	1,195	95.21	0,684	54.50
4.- The influence of the number of bee families (x million families) on the honey production (y tens of thousand tons)	(+) y(x) = 2,277 tens of thousand tons (value adjusted, the year 2014)	tens of thousand tons	2,334	102.50	2388	104.87	2,438	107.07	2,704	118.75
	(-)	tens of thousand tons	2,217	67.36	2153	94.55	2,087	91.65	1,533	67.32

y(x) is the values adjusted on years. The calculus base is the year 2014.

- ***The influence of the purchase price of the honey product (x) on the number of bee families (y)***, which is an effect of adjusting the function (Y), was rendered by results showing an amplification/diminution. The amplification of the purchase price (+x) led to different effects on the number of bee families, as follows: rising the price with up to 10% leads to an increase of the number of bee families (+28% compared to the year 2014); lowering the purchase price leads to a decrease in the number of bee families, which reached the level of 71.39% compared to the year 2014. This makes the producer want to raise the production capacity when the purchase price rises, but the effect is just the opposite: the number of bee families goes down.

- ***The influence of honey purchase (x) on the number of bee families (y)*** reveals different effects, which, according to the regression equation () and comparing the results to the reference represented by the year 2014, may be described as follows: an increase of the consumption with +10% ... +50%, which leads to a successive growth of the number of bee families, which reaches a maximum of 182.2%; a decrease in honey consumption leads to a decrease in the number of bee families, which reaches a level of only 64.7% compared to the year 2014. This clearly influences the relation between the demand (honey purchase) and offer (as a result of the production capacity) on the honey product market.

- ***The influence of the honey consumption (x) on the number of bee families (y million bee families)*** as a form of the relation consumer/producer is rendered by the results of the variations of the regression function (). The conclusions are as follows: a growth in honey consumption (x) the production potential, expressed by the number of bee families, has a significant growth (for its last evaluation stage of x at +50%, the growth of y reaches 281.91% compared to the year 2014); when the honey consumption goes down (-x%), there are different rates of reduction: those between -5% and -10% lead to a level which is still above that of the year 2014, whereas those between -15% and -50% lead to a level that is lower than that of the year 2014, with a decline that reaches 54.50%. The overall conclusion is that the market demand represented by the variation of the honey amounts (x) is in a direct relationship with the offer, represented by the number of bees.

- ***The influence of the number of bee families (x million families) on the honey production (y tens of thousand tons)*** reveals a continuation of the correlative forms rendered in the previous paragraphs, where the regression function () is used to identify the influence of the potential of the apicultural producer upon the honey production. The variations of the number of bee families occur with different rates, which can be expressed by comparing them to the adjusted value of the year 2014. This information can be described as follows:

a growth of the number of families in a succession of +5% ... +50% leads to a growth of the honey production, but at a rate given by the growth of the  $+x$  value, at a slower pace (the growth ranges between +2.5% and +18.75%; the decline of the number of bee families, expressed by the factorial variable  $x$  leads to a decline of the honey production  $y$ , which is below the level of the year 2014, but under a differentiated form (a decrease of -5% and -50% for the variable  $x$  results in a production decrease to levels of 67.36% and 67.32% respectively, whereas a decrease of -10% and -15% reduces the production to 94.55% and 91.65%, respectively). This suggests that the correlation between the production potential (number of bee families) and offer (honey production) appears to be connected to some forms of correlation production  $\leftrightarrow$  market, which lead to differences in the offer, some of them seeming to be described as production seasonality.

**3 – The residual margin and the correlation quotient.** These two parameters are forms of interpreting the dynamics of the factorial variables on the resulting ones. The level of the data that were rendered previously and structured according to the correlating functions is based on the values of the residual margin and of the correlation quotient. All this, which is also displayed in Table 3, points out the following:

**Table 3.** The level of the residual margin and of the correlation quotient ( $x/y$ ) concerning the honey production capacity and the intensity of the market factors.

Crt. no.	Structure of the correlative functions ( $x/y$ )	Residual margin	Correlation quotient (ratio)
	<b>1.-The influence of the purchase price of the honey product (<math>x</math>) on the number of bee families (<math>y</math>)</b>	0.092	0.938
	<b>2.- The influence of honey purchase (<math>x</math>) on the number of bee families (<math>y</math> million families)</b>	0.060	0.975
	<b>3.- The influence of the honey consumption (<math>x</math>) on the number of bee families (<math>y</math> million bee families)</b>	0.064	0.971
	<b>4.- The influence of the number of bee families (<math>x</math> million families) on the honey production (<math>y</math> tens of thousand tons)</b>	0.215	0.320

- the purchase price is very strictly correlated with the number of bee families, in that an increase in the honey purchase/acquisition price makes the apiarist more co-interested (as suggested by the increase in the capacity/potential of honey production and of the number of bee families);

- a correlation that ranges between the same dimensional limits for the residual margin/correlation quotient also occurs for the influence of honey purchase upon the number of bee families (because selling honey directly to the consumer is a frequent phenomenon on the apicultural market);

- honey consumption and the number of bee families are in the same direct correlation and represent a ratio expressed both by the residual margin and by the correlation quotient. This happens because the honey production potential, expressed by the number of bee families, and the honey consumption may be regarded as extreme elements of the honey chain (made of the main stages of the apicultural market);

- the relationship between the number of bee families and production is considered to require a detailed account of the direct correlative factors of the apicultural production (seen as primary factors) and the following factor types: climatic (e.g. the favourability of the season when the pollen is picked up by the bees); economic (e.g. internal/external honey trade); political (the new coordinates of the EU-market concerning the apicultural production and the honey chain, etc.); social (e.g. how beekeeping is learned and performed by the population belonging to different age groups, etc.). All these factors eventually represent the result of the activities on the apicultural market. This is a good reason why one mustn't correlate honey production with the number of bee families only, something which would represent insufficient knowledge, where the correlation quotient is 0.320 only and the residual margin is 0.215.

## Conclusions

The analysis of the capacity of producing apicultural products requires appropriate knowledge, which consists of knowing the overall influence of market factors. Concerning Romania, the following conclusions emerge:

1 The potential of the apicultural production potential, expressed by the number of bee families is on the rise, but also has annual variations. The yearly production of honey occurs at a considerably lower rate compared to the increase rate of the number of bee families. The latter varies mainly in relation to the annual seasonality of the honey product.

2 The fact that the number of bee families is correlated with the purchase price, as well as with the degree of purchasing and consuming honey, resulted by adjusting the functions and the comparisons to the year 2014, suggests the existence of a favourable direct relation.

3 *The influence of the number of bee families (x) on the honey production (y)* occurs at different growth rates compared to the value adjusted of the year 2014. To be exact, an increase in the number of bee families in a succession of +5% ... +50% leads to a growth of the honey production, but at a considerably lower rate. A decrease in the number of bee families leads to a decrease of the honey production below the corresponding value of the year 2014, but under

differentiated forms: a decline of -5% and of -50% leads to a decrease in the production to 94.55% and 91.65%, respectively, whereas a decline of -10% and -15% reduces the value of the production to 94.55% and 91.65 %, respectively. This suggests the necessity of knowing the correlation production ↔ market, and to account for differences in the offer one should take into account the seasonality of honey production.

4 The correlative functions enabled the conclusion that the values of the residual margin and of the correlation quotient reveal the following situations: the purchase price, the process of purchasing and consuming honey are very strongly correlated with the number of bee families. These are frequent phenomena on the honey market and are main stages in the honey chain.

5 The relation between the number of bee families and the honey production requires to know not only the directly correlating factors of the apicultural production but also the factors pertaining to climate, economy, politics, which can all be subsumed to the forms of the apicultural market. However, this last conclusion is not a very strong one, as long as the correlation quotient has a value of 0.320 only and the residual margin is of 0.215.

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