UDK

ESTIMATING METHODS OF ECONOMIC DEVELOPMENT OF HORTICULTURAL ENTERPRISES

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Methodical bases of estimation of economic development of enterprises were considered. Horticultural enterprises of Vinnytsia region by the indexes of economic development were classified. The results of economic and mathematical modeling of optimization of the varieties composition of industrial gardens were analyzed.

Key words: *types of economic development, horticultural enterprises, economic and mathematical model, selective varieties, income maximization.*

Under conditions of modern globalization of world economy the intensification of production is the main and rather objective process because social and economic realia set the problem before national agrarian enterprises to maximize the quantity of production in the conditions of insufficiency and gradual reduction of land resources. Modern tendencies of the development of commercial horticulture testify about absence of clear positive dynamics of effective processes in the field. Despecialization process of horticultural enterprises, worsening of their physical infrastructure and, afterwards, breaking the technological process affects further development of this field. Increasing of fruit and berries production is only possible through increasing both productivity of every land hectare especially perennial plantations and labour productivity.

The problems of economic growth of horticultural enterprises are widely studied in native science and can be found in scientific works of O.M. Shestopal, O.Ye. Yermakov, I.I. Cherven, V.A. Ruliev, I.I. Lukinov and others. However, despite of the diversity of existing researches, the importance of this issue, particularly at the regional level, determines the need for further studying.

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Methods of the research. The aim of the study is to estimate the type of economic development of the enterprises and to make clear the peculiarities of economic and mathematical modeling with the aim to increase the effectiveness of commercial horticulture management. Methods of comparison, systems analysis and synthesis, generalization and economic-mathematical modeling were used to solve the problem.

Results of the research. Intensive development is necessary precondition of effective activity of horticulture enterprises and significant advantage in competitive competition and guarantee of success. Market environment is a result of the state and dynamics of economic processes for the companies.

Economic development identifies the formed type of reproduction at the enterprises which affects the production results and the most important elements of the reproductive process. It is based on the fact that every enterprise should establish and implement a complex system of measures that will provide the most appropriate type for the future economic growth of the agricultural enterprises taking into account the state of its development and economic conditions. [4]

In the opinion of V.G. Andriichuk concerning the formation of the intensive type of development, there is a close interaction between internal and external influencing factors as to the enterprises functioning under modern conditions. So, only those agricultural companies which efficiently and quickly apply the latest advances in science and technology can form intensive type of development. That is the result of changes in the macro environment and, in particular, in its brunch such as scientific and technical environment [1].

There are two types of economic reproduction: simple and expanded. Simple reproduction is characterized by the production process and the output of the produced goods that realizes annually in the same scale (done mostly under unchanged technologies). Expanded reproduction is based on the renewal of the production process in increasing amounts (mainly under improved technologies).

Two types of expanded reproduction are known to be existed such as extensive and intensive.

The extensive type is based on the growth of production under unchanged technologies by involving additional financial and labour resources, intensive type is characterized by production growth through increasing its efficiency by using achievements in science and engineering.

Bashnianyn G.I. separates detensive form (translated as "without strain") equally with generally accepted typification of the economic development [3]. Detensive development consists in the following: amount of the resources should be additionally increased in more than one unit for producing extra unit of output that is the coefficient of elasticity from the expenses of production will be less than unit, resulting in degrading of the enterprise.

The model of economic development of horticultural companies for determining the type of their economic growth was made. The following indexes of this model are suggested: income (I_i) is calculated as the comparison of income (receipts) from sale of horticulture products in the reporting period to its basic value; cost price of fruit and berries production (I_C) is defined as in the previous index, the level of economic efficiency (I_E) is calculated by the comparison of received results and expenses to their achieving (Table 1).

The advantage of the economic development model of horticultural enterprises is that it allows ranking these companies by comparing the calculated values and gives the opportunity to estimate the effectiveness of enterprises operating in the field of horticulture.

1. Model of economic development of horticultural enterprises*

Type of economic development	Sense of criteria		
	I_i	I_C	I_E
Intensive, the most progressive development	$I_i > 1$	$I_C < 1$	$I_E > 1$
Intensive (progressive) development	$I_i > 1$	$I_C = 1$	$I_E > 1$
Predominantly intensive progressive development	$I_i > 1$	$I_C > 1$	$I_E > 1$

Predominantly extensive little progressive development	$I_i > 1$	$I_C > 1$	$I_E > 1$
Extensive regressive development	$I_i > 1$	$I_C > 1$	$I_E < 1$
Extensive fixed (regressive) development	$I_i > 1$	$I_C > 1$	$I_E = 1$
Detensive development	$I_i < 1$	$I_C < 1$	$I_E < 1$

* Own author's elaboration

The essence of intensification obtains deeper meaning in modern terms, as it reflects not only the efficiency of using labour and means of production, but also takes into account the level of provision with the latest equipment and technologies, that helps to increase productivity and products quality and to lower its cost price.

Intensive gardening is understood as a complex of organizational and economic, legal, technical and technological measures directed to reconstruction, modernization of material and technical resources, development of selective activity, heightening employees' qualification and achieving increase and rise of the competitiveness of horticulture products. Gardening intensification is a special form of expanded reproduction providing a complicated organizational and economic process of forming the intensive type on the basis of concentration, extending of specialization, timely renewal of fruit-bearing plantations, equipment and technologies in order to develop technical, technological, organizational and bio-economic factors to increase the efficiency of horticultural enterprises.

Agricultural enterprise of any organizational and legal form of management should strive for continuous development. In more cases, the economic development of the company is achieved through the use of intensive factors. They help to increase the efficiency level of using the productive resources of the enterprise by improving the quality of these resources and their management processes. Enterprise transition from detensive and extensive development to the predominantly intensive type of development is connected with additional expenses caused by increased levels of intensity usage of its productive resources. Therefore, determining the type of horticultural enterprises is necessary condition of modeling the mechanism of the horticulture branch development. Horticultural

enterprises of Vinnytsia region using the criteria (Table 1) by the types of economic development were classified.

The evaluation of horticultural enterprises over the research period (from 2010 to 2012) allowed to single out: eight companies with detensive development, characterized by deterioration of the technical and technological levels of production, they are those horticultural enterprises that gradually degrade; nine companies with extensive regressive development achieved by attracting additional financial and labour resources; nine enterprises were mainly with intensive progressive development which are characterized by increased production due to the rise of its efficiency through the introduction of science and technology achievements.

It is necessary to introduce high-yielding and short-season varieties and expand planting the gardens on vegetative rootstocks for achieving the economic development of the company and maximize income in the field. Thus, a decisive factor to get constantly high and qualitative yields is a selective variety. The introduction of high-yielding varieties of perennial plants allows getting a high yield for the minimum expenses and improving fruit quality. Requirements of varieties to soil and climatic conditions, especially temperature and length of growing season were taken into account while selecting fruit trees varieties with different ripening periods for the matrix of a model. The varieties recommended by experts of Podillia Research Station were used.

Recommended high-yielding varieties of pome crops (apple trees) together with the allocation schemes of plantations, substantial investments and expenses, labour costs were laid in a matrix of the economic and mathematical problem in a package of Excel applications. The model of the problem involves 89 variables which imposed 121 restrictions.

The task is to find the optimal relation of variables in which the purpose function (1) will provide maximum income:

$$Z = x_d - x_v \rightarrow \max, \qquad (1)$$

x_d – amount of receipts from sales of apples in terms of value;

x_v – amount of expenses for production in terms of value;

and the function will satisfy the following conditions:

1. Limitation of space under intensive varieties of perennial plants

$$\sum_{j \in N_1} \sum_{j \in N_2} x_{jkl} \le S_i, (i \in M_1), \quad (2)$$

x_{jkl} – orchard space of j–variety of *l*– layout schemes;

S_i – space under apple orchard by the harvest periods;

j – index of apple variety;

k – index of rootstocks;

l – index of schemes of plantations layout;

N_1 – a set of varieties of fruit plants;

N_2 – a set of schemes of planting the perennial plants;

M_1 – a set of harvest periods;

2. Limitation by schemes of layout the j–apple orchard

$$\sum_{j \in N_3} x_{jkl} - x_j = 0 \quad (3)$$

$$x_j \ge S_j, (i \in M_2) \quad (4)$$

$$\lambda x_{ij} - x_{ij} \ge 0, (i \in M_3) \quad (5)$$

x_{ij} – the total space of the orchard of j–variety;

S_{jj} – minimum projected space of the garden layout of the j–variety plantations;

λ – the relation ratio between planting schemes of j–variety orchard.

M_2 – a set of limitations of apple orchard varieties;

M_3 – a set of limitations of space schemes of fruit trees of j–variety.

3. Limitation by using labour resources:

$$\sum_{j \in N_1} \sum_{j \in N_2} c_{ijl} x_{ijl} \le A_i, (i \in M_4), \quad (6)$$

c_{jklt} – rate of using labour resources on 1 hectar of apple orchard of j–variety within *l*– layout schemes;

A_i – amount of labour resources by harvest periods (decades)

M_4 – a set of limitations of harvest periods (decades)

4. Limitation by investment for growing fruit trees:

$$\sum_{j \in N_1} \sum_{j \in N_2} v_{ijl} x_{ijl} \le K, \qquad (7)$$

v_{ijl} – investments on 1 hectare of industrial garden of *j*–variety of commercial products of *l*–layout schemes;

K – total amount of investments.

5. Determining of economic indicators:

$$\sum_{j \in N_1} \sum_{j \in N_2} w_{ijl} x_{ijl} - x_d (x_v) = 0 \qquad (8)$$

w_{jkl} – receipts from the sale or expenses on 1 hectare of garden *j*–variety of *l*–layout schemes.

6. The condition of variables inhesion:

$$x_{ijl} \ge 0; x_d \ge 0; x_v \ge 0 \qquad (9)$$

Economic and mathematical model was solved by the simplex method of iterative calculating procedure that starting from the basic plan with a finite number of steps makes it possible to obtain an optimal plan of the model. According to the calculations horticultural enterprises will receive the maximum income under the following structure of fruit plantations.

The results of the conducted modeling show that the financial resources of the company will be used more efficiently, and this is due to the fact that apples of winter varieties are sold later at more attractive prices, which significantly increases the income in the field using the proposed structure of fruit trees in horticultural enterprises, particularly in the following ratio: summer varieties – 5%, autumn varieties – 15% and winter varieties - 80%.

The main varieties in apple orchards of Vinnytsia region enterprises of old age group are Kalvil snow, Jonathan, Boiken, Renet Symyrenka, Antonivka, Spartan. Golden Delicious, Jonagold, Gloster, Champion, Ligol, Idared, Renet Symyrenka, Re-varieties and others are dominated in young plantations of high intensity [2]. Optimal structure of the varieties of perennial plants for horticultural enterprises in Vinnytsia region was obtained in the result of doing the model. Yerlist-Geneva (49.6%) is recommended among summer varieties of perennial plants, Gala (46.3%) is of autumn varieties, among winter varieties there are Golden Delicious (11.4%), Jonaprince (10.1%), Re-varieties - Revena (9.3%), Relinda (9.3%), Renora (9.3%), Reanda (9.3%). Resistant varieties (Re - varieties)

have the following advantages: high efficiency, stable yields, low cost price; simplified system of protection that reduces expenses; simplicity of varieties to soil; plantations are easily formed without using complex pruning methods; the technology reduces negative impact to environment; possible organic production; varieties resistance to diseases keeps a high quality of product; the technology provides fruit production that meet international quality standards.

Comparative analysis between actual data of horticultural enterprises in Vinnytsia region and model data got from the optimization of the ratio of varieties set of perennial plants of different ripening periods was done for argumentation the expediency of the made model (Table 2).

2. Economic estimation of varieties set of perennial plantations of different ripening periods is based on the solution of economic and mathematical model of agricultural enterprises of Vinnytsia region*

Index	Actually for 2007-2012 years	By optimal plan	Optimal plan in comparison with actual plan, %
Space during fruit-bearing age, ha	12083,0	12100,0	100,1
Gross yield, thousands of centners	931,6	4613,0	495,2
Yielding capacity, centners/ha	78,3	381,2	486,8
Substantial investments for 1 ha, UAH	46856,5	157291,5	335,7
Production expenses:			
for 1 ha	7955,3	24333,3	305,9
for 1 centner	94,9	75,8	79,9
Labour costs for harvest of 1 ha in the garden, man-hour	1248,6	1444,5	138,4
Cost price of 1 centner of sold fruits, UAH	124,2	109,2	87,8
Average price of 1 centner of sold fruits, UAH	157,1	377,9	240,5
Income (loses), UAH:			
for 1 ha	2291,6	124761,9	5444,3
for 1 centner	29,8	388,5	1303,7
Level of profitability, %	27,6	355,9	328,3 в.п.

* Own author’s elaboration

Data of the modeling results indicate the possibility of horticultural enterprises not only increase the yield of fruit, but also reduce the cost price of sold production. In particular, while increasing in 3,1 times (or 16,4 thousand UAH more) under optimal variant by increasing the level of production expenses for 1 ha of fruits and increasing labour resources in 195,9 man-hour/ha, plantations productivity will be 4,9 times and production cost price will decline to 15,1 UAH/ centner. In addition, full usage of technological, technical, organizational and economic methods, necessary farming measures and methods of intensification will allow horticultural enterprises to increase the efficiency of varieties set of perennial plants with different ripening periods. Thus, by using recommended price for selling the products by specialists of Podillia Horticultural Research Station and our offered structure of fruit plantations, the income increases by 1 centner and 1 ha, respectively by 13,0 and 54,4 times while the profitability is 355,9 %.

Using the economic and mathematical modeling to optimize the production plan in the field of horticulture allows systematizing qualitatively the flow of information which is formed in the activities study of horticultural enterprises. As a result it is possible to improve the reliability level of the efficiency estimation of the companies' activity for the previous period and to predict the desired effect by using the appropriate combinations of selected problems and limitations.

Conclusions. Solving the economic and mathematical matrix of optimization the ratio of varieties set of perennial plants of different ripening periods in horticultural enterprises made possible conclusion that the mathematical interpretation of the relation function of varieties provides mathematical description of the relations between the volume of fruit production, substantial and production expenses and labour costs. Substantiated optimization of varietal set of plantations at the enterprises will provide reduction of cost price, productivity growth of plantations, increase of income and profitability level and efficient using of labour resources. Compliance of technological processes in the field, proper labour organization before and during the harvest, effective work of managerial staff, properly adjusted work of marketing service as to the sales of fruit and organized mechanism of income distribution from industrial and economic activity will improve the production efficiency of horticultural enterprises.

REFERENCES

1. Andriichuk V.G. On the necessity of complex using the profitability indexes in planning and economic work / V.G. Andriichuk // Improvement of the economic mechanism of agrarian enterprises functioning under uncertainty:

Collection of scientific proceedings of the International Scientific Conference during May 19th-20th, 2004 – K.: KNEU, 2004. – P. 30-36.

2. Barabash L.O. Development of industrial gardening in Vinnytsia region / L.O. Barabash, K.V. Mazur, V.I. Zarubenko // Collection of proceedings of Vinnytsia National Agrarian University. Series “Economics” / Editors: Kaletnik G.M. (chief editor) and others. – Vinnytsia, 2012. Issue No.2 (64). – P. 3-7.

3. Bashnianyn G.I. Capital of the company, its circulation and turnover. Social reproduction / G.I. Bashnianyn, P.Yu. Lazur, V.S. Medvediev // Political Economy . – K.: Nika-Tsentr, Elga, 2000. – 529 p.

4. Berezivskyi P.S. Intensification directions of the development of agricultural enterprises / P.S. Berezivskyi, N.P. Osoba, Z.P. Berezivskyi // Economy of AIC (agro-industrial complex). – 2009. – No.6. – P. 18-25.