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Assessment of Economic Efficiency of Vegetable Production in Greenhouses

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Abstract – The article provides a methodology for determining the economic efficiency of vegetable production in the greenhouse conditions of Uzbekistan.
The development of vegetable growing in the greenhouse economy is one of the main problems for the continuous supply of the population of the Republic with vegetable products, increasing the export capacity of the industry and improving the quality indicators of products.

Keywords – Vegetable growing, efficiency, cooperation, technology, modernization, innovation.

I. Introduction

In the process of economic reforms carried out in the agriculture of the Republic of Uzbekistan, much attention was paid to the development of vegetable growing, several positive results were achieved to improve the efficiency of enterprises in the industry through structural changes, reforms of the management system, integration of the activities of enterprises in the industry, creation of cooperation and its development [1, 2011; 2, 2013-2014].

The fact is that the growth of the population and, accordingly, the growth of demand for vegetable products require, in turn, the rapid development of the vegetable growing industry. For this reason, today in the republic much attention is paid to expanding cultivated land, increasing production and economic efficiency by modernizing the industry, in particular, by developing the production of vegetables in greenhouses in the republic. That is why the study in this industry of theoretical and methodological characteristics of assessing the efficiency of vegetable production in greenhouses can have a positive impact on the development of the agricultural industry.

II. The Main Findings And Results

The cultivation and sale of vegetable products ultimately makes it possible to improve economic results and ensure the competitiveness of agricultural producers. Important conditions for the production of vegetable products are considered to be a reasonable organization of labor, the introduction of modern, intensive technologies into production, base all production processes in complex mechanization, mineralize and organically fertilize the soil, use chemical and biological methods of plant protection, use highly biological varieties that provide potential yield.

Based on the peculiarities of vegetable growing in greenhouses, it is necessary to use the following system of indications for assessing economic efficiency:

- Gross yield of vegetables (by type);
- The amount of the crop obtained from 1m^2 of the greenhouse plot;
- A unit of the grown product by saving labor costs;
- By the composition and type of costs (heating, lighting, seeds, etc.);

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- The total cost per unit of the grown product;
- The average realizable cost per unit of the product;
- The amount of expenses for heat supply, electricity, seeds, chemicals and water per 1 centner of the product;
- The amount of expenses for heat supply, electricity, seeds, chemicals and water per 1m^2 of the greenhouse area;
- Gross income;
- The income received from 1 m^2 of the structure and 1 centner of the product;
- The degree of profitability of production by types of vegetables and general production.

The composition of expenses related to the production of vegetables consists of the following:

- Construction and repair of greenhouses (equipment);
- Seeds, seedlings materials;
- Plant protection products;
- Mineral and organic fertilizers;
- Fare;
- Consumption of electricity, heat supply;
- Water supply costs;
- Wages and social security payments;
- Costs spent on other needs.

The following can be cited as the main indicator for determining the economic efficiency of vegetable production in greenhouses: labor and material costs spent to obtain a product from one square meter; the quantity and cost of the product obtained from one square meter; the amount of income received from 1 centner of the product; quantity and amount of product per worker.

In vegetable growing, the average profitability is high and the profitability can reach up to 300%. In vegetable growing, labor costs per 1 hectare of sowing area are 500-600 workers / hour, for 1 centner of product 4-5 workers / hour. In a greenhouse, one worker is required per plot of 200 square meters. Comprehensive coverage of the greenhouse costs is 10 months [5, 2002].

To assess the effectiveness of the use of intensive technologies of the measurement effect in vegetable growing, it is necessary to take into account economic production, ecology, and quality, social and medical criteria (1-table).

When assessing the effectiveness of intensive technologies for growing vegetables in greenhouses, it is necessary to take into account the totality of the above criteria and indicators. At the same time, their interconnection with each other and the efficiency of growing vegetables in a greenhouse is objectively assessed based on the last result. This makes it possible to take into account the efficiency of the producer and consumers.

Analysis and calculations based on the definition of economic efficiency within the enterprise is expressed in the following results.

Table 1. Criteria and indicators for assessing the effectiveness of intensive technologies in the production of vegetables in greenhouses

Criteria	Indicators	Calculation method
1. Economic production	**Samarasi:** **1.1.** Increase in the yield of vegetables in covered ground**, kg, Xc**	**Xc = Ox–Hx** **Ox -** actually the harvest in the greenhouse**, kg;** **Hx -** yield of the main control**, kg.**
	1.2. Volume of additional product received by production, increase in income, thousands of soums, **ΔФ**	**ΔФ = Oxф–Hxф** **Oxф -** actually the harvest in the greenhouse, thousands of soums**;** **Hxф -** income from the control harvest, thousands of sums**.**
	1.3. Reduction reserve for the unit cost of the product, sum / kg, **Tкз**	**Tкз = Txак–Tк** **Txак** - the real cost**, kg / sum;** **Tк** – expected prime cost**, kg / sum.**

	Economic efficiency: 1.4. Adjusted net profit, NPV (thousand soums)	$NPV = \sum_{t=1}^{n} \frac{V_t - C_t}{(1+\frac{d}{100})^{t-1}} - \sum_{t=1}^{n} \frac{K_t}{(1+\frac{d}{100})^{t-1}}$ **Vt -** arrival period t; **Ct -** period of current costs **t;** **Kt -** cost period **t;** **d -** discount (costs not paid on time and fees deducted from it)
	1.5. Internal profit limit, %, **IRR**	$IRR \approx d_+ + \frac{NPV_+}{NPV_+ - NPV_-} \times (d_+ - d_-)$ $IRR_{год} = \left[(1+\frac{IRR}{100})^n - 1\right] \times 100\ \%$
	1.6. Project maturity, year, **Лкм**	**Лкм = Хум / ΔФ** **Хум -** total cost $Л_{км} \approx t_- - \frac{NPV_-}{NPV_+ - NPV_-}$
	1.7. Expected profitability (point of no tolerance for damage), thousand soums, Rk	**Рк = Хд / Дму** **Хд**– constant annual costs**;** **Дму**– the share of marginal income in revenue**.** **Дму = (d * V / Пт) * 100** **d -** marginal income per unit of product**;** **V** is the volume of the product**;** **Пт**– revenue**.** **d = (Пт–Хбош) / V** **Хбош–-** initial consumption
	1.8. Profitability level**,%, Р**	**Мк = Хд / d** **Мк**– expected amount **Р = (ΔФ / (Хс * Тк)) * 100**
2. Ecological	2.1. Environmental damage resulting from the use of technologies, thousands of soums	The amount of costs incurred as a result of production intensity
	2.2. Economic and environmental efficiency, thousands of soums, IE	**Иэ = (И–Хс) / Хис** **И -** economic benefits; **Хс** - the cost of economic benefits that arose earlier
3. Quality	3.1. Greenhouse-grown vegetables	Compliance with state standard requirements
4. Social	4.1. Social Performance Index, **Иси**	**Иси = (100*Ису)/К** **Ису** – the size of social benefit **К** – investment amount, sum If **Иси** No. 1, then from the social point of view the technology is considered of little use**.**
	4.2. Food security in the country, comfortable working conditions, high wages	
5. Medical	5.1. The impact of the resulting product on human health from the quality and demand side (positive and negative)	Strengthening a positive impact on increasing consumer requirements, abandoning negative products or reducing the need for them

- The results of production - income received from the sale of the manufactured product, personal need except for all costs;
- In terms of social outcome, relevance to workers, participants in the enterprise and their relatives;

Determination of economic efficiency is carried out by the following indicators:

1. The relationship of the gross product with human and material labor costs, ***Иям***:

$$И_{ям} = \frac{ЯМ}{X_{дич} + A_ф * C_к}$$

ЯМ – the sum of the gross product, production within a specified period;

Хдич – current production costs;

Аф – the sum of the stock average annual production

Ск– coefficient of efficiency of the main fund (capital funds)

2. The ratio of the produced product to human and material labor costs, ***Имк***:

$$И_{мк} = \frac{МК}{X_{дич} + A_ф * C_к} \quad ,$$

МК – the amount of the product produced.

This indicator is called the ratio of gross income to labor costs. Moreover, it does not indicate the results of production activities, but financial processes.

3. The ratio of net profit to human and material labor costs:

$$И_{сд} = \frac{СД}{X_{дич} + A_ф * C_к} \ ,$$

СД – the net profit of the enterprise, the amount of the additional product, expressed in money, the difference between the gross or sold product and the cost of production.

Net profit is split into created and received parts. In the first case, the entire produced product and the amount of costs for its production are considered, in the second only the ratio of the sold product.

Sales income is an absolute indicator; it can be calculated in specific performance indicators. Since, in terms of income from their implementation, it is involved in the calculation of efficiency and costs.

The profitability indicator is expressed in high interests:

1. Profitability of the product, ***Рм***:

$$P_M = \frac{Ф}{M_Т} * 100\% \quad ,$$

Ф - income; ***МТ*** is the cost of the product.

2. Profitability of fixed assets and working capital (profit limit), ***Раав***:

$$P_{аав} = \frac{Ф}{АВ + A_K B} * 100\% \ ,$$

АВ - fixed assets; ***АкВ*** - the average balance of working capital.

3. Profitability of funds of the enterprise, ***Ркм***:

$$P_{КМ} = \frac{Ф}{M_к} * 100\% \quad ,$$

Мк - the entire property amount of the enterprise.

The analysis of the economic activity of the production of vegetables in greenhouses first of all begins with the definition of the volume of the enterprise and the following indicators:

- The sum of the gross product in comparative prices;
- The amount of the product in realizable prices;
- The average annual amount of the main production fund;
- The average annual number of workers;
- The area of vegetables.

Since the efficiency of the system for selling vegetable products produced in greenhouses is low, the degree of profit is reduced. Because, the bulk of the product's profits is distributed to intermediaries and those who buy and sell. To obtain high profits from the sale of a product, it is advisable to expand the ways that bring more profit and to connect with existing retail chains [3, 2017].

In the conditions of self-provision of funds, which is a condition of market relations, when determining the economic efficiency of agricultural production, the role of

indicators (financial stability, solvency, etc.), indicating the financial condition of commodity producers, increases. Under these conditions, financial results and the interconnectedness of repeated production processes play an important role (1-figure).

At the level of commodity producers, the efficiency of vegetable growing in greenhouses is associated with the ability of all components (production relations, resources, product) to carry out the process of extended re-production. Therefore, when assessing the financial and economic activities of commodity producers, it is necessary to determine the degree of use of available resources and re-production.

When growing vegetables in a greenhouse in a guaranteed volume, an acceptable model, reflecting the limitation of widespread use of production resources and land, is drawn up in the following order:

- on the use of greenhouse areas

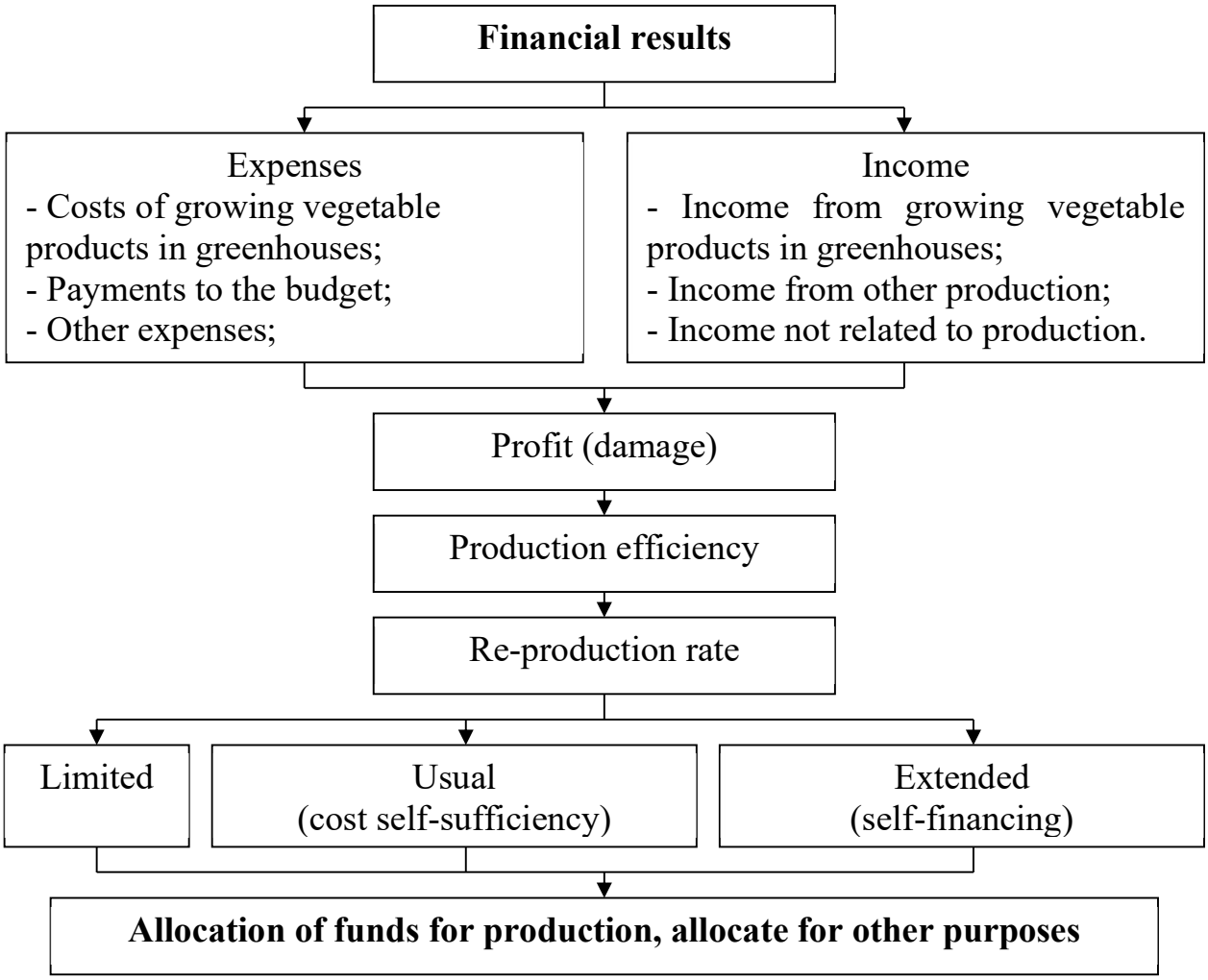
$$\sum_{j=1}^{n} x_j = S \qquad 1,$$

j - changing index;

n - the number of changing;

xj - the occupied sown area in the greenhouse according to the technology type j;

S is the total area of greenhouses.



- By the use of production resources

$$\sum_{j=1}^{n} a_{ij} * x_j \le A_i, i \in M \qquad 2,$$

i - resource type index;

M is the number of types of resources;

a_{ij} - the limit of costs of a resource of type i, suitable for changing unit of type j;

A_i - volume of production resource of type i.

- For the production of vegetable products in the guaranteed volume

$$\sum_{j=1}^{n} V_j * x_j \ge Q_j \qquad 3,$$

V_j - j the yield of a vegetable according to the technology of type j;

Q_j - j guaranteed production volume of a product using technology j;

$x_j \ge 0$ - the condition of not denying the changing ones.

As an optimality criterion, the minimum consumption of production resources (in the form of quantity and amount) and the production of vegetable products to the maximum extent are selected:

- The minimum cost or energy consumption in the form of an amount for the production of vegetable products.

$$\sum_{j=1}^{n} c_{ij} * x_j \to \min \qquad 4,$$

c_{ij} - costs for a changing unit of the form j.

- Gross yield of vegetable products to the maximum extent

$$\sum_{j=1}^{n} V_j * x_j \to \max \qquad 5$$

The ratio of areas in which vegetable products are grown using different technologies affects the distribution and amount of expenditure of material costs and energy costs.

Evaluation of the efficiency of growing vegetable products in greenhouses according to several criteria makes it possible to choose the most correct option for the acceptability of different types of greenhouse areas.

III. Conclusion

The above economic-mathematical model for farms makes it possible to assess the range of products grown, crop rotation, production and financial resources of farms, technologies used and form an acceptable system of technologies.

An increase ²in production volume, product sales, reorganization of the preparation system will lead to an increase in profit growth and the degree of profitability.

Increasing the efficiency of growing vegetables in greenhouses, its development and ensuring growth, long-term plans for the future in order to increase the share of vegetable products on the market requires the improvement of some elements of production technology (seed treatment with a laser, use of high-quality seeds) and preparation technology (expansion of the existing preparation of technologies , introduction of new sales channels, improvement of the packaging system, expansion of assortments, advertising, formation of marketing services, etc.).

The results of solving the problem of reorganizing the preparation system in growing vegetables in greenhouses shows the need to develop a system of trade enterprises, supermarkets that buy grown products in bulk, dealers engaged in retail trade, and the widespread introduction of a cooperation system.

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