

UDC 664

ECONOMIC EFFICIENCY OF PRODUCTION OF BERRY SEMI-FINISHED PRODUCTS USING CRYOPROTECTANTS

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Abstract. One of the key factors in assessing the economic efficiency of production is not only the quality of the product, but also the profit from its sale. To calculate the cost of production, it is necessary to determine all costs that occur in the production process (the purchase price of raw materials, wages, electricity and other auxiliary costs related to the business and production activities of the enterprise).

Keywords: the economic efficiency, cost, freezing fruit and berry, cryoprotectants, vitamin C.

According to traditional technology, berries are frozen in a freezer without air circulation at a temperature of -20°C for 150-180 minutes. Pre-treatment of berries with solutions of cryoprotectants (berries are immersed in a solution of cryoprotectants for 40-60 minutes) together with the use of shock freezing (in a quick-freezing chamber with air circulation at a speed of 4...6 m/s and a temperature of -36°C for 20...30 minutes) in the technology of production of frozen berries makes it possible to significantly reduce the technological process from 150...180 minutes to 70...80 minutes.

It is known that any of the options for innovative measures has both advantages and disadvantages. Valuations are the only form of indicators that allows you to compare these disparate values, which include many technical, social and economic characteristics. Such an assessment can be made only through income and expenditure indicators.

Changes that occur as a result of the implementation of the proposed technology can affect the company's income in the following three directions:

- for changes in the volume of products sold per unit of time, i.e., quantitative indicators of productivity;
- due to changes in the price of a product unit, i.e. its quality characteristics;
- by changing the time period of the economic process.

Another component that determines the size of the economic effect is the amount of costs associated with the implementation of a specific measure. This can affect changes in working conditions, prices for resources used, wage levels, as well as technical and economic parameters of production processes.

The raw material for the production of frozen berry products is wild blueberries, which are used both as an independent food product and as a supplement to food rations.

The article "Raw materials and materials" includes the cost of raw materials and materials included in the product or used in the production process. The calculation of costs for raw materials and materials is given in Tables 1-3.

For 100 kg of blueberries, 6.7 liters of 10% sucrose solution were used.

Table 1

Calculation of the cost of raw materials and materials for the production of 100 kg of blueberries frozen with cryoprotector

Type of raw materials and basic materials	Unit	Cost norms for 100 kg of product	The price of a unit of raw materials, UAH.	Amount, UAH
Blueberry berries	kg	99,9	40	3996
Saccharose	kg	0,67	62,00	41,54
Together				4037,54

Based on the above data, the expenses for the article "Raw materials and materials" amount to 3038,54 UAH per 100 kg of product.

The costs of raw materials and materials in new types of products are increased due to the use of a cryoprotectant solution.

Calculation of costs for fuel, energy for technological purposes. This article includes costs for all types of fuel and energy, which are spent on technological needs during the implementation of the main production, which can be obtained both from third-party organizations and manufactured at the enterprise itself. The calculation of the cost of energy consumption is given in Table 2.

Table 2

Calculation of the cost of energy consumption by species per 100 kg of frozen semi-finished products

Types of berries	Unit	Price per unit, UAH.	Consumption rate per 100 kg	Amount, UAH
Blueberries are frozen using traditional technology	kWh	2,75	55	151,25
Blueberries are frozen with cryoprotectants	kWh	2,75	65	178,75

Calculation of the basic salary according to the costing article "Basic salary" refers to the costs of paying the basic salary of workers, calculated in accordance with the payment systems adopted by the company, in the form of tariff rates (salaries) and piece rates for workers engaged in the production of products.

The technological line for the production of frozen semi-finished products employs 2 sorters, an automatic line operator and a packer.

The duration of the shift is 8 hours.

Table 3

The basic salary of workers working under the hourly wage system

Profession	Number of workers per shift	Hourly tariff rate, UAH	Shift duration, hours	The tariff fund of variable wages, UAH
Sorter	2	25,13	8	402,08
Automated line operator	1	60,28	8	482,84
Packer	1	25,13	8	201,4
In total	4	-	-	1086,3

The rate of production per change of frozen blueberries (according to traditional technology) is 400 kg. The basic salary for 400 kg of berries is 1086,3 UAH.

Pre-treatment of berries with solutions of cryoprotectants together with the use of shock freezing in the production technology of frozen berries makes it possible to significantly reduce the technological process from 150 to 180 minutes to 70 to 80 minutes.

Therefore, the rate of production for a change of frozen berries with cryoprotectors is 800 kg. Basic salary for 100 kg of berries (table 4):

$$1086,3 / 8 = 135,79 \text{ UAH.}$$

Calculation of additional wages. Additional wages include payments to the production staff of the enterprise, which are calculated for work above the established norms, for labor successes and ingenuity, and for special working conditions. It includes additional payments, allowances, guarantee and compensatory payments provided for by law, bonuses related to the performance of production tasks, payment of vacations and other unworked time.

Table 4

Calculation of additional wages

Types of berries	Basic salary per 100 kg of product, UAH	Amount of surcharges, %	Additional salary, UAH
Blueberries are frozen using traditional technology	271,58	110,00	298,74
Blueberries are frozen with cryoprotectants	135,79	110,00	149,37

The article "Single social contribution" includes deductions for social needs and makes up 22.0% of the wage fund.

Calculation of costs for maintenance and operation of the equipment includes:

The cost of maintenance and operation of the equipment can be taken at the level of 70% of the basic salary of the workers (table 5).

Blueberries, frozen according to traditional technology:

$$271,58 * 0,70 = 190,11 \text{ UAH /100 kg}$$

Table 5**Calculation of the single social contribution**

Types of berries	Wages per 100 kg, UAH		Total wage fund, UAH	Social contribution, %	Amount of enrollments for wages, UAH
	basic	additional			
Blueberries are frozen using traditional technology	271,58	298,74	570,32	22	125,47
Blueberries are frozen with cryoprotectants	135,79	149,37	285,16	22	62,73

Blueberries frozen with cryoprotectants:

$$135,79 * 0,70 = 95,05 \text{ UAH}/100 \text{ kg}$$

Calculation of general production costs. The article "General production costs" includes costs for:

- production management; include costs for wages and deductions for social events of the management apparatus of workshops and divisions; payment of business trips for the personnel of workshops and divisions; costs for the purchase of specialized literature; expenses for raising the professional level;

- sums of payments paid by the lessee for the use of fixed assets, other non-current tangible assets and intangible assets of general production purpose provided for operational leasing (rent);

- depreciation of fixed assets and intangible assets of general production purpose;

- non-capital expenditure related to the improvement of production technology and organization, improvement of product quality;

- costs for maintenance of the production process (provision of production with raw materials, materials, fuel, energy, tools, intra-factory movement of goods); for the maintenance, operation, technical inspection and maintenance of the main means of workshop purpose; implementation of technological control over the production

process; maintenance of general production personnel engaged in maintenance of the production process;

- expenses for labor protection (providing and conducting medical examinations of workers; providing special clothing; ensuring compliance with the rules of occupational safety and health, sanitary and hygienic requirements);

- expenses for fire and security guards;

- fee for the use and maintenance of signaling devices, for telephone services provided for production needs;

- taxes, fees and other mandatory payments directly related to the production process provided by law (land tax, vehicle owner tax, environmental pollution fee, local taxes and fees, utility tax);

- payments for insurance of risks of civil liability related to the operation of vehicles that are part of production funds of general production (shop) purpose;

- expenses for heating, lighting, water supply and other maintenance of industrial premises;

General production costs are accepted in the amount of 70% of the basic salary of workers.

Blueberries, frozen according to traditional technology:

$$271,58 * 0,70 = 190,11 \text{ UAH} / 100 \text{ kg}$$

Blueberries frozen with cryoprotectants:

$$135,79 * 0,70 = 95,05 \text{ UAH} / 100 \text{ kg}$$

The production cost of 100 kg of products will be: according to the traditional technology - 5223,26 UAH, according to the improved technology (with cryoprotectors) - 4754,28 UAH.

Sales costs of 9% for frozen semi-finished products from production cost: according to traditional technology – 470,09 UAH, according to improved technology (with cryoprotectors) – 427,89 UAH.

We accept administrative costs in the amount of 10% of the production cost: according to the traditional technology - 522,33 UAH, according to the improved technology (with cryoprotectors) - 475,43 UAH.

Table 6

Calculation of frozen semi-finished products according to traditional production technology and according to improved technology (using cryoprotectants)

№	Names of costing articles	Costs per 100 kg, UAH.	
		By traditional technology	Using improved technology (with cryoprotectors)
1	Raw materials and materials	3996	4037,54
2	Fuel and energy	151,25	178,75
3	Basic salary	271,58	135,79
4	Additional salary	298,74	149,37
5	Single social contribution	125,47	62,73
6	Equipment maintenance and operation costs	190,11	95,05
7	Total expenditures	190,11	95,05
8	Production cost	5223,26	4754,28
9	Administrative expenses	522,33	475,43
10	Selling expenses	470,09	427,89
11	Full costs of production and sale of products	6216,02	5657,60

Table 7

Calculation of the selling price of frozen semi-finished products according to the traditional production technology and according to the improved technology (with the use of cryoprotectants)

	Indicators	The amount, UAH	
		By traditional technology	Using improved technology (with cryoprotectors)
1	Full costs	6216,02	5657,60
2	Profitability, %	20	20
3	Profit	1243,20	1131,52
4	Selling price of the enterprise (without VAT)	7459,22	6789,12
5	VAT 20%	1491,84	1357,82
6	Selling price with VAT	8951,06	8146,94
7	Selling price for 1 kg	89,51	81,47

Table 8

Calculation of profit per production rate for changing frozen semi-finished products according to traditional production technology and according to improved technology (with the use of cryoprotectants)

Indicator	By traditional technology	Using improved technology (with cryoprotectors)
Income, UAH	29836,88	54312,88
Total costs for production and sale of products, UAH	24867,08	45260,8
Profit, UAH	4972,8	9052,08

While maintaining high quality and an acceptable price, we get competitive products on the market that bring profit (tables 6-8). This allows us to say that it is possible to establish the production of frozen blueberries from local raw materials at processing enterprises.

Conclusions. An economic calculation of the production efficiency of berry semi-finished products was carried out. The rate of production per change of frozen blueberries (according to traditional technology) is 400 kg. Pre-treatment of berries with solutions of cryoprotectants together with the use of shock freezing in the production technology of frozen berries makes it possible to significantly reduce the technological process from 150...180 minutes to 70...80 minutes.

Therefore, the rate of production for changing frozen berries using improved technology using cryoprotectants is 800 kg.

The profit per production rate for the change of frozen semi-finished products according to the traditional production technology and the improved technology with and 9052,08 UAH using cryoprotectors amounts to 4972,8 UAH, respectively.

Our improved technology for the production of frozen berry semi-finished products made it possible to obtain competitive products. The resulting frozen semi-finished products are promising for sale both on the domestic market and as export-oriented products. Based on them, it is quite possible to form a stable market of frozen fruits and berries, which are fully capable of overcoming the vitamin

deficiency in the diet of the population during the period of absence of fresh raw materials.