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Design of specialized workshops to produce homogenized vegetable pastes and marinades for agriculture

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Abstract. Recently, in Krasnoyarsk, there has been an increased demand for local plant products, in particular, for vegetable pastes and marinades. An important aspect is the fact that the products should be as useful as possible, have high taste qualities and be from local producers. This article proposes the idea of opening a shop for the production of homogenized pastes and marinades from local vegetables with the addition of squeezed cowberries and cranberries with enhanced microbiological resistance for implementation in the food industry.

1. Introduction

At present, fruit and vegetable canned food and pickles are especially popular among the population of the Russian Federation. On the one hand, this product is a source of beneficial substances (dietary fiber, pectin, β -carotene, lycopene, etc.) for the human body, and on the other hand, it has an adverse effect on the digestive system and the human body as a whole, due to artificial preservatives, stabilizers, emulsifiers, etc. It is possible to solve this problem by developing new types of canned fruits, vegetables and marinades. Food products containing natural sources of preservative substances (organic acids) will be added as preservatives, suppressing the development of pathogenic microflora and thereby increasing the shelf life of canned products.

Wild cowberry and cranberry may be of practical interest as promising sources. Since these berries are sources of organic acids and, in particular, benzoic. Benzoic acid is widely used in the food industry as a preservative. This acid is slightly soluble in the aquatic compartment, therefore, is minimally absorbed in stomach, intestinal tract and excreted unaltered from the body. Of particular interest, as a natural source of benzoic acid, are secondary raw materials (waste juice production), cowberries and cranberries squeezing. Berries squeezing can be used as preservatives for the production of homogenized pastes and marinades of enhanced microbiological resistance. Therefore, the development of new formulas, technological schemes for producing canned fruit and vegetable products and designing specialized workshops for their production is one of the topical directions in the development of food industry. This concept is consistent with the state policy of the Russian Federation until 2020, providing for the design of specialized production of new types of products for a balanced diet.

The purpose of this study is to develop new formulas, technological schemes for producing canned fruit and vegetable products and to design a specialized workshop for their production.

To achieve this goal, the following tasks were solved:

- To develop new formulas and technological schemes for producing canned fruit and vegetable products of enhanced microbiological resistance.



- To assess the effectiveness of application of new technologies for the production of canned fruit and vegetable products for a rational and balanced diet.
- To design a specialized workshop for the production of canned fruit and vegetable products of high microbiological resistance.
- Estimation of the economic efficiency of designing the specialized workshops.

2. Materials and methods of research

Objects of study: homogenized vegetable pastes and marinades; the project of a specialized workshop for the production of homogenized pastes and marinades.

In this paper, generally accepted methodologies for conducting technological calculations and estimating the economic efficiency of designing the specialized workshops were used.

3. Research results

We have developed new formulas of homogenized pastes and marinades with cowberry and cranberry squeezing with enhanced microbiological resistance:

- homogenized vegetable paste with cowberry and cranberry squeezing (GOPVB, GOPVK);
- homogenized beet paste with cowberry and cranberry squeezing (GSPVB, GSPVK);
- homogenized vegetable marinade with cowberry and cranberry squeezing (GOMVB, GOMVK);
- homogenized beet marinade with cowberry and cranberry squeezing (GSMVB, GSMVK).

The quality and safety indicators of the developed homogenized pastes and marinades are investigated. Which, in accordance with the technical regulations of the Customs Union "On the safety of food products" (TR TS 021/2011) do not exceed the maximum permissible levels.

It is not advisable to produce such a product in a single enterprise, since it is not profitable on the scale of a single establishment, therefore it is advisable to design and open a vegetable workshop with a department for preparing homogenized pastes and marinades that can be sold to various catering establishments and retail chains.

The implementation of the idea involves the organization of a workshop in the city of Krasnoyarsk or its suburbs. One of the important factors is that the purchase of vegetable products will be carried out not only from major suppliers, but also from local farmers and farms.

To determine the feasibility of opening a workshop, a survey was conducted among the heads of various catering establishments (30 establishments) and large retail stores (Komandor, Krasny Yar, Lenta, Alleya).

As a result of the survey, it was found that there is a need for a workshop for the production of fruit and vegetable pastes and marinades, since the question: "Are vegetable pastes and marinades in demand?" 75% of respondents answered positively. 68% of respondents answered positively to the question: "Would you like to purchase similar products for your establishment (store)?"

The next question was about pricing: "What would be the best price for one kilogram of paste and marinade?" Distribution of answers to this question is presented in the figure 1.

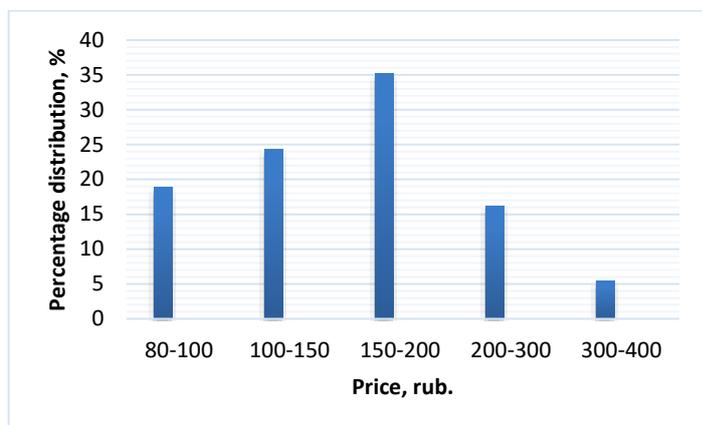


Figure 1. Structure of answers about the products price, %.

Thus, according to the results of the survey, it was revealed that the need for designing this workshop is appropriate. The price of this product should not be high, while the product must have excellent gustatory qualities, and of course provide health benefits.

The projected workshop will consist of five sections: a cooled chamber for storing vegetables; area for the preparation of vegetables; area for pastes and marinades preparation; area for packaging the products and expedition of finished products; room for cleaning equipment and containers.

Area calculation with a complete list of technological equipment to be installed is made. The table 1 shows the lines and areas of the designed workshop with an indication of the necessary equipment.

Table 1. Lines and areas of the workshop for the production of homogenized pastes and marinades.

Line name	Technological operations	Equipment for the mechanization of technological processes
Area of washing, cleaning and cutting vegetables		
The production line of raw, peeled and chopped vegetables and root crops	Washing, cleaning, cleaning, washing, cutting	Inspection conveyor, Production line for washing and cleaning raw vegetables and root crops, machine for cutting raw vegetables (Vegetable cutter Robot coupe CL 20)
The berry components preparation line	Unpacking, inspection, defrosting, sorting, drying	Inspection conveyor, Culinary machining production line
Culinary area of the workshop for the production of homogenized pastes and marinades		
The line browning onions, root vegetables, tomatoes	Stirring, browning	Food cooking boiler overturning with a stirrer (Firex PR IE 500 M), electric frying pans, steam cooker of periodic action
The area of heat processing of vegetables and root crops	Heat treatment of vegetables and root vegetables	Food kettle tilting with stirrer (Firex PR IE 500 M)
The area of homogenization pastes and marinades	Homogenization of pastes and marinades	Industrial Blender RY Blender - B32L
The packaging and labeling area		Functional tanks, AD-5 scales, containers, racks of SP-230

Products are packaged in sterile 1-liter glass jars and transported in cardboard boxes to sales companies.

On the basis of calculations and sanitary standards, we take the following values of the room space: a cooled storage chamber for vegetables - 5 m²; the area for preparation of vegetables - 8.5 m²; the area for the preparation of pastes and marinades - 7 m²; the area for packaging products and expedition of finished products - 6 m²; the area for cleaning equipment and containers - 5 m². Because of limited

space, it is possible to organize the workshop in an already rebuilt building, in a room with a total area of 35-40 m².

The initial investment required to organize the work of the workshop amounts to 913.7 thousand rub. (table 2).

Table 2. The calculation of the initial investment in the design of the workshop.

Equipment identification	Model	Quantity, pcs.	Price ¹ , thou.rub.	Amount, thou.rub.
Production floor stand	PT - 600/3	2	6,2	12,4
Rack stationary	STK - 600/400	3	12,7	38,1
Onion production table	SPL	1	14,2	14,2
Production table	SP-2/1200	4	4,8	19,2
Washing bath	VSM-1/530	3	8,5	25,5
Mobile shelving	SP-230	3	7,9	23,7
Production table	CPH-1/600	1	3,6	3,6
Washbasin	BPK	4	5,9	23,6
Vegetable cutter	Robot coupe CL 20	1	60,5	60,5
Cooking pot	Firex PR IE 500 M	1	328,1	328,1
Refridgerator	IIIX-0,40M	2	38,6	77,2
Industrial blender	Blender RY - B32L	1	32,0	32,0
Table scales	AD-5	1	11,3	11,3
Dishwasher	OBY500	1	95,4	95,4
Total for the acquisition of fixed assets				764,8
Organizational costs				300
Total investment				1064,8

The expected average cost of one can of pasta and marinade is 190 rub. The annual turnover of the workshop for 210 working days, according to calculations, will be 9, 576 thou. rub. The cost of the raw materials (cost of sales) – 6, 840 thou. rub. The amount of commercial expenses (costs of public catering) according to calculations will be 1502, 6 thou. rub. per year (table 3).

Table 3. Calculation of the expected profit from the project.

Indicators	Units	Annual volume
1. Product release	thou.kg	50,4
2. Proceeds from sales without VAT	thou. rub.	9576,0
3. Cost of production	thou. rub.	6840,0
4. Selling expenses, total	thou. rub.	1502,6
Including:		
- labor costs and social needs	thou. rub.	732,1
- depreciation	thou. rub.	107,9
¹ Prices are from the catalog of the company “Trade design” http://www.t-d.ru		
- electricity costs	thou. rub.	27,6
- rent	thou. rub.	240,0
- the cost of dishes	thou. rub.	120,0
- other expenses	thou. rub.	275,0

4. Pre-tax profit	thou. rub.	1233,4
5. Tax on the simplified tax system (15%)	thou. rub.	185,01
8. Net profit	thou. rub.	1048,4
10. Amount of investment	thou. rub.	1064,8
11. Project payback period	years	1,02

As a result of the decrease in revenues by the amount of expenses, the pre-tax profit in the first year of work is projected to be 1,233.4 thou. rub., the net profit is 1048.4 thou. rub.

Logistics costs reducing is achieved by a clear organization of a single product distribution process from a supplier to an end customer, the purpose of which is to minimize the costs for purchasing, transporting, storing to the required level and accelerating capital turnover by minimizing stored reserves. It is important to conduct regular monitoring of purchase prices for the most expendable items; this will eliminate unnecessary costs, and thereby contribute to the preservation and increase profits.

Currently, projects that provide a return on investment in 2-3 years are effective. According to the calculations, the payback period of financial investments in the implementation of the plant opening project is 1.02 years.

Based on the research and calculations, we can conclude that the proposed idea of opening a workshop for the production of homogenized pastes and marinades with the addition of squeezed cowberries and cranberries with increased microbiological stability is beneficial.

4. Conclusions

1. Formulas and technological schemes for the production of homogenized vegetable pastes and marinades of increased nutritional value have been developed.
2. The efficiency of the introduction of new technologies for the production of canned fruits and vegetables for a rational and balanced diet is justified.
3. A project has been developed for a specialized workshop for the production of canned fruit and vegetable products of enhanced microbiological resistance.
4. The economic efficiency of the design of specialized workshops has been justified.

References

- [1] Ruse K and Rakcejeva T 2014 Physical and chemical parameters of Latvian fresh cranberries *FOODBALT* 167–71
- [2] Çelik H, Özgen M, Serçe S, and Kaya C 2008 Phytochemical accumulation and antioxidant capacity at four maturity stages of cranberry fruit. *Scientia Horticulturae* **4** 345–8
- [3] Beattie J, Crozier A and Duthie G G 2005 Potential health benefits of berries. *Current Nutrition & Food Science* **1** 71-86
- [4] Borges G, Degeneve A, Mullen W and Crozier A 2010 Identification of flavonoid and phenolic antioxidants in black currants, blueberries, raspberries, red currants and cranberries. *Journal of Agricultural and Food Chemistry* **58** 3901-9
- [5] Borowska E J, Szajdek A and Borowski J 2005 Antioxidant properties of fruits, vegetables and their products. *Fruit Processing* **Jan./Feb** 38-43
- [6] Brand-Williams W, Cuvelier M E and Berset C 1995 Use of a free radical method to evaluate antioxidant activity. *LWT-Food Science and Technology* **28** 25-30
- [7] Bravo L 1998 Polyphenols: chemistry, dietary sources, metabolism, and nutritional significance. *Nutrition Reviews* **56** 317-33
- [8] Cooke D, Steward W P, Gescher A J and Marczylo T 2005 Anthocyanin from fruits and vegetables – does bright colour signal cancer chemopreventive activity? *European Journal of Cancer* **41** 1931-40
- [9] Franke A A, Custer L J, Arakak I C and Murphy S P 2004 Vitamin C and flavonoid levels of fruits and vegetables consumed in Hawaii. *Journal of Food Composition and Analysis* **17** 1-35
- [10] Galvano F 2005 The chemistry of anthocyanin. *Functional ingredients magazine* **7** 1-6