

Profitability analysis of the establishment of currant and gooseberry plantations for obtaining and processing the fruits in pasteurized juice

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Abstract. Currants and gooseberries are part of the category of consumer goods, being appreciated both for their special taste and for their healing properties, being very rich in antioxidants and bringing health benefits, and for this reason they are used in food and pharmaceutical industry. The paper presents: the description of the area chosen for the establishment of the plantation, the currant and gooseberry varieties, diseases and pests, the planting technology, maintenance and harvesting of the fruits and the economic analysis of the business.

Keywords: *Currants, gooseberries, juice, pests, technology, economic analysis.*

Introduction

Blackcurrant and gooseberry are specific with early fruiting, from the fourth year after planting, with growing productions up to the 6th year. The fruits are rich in vitamin C, organic acids and mineral salts with a role in strengthening the human body and improving health.

In addition to the fruits, consumed in processed, frozen or dehydrated form (teas), the leaves and especially the buds, which are rich in essential volatile oils with antibacterial and cicatrizing properties, can also be used.

The main blackcurrant varieties grown in our country are: Tsema, Deea, Abanos, Amurg, Perla negrag, Record 35, the redcurrants: Early Red, Jonkheer van Tets, Abundent, Houghton Castle, and the whitecurrants: Pearl, Blank and Smoleaninovskaya.

Gooseberry varieties are divided into two groups, namely varieties with thorns (Ruschii and Invicta) and varieties without thorns (Verda). The fruits have various colors from pale green, yellowish green to greenish yellow and from pink to dark red or violet.

The most common diseases and pests of currant and gooseberry are: *Pseudopeziza ribes*, *Sphaerotheca mors-uvae.*, *Cronartium ribicola*, *Botrytis cinerea*, *Abraxas grossulariata*, *Synanthedon tipuliformis*, *Quadraspidiotus perniciosus* and *Cryptomyzus ribis*.

The technology of establishment and maintenance of currant and gooseberry culture*a) Technology of establishment until entering the fruit*

Land preparation. It consists in removing the plant residues of the preceding crop at least two months before planting, followed by the leveling of the land and the execution of a deep plowing of 35-50 cm.

Lands sheltered from winds and cold air currents are chosen.

Density. Planting density is chosen depending on soil maintenance work and fruit harvesting technology 1.5 m is chosen between the rows, and 0.8 m is chosen between the cuttings on the same row.

Support system. The support system is made of concrete trellises with three or four wires and a distance between them of 8 m.

Irrigation system. Two irrigation systems can be used, namely sprinkler irrigation or drip irrigation.

Planting period. Planting of cuttings is carried out in autumn at the end of October. The cuttings are planted so that the entire root and 3-4 cm of the stem enter the planting hole. The soil is compacted very well around the plant and 5 - 6 liters of water are added.

Ground maintenance. Between the rows and in each row, the land is kept clean by performing weeding and weeding works. Spacing between lines is not recommended.

b) Technologies applied after entering the fruit

Irrigation. During dry periods, sprinkler or drip irrigation is done 5 - 7 times per season depending on the rainfall during the growing season.

Fruiting cuttings. It is carried out starting from the 6th year when the crown of the bush is fully formed, the broken, diseased, dry branches and those that fill the bush are removed. The lateral branches are shortened to a length of 20-25 cm.

Ground maintenance. It is kept free of weeds along the row by hoeing or mulching.

Fertilization. NPK doses of 15:15:15 are applied in fruit plantations.

Fruit harvesting and storage. Fruit harvesting is chosen according to the method of utilization. For industrial processing, picking begins in May, when the fruits are still green. For fresh consumption, the fruits are harvested at full maturity, when the skin is transparent, and the pulp is soft. Fruits are stored in cool rooms for 5-6 days or in cold stores at a temperature of -0.5-1.0 0C for 7-8 weeks. Harvesting is done manually or mechanized.

Presentation of the planting plan and the technological stages**I) Planting plan**

It is proposed to establish a plantation of fruit bushes of the currant and gooseberry species in Bălteni commune (Gorj County) on an area of 2 ha, of which 1.5 ha of black currant and 0.5 ha of gooseberry. After analyzing the characteristics of the currant and gooseberry varieties, presented in the specialized literature, it was decided to cultivate blackcurrant of the *Tsema* variety, and for gooseberries, the *Verda* variety.

The proposed plantation plan for the project implementation period is presented in table 1.

Table 1. Plantation plan

Current Number	Plantation Name	Planting Area [ha]
1	Currant	1.5
2	Goosberry	0.5
Total		2

A modern, intensive system of establishment and exploitation of the mixed currant/gooseberry culture will be adopted within the fruit bushes plantation, characterized by the application of efficient work methods that require minimal labor consumption and low operating costs. The realization of the project will mean the capitalization of a whole series of economic opportunities (free land, access to the road,

free water) and social (creation of new jobs), with favorable effects in the development of the local economy (local input suppliers will be stimulated). services, etc.), as well as in increasing local budget revenues.

II) Calculation of the material requirements for the establishment of the plantation

Calculation of the nutrition area for the currant plantation in an intensive system

$$\begin{aligned} N_s &= R_d \cdot P_s \\ &= 4 \cdot 0.5 \\ &= 2 \text{ m}^2 \end{aligned}$$

Where:

N_s – nutrition space;

R_d – distance between rows (4 m);

P_s – the space between plants in a row (0.5 m).

Calculation of the number of cuttings for the cultivated area of 1.5 ha

$$\begin{aligned} C_r &= \frac{P_a}{N_s} + p \\ &= \frac{15,000}{2} + 10\% \\ &= 7,500 + 750 \\ &= 8,250 \text{ currant cuttings} \end{aligned}$$

Where:

C_r – the number of cuttings required;

P_a – the area that is desired to be planted ($P_a = 15,000 \text{ m}^2$);

N_s – nutrition space (2 m²);

p – required filler cuttings (10% of C_r).

Calculation of the nutrition area for gooseberry plantation in intensive system

$$\begin{aligned} N_s &= R_d \times P_s \\ &= 1.5 \times 0.8 \\ &= 1.2 \text{ m}^2 \end{aligned}$$

Where:

N_s – nutrition space;

R_d – distance between rows (1.5 m);

P_s – the space between plants in a row (0.8 m).

Calculation of the number of cuttings for the crop area of 0.5 ha

$$\begin{aligned} C_r &= \frac{P_a}{N_s} + p \\ &= \frac{5,000}{1.2} + 10\% \\ &= 4,166 + 416 \\ &= 4,582 \text{ goosberry cuttings} \end{aligned}$$

Where:

Cr – the number of cuttings required;
 Pa – the area that is desired to be planted ($Pa = 5,000 \text{ m}^2$);
 Ns – nutrition space (1.2 m^2);
 p – required filler cuttings (10% of Cr).

III) Calculation of water requirements

The water requirement for the 1.5 ha of blackcurrants

$$\begin{aligned} Q_{H_2O} &= N_u \cdot Nr_w \\ &= 280 \cdot 10 \\ &= 2,800 \text{ (m}^3/\text{ha)} \cdot 1.5 \\ &= 4,200 \text{ m}^3 \end{aligned}$$

Where:

Q_{H_2O} - the water requirement for irrigation of the plantation during the growing season.
 No – watering norm ($280 \text{ m}^3/\text{ha}$).
 Nr_w – the number of waterings (10 waterings).

The water requirement for the 0.5 ha of yellow gooseberry

$$\begin{aligned} Q_{H_2O} &= N_u \cdot Nr_w \\ &= 320 \cdot 5 \\ &= 1,600 \text{ (m}^3/\text{ha)} \cdot 0.5 \\ &= 800 \text{ m}^3 \end{aligned}$$

Where:

Q_{H_2O} - the water requirement for irrigation of the plantation during the growing season.
 No – watering norm ($320 \text{ m}^3/\text{ha}$).
 Nr_w – the number of waterings (5 waterings).

Description of the technological flow for obtaining currant and gooseberry juice

The technology of obtaining juice, the production of currants and gooseberries goes through the following stages:

Qualitative and quantitative reception. The qualitative reception consists of:

- the external examination of the batch;
- the organoleptic examination (taste, smell, aroma);
- physical-chemical analyzes (consistency, pH, acidity, soluble dry matter).

Temporary storing. Only if the flow of raw material exceeds the processing capacity, temporary storing carried out.

Sorting. The sorting of the fruits will be done on each batch separately. On this occasion leaves, unripe fruits, rotten fruits, crushed fruits or other impurities will be removed.

Washing. The washing operation must be carried out in order to completely remove any mineral impurities (traces of earth), but especially to remove any traces of the chemical substances used in the treatments against pests.

Cleaning. The rachis and peduncle of the fruits are removed.

Crushing. A good crusher must cut a homogeneous, fine-grained pulp, without large pieces, but without a pasty consistency.

Pasteurization - cooling. The operation of heating the crushed currants/gooseberries is particularly important because the anthocyanin substances are mainly located in the skin, being difficult to extract by pressing.

Enzymatic maceration. It is the operation through which the fruits are thermally treated to facilitate the extraction of coloring substances from the skin.

Pressing. It is the most used method for obtaining juices.

Enzymatic clarification. It is recommended for treating juices rich in pectic substances and for obtaining concentrated juices, in order to reduce viscosity and avoid the phenomenon of gelation.

Filtering. This operation is necessary to ensure the transparency and stability of the product.

Preparation of sugar syrup. To prepare the sugar syrup, calculate and weigh the amount of sugar required for production depending on the variety of currants/gooseberries and the size of the mixture, then calculate the volume of water required.

Coupling. Assembling the ingredients to obtain the blend is based on two processes:

- a physical process, of dissolving the ingredients;
- a mechanical, mixing and homogenizing process.

The principle underlying the preparation of the blend is "what dissolves in what".

Packaging. The packaging of the products must process from fruits and vegetables must exclude any possibility of their contamination involving two distinct technological operations: dosing the product and closing the container.

Pasteurization. Pasteurization aims to destroy the remaining microorganisms in the juice to prevent it from spoiling during the warranty period.

Storing. The purpose of storage is to preserve the integrity and quality of the finished product.

Table 2 shows the material balance centralizer.

Table 2. Material balance for obtaining currant and gooseberry juice

Operation	The amount of incoming materials, kg/day	The amount of materials released, kg/day	Loss
1. Qualitative and quantitative reception	500	500	0%
2. Temporary storing	500	490	1%
3. Sorting	490	475.3	3%
4. Washing	475.3	467.87	1.5%
5. Cleaning	467.87	463.2	1%
6. Crushing	463.2	460.9	0.5%
7. Pasteurization	460.9	459.75	0.25%
8. Cooling	459.75	458.6	0.25%
9. Enzymatic maceration	458.6	456.346	0%
10. Pressing	456.346	296.692	1%
11. Enzymatic clarification	296.692	296.707	0%
12. Filtering	296.707	293.729	1%
13. Coupling	1650.559	1642	0.5%
14. Packaging	1642	1,633.79	0.5%
15. Pasteurization	1633.79	1,633.79	0%
16. Storing	1633.79	1,633.79	0%

Table 3 shows the indicators of the economic efficiency of establishing a currant and gooseberry plantation for the successful transformation of production.

Table 3. Calculation of economic efficiency indicators

Current Number	Indicator	Value
1	Turnover-T	1.237.721,70
2	Annual profit- A_p	189.254,084
3	Profit Rate- $P_r = T/A_p$	0.152
4	Payback period- $P_r = I/A_p$	6.5 years
5	The investment efficiency coefficient- $E_i = I/P_r$	190,418

Where: P- production = 163,379.00 liters of juice/season; I – investment = 1,237,721.70 Lei.

Conclusions

For currant culture, the most favorable soils are fertile, rich in organic matter, light, well-drained: alluvial, clay-sandy, clay-loamy and even clayey if they have good water drainage.

Gooseberry prefers deep, well-drained, loamy-sandy, sandy-loamy soils with a high humus content, with a pH of 5.5-7.5.

The main diseases and pests of currants and gooseberries are the followings: anthracnose, powdery mildew, rust, gray rot, leaf spot, stem borer, San Jose aphid and yellow aphid.

Currants and gooseberries are marketed in two quality classes: quality I and quality II - a.

Since currants and gooseberries are very perishable, a technological line for obtaining currant and gooseberry juice will be created with a processing amount of 500 kg/8 hours of operation. From the production of currants and gooseberries that will be produced starting from the fourth year of the plantation, 10% of the production will be sold fresh and 90% will be processed in the form of juice. The calculations resulted in a production cost of 5.79 lei/liter of juice and a minimum delivery/sale price of 7.57 lei/liter. The recovery period of the investment that will be made for the establishment of the plantation and the realization of the processing line is 6.5 years.

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