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ORGANIC SWEET POTATO PRODUCTION AND MARKETING IN ROMANIA – A CASE STUDY ON CHALLENGES AND OPPORTUNITIES

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Abstract

In Romania, demand for organic food has surged since the pandemic began in the spring of 2020. Healthy growth is expected to continue in the coming years as consumers associate organic foods with good health, nutrition, and wellness. The complex challenge of protecting ecosystems while sustainably feeding the global population has attracted increasing attention in recent years and the need for improving food production and consumption led to the development of this field. The present study represents a comparative economic analysis of the sweet potato crop in a conventional and organic system. Data on production costs (materials, labour, mechanical works) as well as data on the commercialization of production, including preparatory activities for marketing (packaging, marketing conditioning) were taken into account. Following the analysis, cost efficiency proposals are highlighted in order to improve the producer's economic performance.

Key words**:** *organic agriculture, sweet potato, sustainable food, protecting ecosystems, Romania*

INTRODUCTION

In Romania, over the course of 10 years, from 2011 to 2021, the market for organic products grew four times, rising from 10.16 to 40.5 million euros [8]. Increased interest in organic products is the result of a mixture of factors, including Romania's growing economy, a greater focus among retailers on green products, and increased awareness among consumers of healthy food and the environment.

Sweet potato (*Ipomoea batatas* L.) plays an old and important role in food culture worldwide, being a highly nutritious vegetable species that surpasses most carbohydrate foods in terms of vitamin, mineral, dietary fiber and protein content [20, 3, 1, 19]. Sweet potatoes are cultivated on more than 9 million ha. The corresponding yield is about 124,000 thousand tons, while the average yield is about 13.7 tons/ha [6].

The developing countries are the main cultivators of sweet potatoes, covering over 97% of world output of which more than half representing 4.7 million ha (52%) is cultivated in China.

The rest of Asia accounts for 6 percent, Africa 5 percent, Latin America 1.5 percent, and the United States 0.45 percent. Vietnam is the second largest producer.

The largest European producer is Portugal with only 0.02 percent of world production [6, 7].

Yields differ across regions and, sometimes depending on climate conditions, even fields in the same location [10]. According to Faostat data the average yield in African countries account for 4.7 tons/ha, with yields of, 8.9 tons/ha in Kenya, 4.3 tons/ha Uganda,

tons/ha 2.6 Sierra Leone, and 6.5 tons/ha Nigeria, respectively. In the same tine, in Asian region, the yields resulted are significantly higher, with an average of 18.5 tons/ha as follows: China 20 tons/ha, Japan 24.7 tons/ha, Korea 20.9 tons/ha, Thailand 12 tons/ha. Israel gives the highest yields of 33.3 tons/ha. In South America, the average yield for 2017-208 was 12.2 tons/ha, with Argentina, the lead with 18 tons/ha, respectively. For comparison, the average yield in the US is 16.3 tons/ha (all data are averages for 2017 and 2018 from the FAOSTAT (2019) [7].

Sweet potatoes vary enormously in taste, size, shape, and texture. Sweet potato flesh can be white, orange, yellow, purple, red, pink, and violet, while skin color varies among yellow, red, orange, and brown.

Like in the case of other crops, the profitability of sweet potato production is closely related to yield and the sales price [9, 14, 2, 13]

For several years, intensive work has been conducted by the Research and Development Station for Plant Culture on Sandy Soils Dabuleni (SCDCPN Dabuleni) in order to introduce this plant into the Romanian climate and soil conditions [5]. In a temperate climate, this species is an annual plant, with high adaptability and resistance and has the potential in becoming an alternative crop in South Romania [4].

Tubers, rich in nutrients, are consumed after cooking, frying, or baking, whereas aerial parts can be used as valuable feed for animals or raw material for bioethanol or biogas production [14].

Sweet potato tubers also have high technological potential. In developing countries, all parts of this plant are valued and used in multiple sectors of the food and pharmaceutical industries [17, 11, 16].

According to [12] as well as [15], the sweet potato is a vegetable with broad applicability, mainly used to enrich the everyday diet, as well as a valuable medicinal plant with anti-inflammatory, anti-cancer and anti-diabetic properties, which can be a valuable raw material for the pharmaceutical industry. Sweet potato tubers can also be used in food processing to produce sugar, flour, pasta, desserts, alcohol, and thanks to a high content of vitamins, macro-, and microelements, supplements can be produced.

There are still no up-to-date studies of the production costs of sweet potatoes.

Therefore, the aim of this research was to assess the cost of sweet potato production and sales in Romanian soil, climate, and market conditions.

MATERIALS AND METHODS

The study areas were Dăbuleni Research and Development Station for Plant Cultivation on Sandy Soils (SCDCPN Dăbuleni) in Dolj County for a conventional system and an Organic certified farm from Vâlcelele, Călărași County.

The sweet potato field cultivation technology developed by SCDCPN Dăbuleni in 2018 was applied Diaconu et al. (2018) [4], the density of planting being 40,000 plants/hectare in the conventional system, respectively 35,000 plants/hectare in the organic system.

For the economic analysis were taken into account the production, costs, and prices related to the year 2022. The sweet potato line *DK 19/1*, originating from SCDCPN Dăbuleni, was used as biological material, a genotype characterized by high productivity, white flesh, very sweet, reddish tuberous root skin, with increased tolerance to specific pathogens.

Both locations were equipped with weather stations from which the data related to the sweet potato vegetation period were processed (May 27 - September 20 for the ecological system, respectively May 10 - September 10 for the conventional system).

The soil analyses performed in the biochemistry laboratory of SCDCPN Dăbuleni consisted of determinations of soil pH, organic carbon (%), total nitrogen (%), extractable phosphorus (ppm), exchangeable potassium (ppm), (Table 1), using the following methods:

- total nitrogen – Kjeldahl method;
- extractable phosphorus (P-AL) - the Egner - Riem Domingo method, by which phosphates are extracted from the soil sample with an

acetate - ammonium lactate solution at pH - 5.75, and the extracted phosphate anion is determined colorimetrically as - blue of molybdenum;
- exchangeable potassium (K-AL) – the Egner - Riem Domingo method by which the hydrogen and ammonium ions of the extraction solution replace the potassium ions in exchangeable form from the soil sample which are thus passed into the solution. The dosage of potassium in the solution thus obtained is done by flame emission photometry.
- organic carbon – method of wet oxidation and titrimetric dosing (according to Walkley – Blak in Gogoaşa modification);
- soil pH, potentiometric method.

The economic efficiency analysis consisted of the calculation of effort, effect, and economic efficiency indicators. Effort indicators were calculated such as expenses per hectare (Ch/ha), expenses with the labor force, materials, mechanical works, irrigation, delivery expenses, as well as certification expenses. The effect indicators were reflected by income per hectare and those of economic efficiency by the cost per product unit (C), labor productivity (W), total profit, profit rate (Rp), and expenses per 1,000 lei of income (Ch/1,000 lei income).

For both culture systems, the profitability threshold was also calculated, an indicator capable of providing synthetic information to support farmers' strategic decisions regarding the introduction or expansion of sweet potato cultivation.

$$Qpr = \frac{CF}{p - cuv} \quad \text{.....(1)}$$

where:
Qpr = the physical volume of production at the break-even point;
CF = fixed costs;
p = unit price;
cuv = variable unit cost.

RESULTS AND DISCUSSIONS

Consumption of sweet potatoes in Romania is on a positive trend for the last decade, both as raw material and processed (Figure 1).

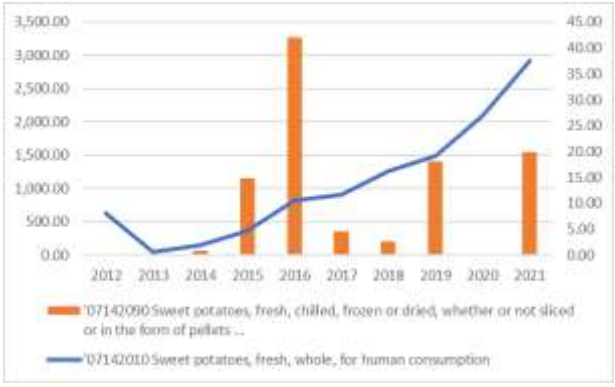

Fig. 1. Quantities (thousand kg) imported in Romania for sweet potato
Source: Trade map data [18].

In 2021, Romania was importing a quantity of sweet potatoes of over 2,900 tons. The main supplying markets were Germany, Egypt, and the United States (Figure 2).

Although import data show that there is demand for this product, in Romania this crop is not so much cultivated.

Fig. 2. Main supplying markets for sweet potatoes in Romania, 2021
Source: Trade map data [18].

Fig. 3. The geographical location of the two case study areas
Source: authors own contribution.

The most important supplier of planting material is SCDCPN Dăbuleni, one of the locations studied in this article.

The two case study areas are both located in Southern Romania, as plotted in Figure 3.

Sweet potatoes in the conventional system at the SCDCPN Dăbuleni are cultivated on sandy soil with low natural fertility. The crop in the organic system from Vâlcelele, Călărași County are cultivated on fertile soil of chernozem type.

Location, soil, and climate characteristics of the case study areas of sweet potato are presented in Table 1.

Table 1. Location, soil, and climate characteristics of the case study areas of sweet potato

Analyzed parameters	Organic certified farm	SCDCPN Dabuleni
Longitude	27° 00' 09' 55''	24°06' 81' 26''
Latitude	44° 00' 22' 42''	43°80' 03' 40''
Elevation (m)	27	56
Soil pH	6.6	5.99
Organic carbon (%)	1.04	0.45
Total nitrogen (%)	0.1	0.05
Extractable phosphorus (ppm)	31	57.84
Exchangeable potassium (ppm)	58	32.00
Precipitation (l/mp)	125.7	151.4
Average temperature (°C)	23.7	22.88
Accumulated temperature (>15 °C)	2,764	2,854

Source: in house development.

Economic indicators

Comparing the production achieved and the total expenses for the two cultivation systems, a major difference can be observed regarding the level of production, total production expenses as well as marketing expenses. Regarding the production per hectare, in the organic system, the yield obtained was about 10,555 kg/ha, in the conventional system 20,000 kg/ha were obtained (Figure 4).

The main reason for this difference was the administration of chemical fertilizers. Regarding the total production expenses, they are higher within the analyzed conventional system.

Conversely, the marketing expenses for the selling of the production were approximately 96 % higher in the case of organic production. This difference was made up of a series of raw materials necessary for packaging (organic fruits and vegetables are sold packed if the retailer in which they are sold sells conventional products also) in such as micro-perforated bags, labels, crates, packing manual labor, and delivery expenses etc.

The cost of production, the last indicator analyzed, which represents the costs incurred to obtain a unit of product, shows a higher value in the case of the organic production system.

Thus, if in the conventional system, the production cost was 2.1 lei/kg, in the organic system it was higher, reaching 3.5 lei/kg. Analyzing the structure of the production cost in the organic system, it was found that the expenses for raw materials and materials have the largest weight, followed by the expenses with the labor force and the expenses with the irrigation.

At an average production selling percentage of approximately 90-91%, the total revenues obtained were 90,000 lei for the conventional culture system and approximately 79,900 lei for the organic system.

The average sales price obtained after negotiating with the different retailers, during the 2022 marketing year, was 8.3 lei/kg in the case of the organic system and 5 lei/kg in the conventional one.

The analysis of the profit and the profit rate revealed a net advantage for the production under organic area. This advantage was unquestionably caused by the considerably higher sale price.

Thus, if in the conventional system, the achieved profit was around 28,555 lei/ha, in the case of the organic production system, it reached the value of 32,469 lei/ha, with approximately 13.7% higher (Figure 5).

Obviously, the profit rate also kept the same superiority advantage, being 19% higher, from 68.9% in the conventional system to 87.9% in the organic system.

Labor productivity is another important indicator, which reflects the effectiveness of labor spent in the production process and is determined as a ratio between the output obtained and the amount of labor used. In the present case, a higher productivity is found in the conventional production system since a large part of the work is performed mechanized. Thus, if in the ecological production system the value of labor productivity was 669 lei/MD, that is, an 8-hour norm brought an income of 669 lei, in the case of the conventional system, the value reached 1,000 lei/MD.

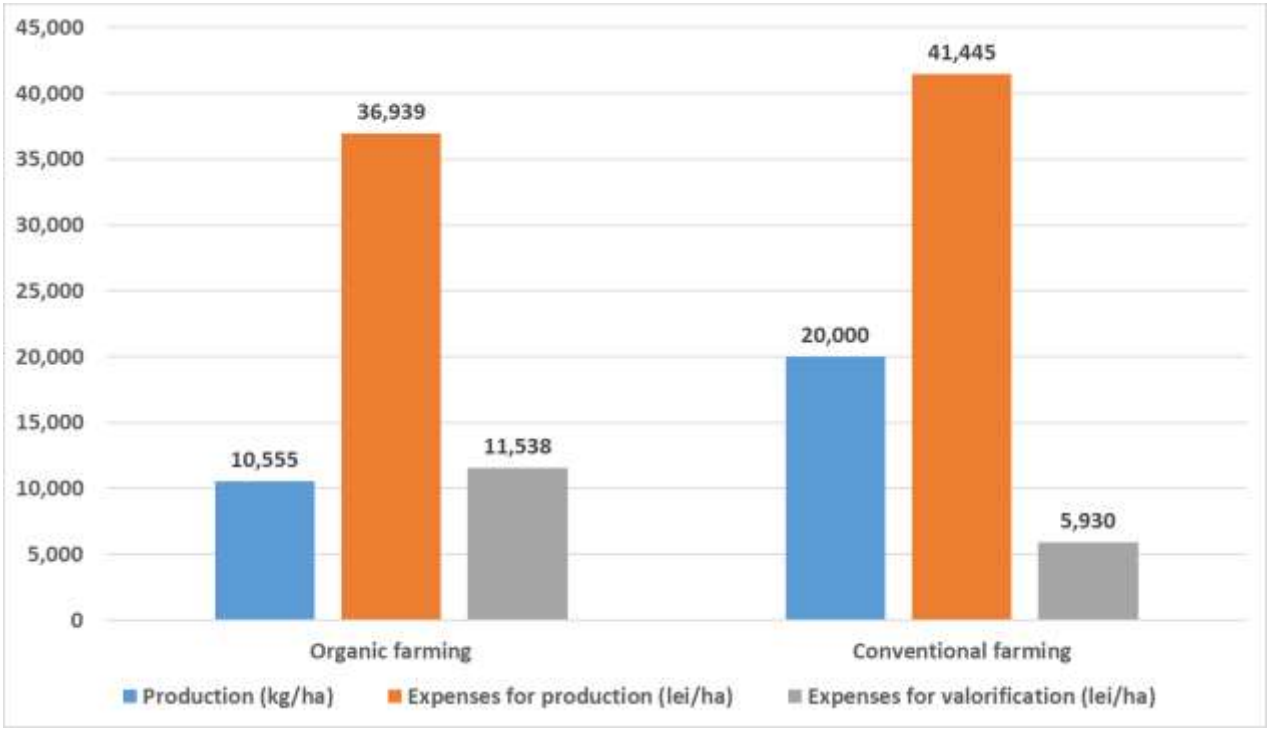

Fig. 4. Comparison of production vs expenses for organic vs conventional production system
Source: in house development.

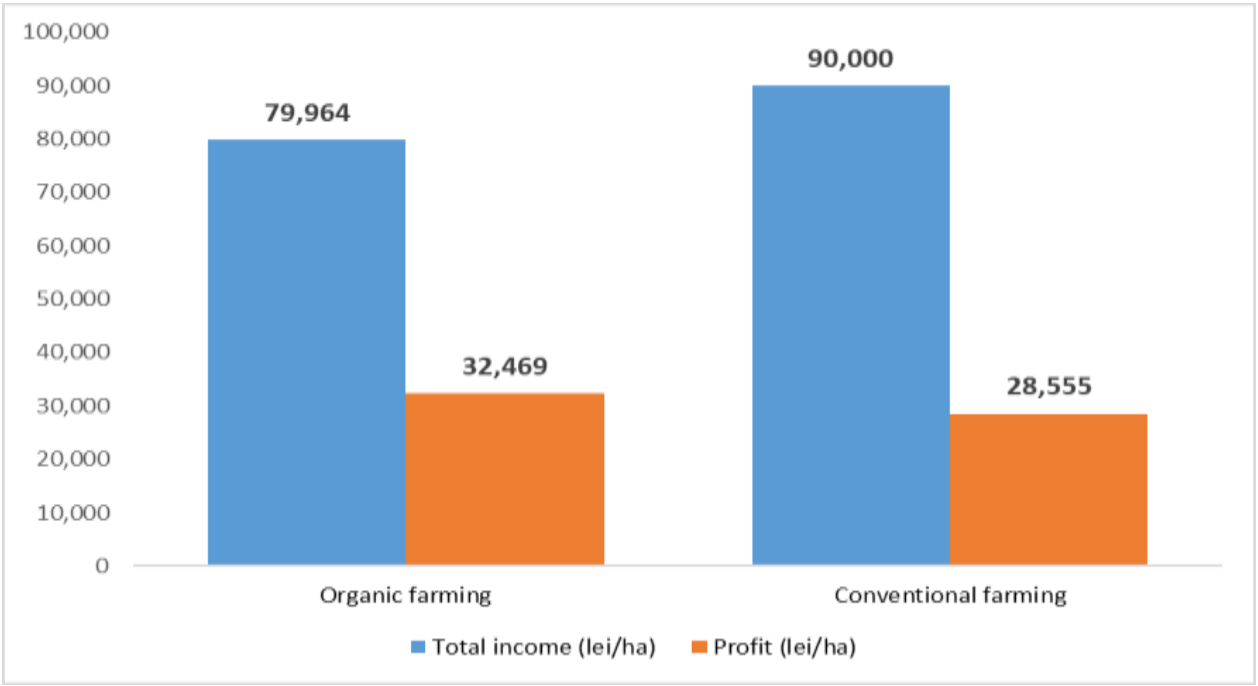

Fig. 5. Comparison of revenues vs profit for organic vs conventional production system
Source: in house development.

Photo 1. Organic (a) vs conventional (b) production system – aspects from experimental fields
Source: in house development.

Table 2. Comparative economic indicators

Indicators	M.U.	Organic System	Conventional System
Yield	Kg/ha	10,555.0	20,000.0
Production costs	Lei	36,939.5	41,445.0
Production marketing costs	Lei	11,538.0	5,930.0
Percentage of the production sold	%	90.90	90.00
Market price	Lei/kg	8.35	5.00
Total work force	Days	119.50	90.00
Total income	Lei	79,963.8	90,000.0
Profit	Lei	32,469.3	28,555.0
Profit rate	%	87.90	68.90
Work force productivity	Lei/Day	669.15	1,000.0
Profitability threshold	Kg/ha	4,434.51	8,289.0
Unitary production cost	Lei/kg	3.50	2.05

Source: in house development.

The break-even point represents the point at which the revenue collected from the sale of the production fully covers the expenses related to the realization of the production, being the point from which any additional income will generate profit.In the present case, the value of the profitability threshold obtained in the conventional system was 8,289 kg, and in the organic system it was 4,434 kg, which means that the difference to the total production achieved represents the profit. The detailed indicators dashboard is presented in Table 2.

Marketing channels

The marketing channels of the two study cases, differ, as well. The conventional farm is selling the production to a retail supermarket chain, only in loose packing.

The organic farm is selling to multiple retailers and buyers, in various packing variants (Figure 6).

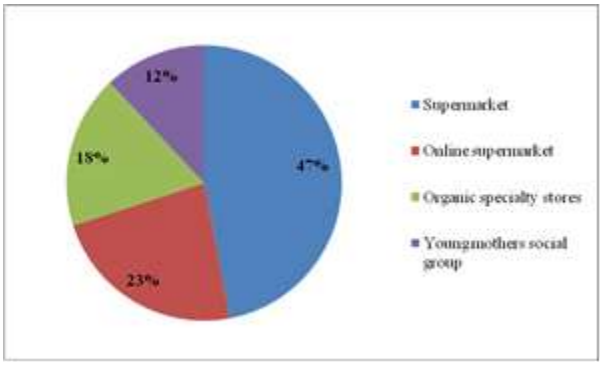

Fig. 6. Qunatities sold by the organic farm, by packing categories
Source: in house development.

Most of the production went to the supermarkets, be it online (23%) or physical stores (47%) The organic specialty stores represent almost 20% of the sales share of the organic farm. An important share is sold to an informal channel, namely a young mothers social group as shown in Fig. 7.

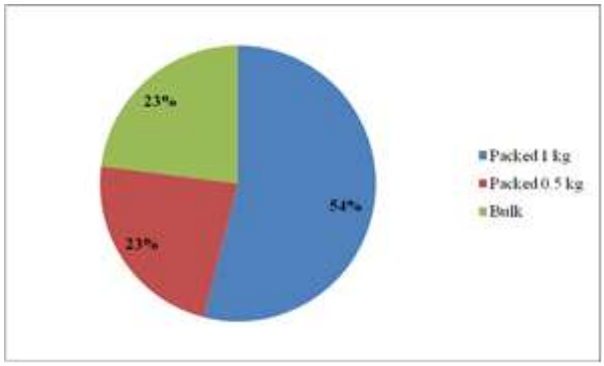

Fig. 7. The share of sales for organic farm by product category
Source: in house development.

The farmer is delivering to this market segment almost 12% of the production, returning 5% of income. The products sold to this channel are second grade quality and half-price. Thus, in addition to a greater diversity of conventional sales channels used in the case of the analyzed organic farm, we also note an approach that considers social awareness of the relevance of purchasing organic products found within certain consumers groups.

It is well known the fact that fruits and vegetables first-grade quality marketing standards may cause economic loses, especially for organic producers, because a part of the harvested crops may not be sold by conventional trading channels due to criteria such as, among others, appearance, and conformation.

Therefore, in addition to a strong commitment to environmental issues, it is equally important for organic producers to be able to target different segments of consumers for which nutritious and healthy criteria prevail rather than appearance and size standards.

In order to develop a more effective marketing approach for organic producers, consumer perception of the benefits and values of organic products as well as government support to increase public awareness should be explored in future research.

CONCLUSIONS

Selecting a variety of species and plant varieties with high adaptability to climatic and soil conditions is required to achieve high, safe, and stable productions in the context of market and climate change. Romania has a lot of potential for sweet potato farming. It produces a good yield per hectare, and market demand is rising. The introduction of the newest cultivation technologies into production must be supported by economic efficiency calculations that provide the opportunity to select the best technological options, capable of ensuring high production per surface unit, of superior quality, with minimal production costs and workforce consumption. The organic system is a good production niche. Despite the lower production per acre than

Given that the selling price is greater and the costs are lower, even though the production per hectare is lower for the sweet potato system than for the conventional system, total profitability is higher for the sweet potato system.

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