

SUMMARY

Keywords: sustainable vegetable farming, natural vegetable farming environment, disruptive factors, case study, SWOT analysis.

Vegetable growing is one of the most intensive agricultural activities, based on mechanization, chemicalization, irrigation, and the use of high-performance cultivars. Vegetable growing uses the most modern methods, techniques, and technologies, starting with in vitro crops, crops in protected areas, as well as crops in open fields, where they are applied technologies that ensure economic performance. At the same time, the technologies used must be as environmentally friendly as possible in order to avoid damaging the vegetable ecosystem. These technologies must also ensure unpolluted harvests in sufficiently large quantities to ensure economic efficiency.

The above presents the essence of sustainable vegetable farming, i.e., vegetable farming that preserves the natural ecosystem for future generations, vegetable farming that is non-polluting and unpolluted, under conditions of economic efficiency.

Currently, there are several agricultural systems in Romania: the conventional system (classical or traditional, intensive or extensive), the unconventional system (with several variants: biodynamic, biological, organic, or ecological agriculture). Between these two systems lies sustainable agriculture, considered to be a compromise between conventional and unconventional agriculture.

Vegetable farms in Romania encompass all of the above-mentioned systems, but it is important to know how these farms have managed to survive over time, or more precisely, how they have ensured their sustainability.

The doctoral thesis entitled "**Research to evaluate the main impact factors on the sustainability of vegetable production in the Tecuci area, Galati county**" aims to find answers to those means (methods, techniques, and technologies) that ensure the sustainability of vegetable farms.

The proposed *aim of this thesis* is to evaluate the sustainability of vegetable production in an area with a long tradition in the Tecuci vegetable-growing basin, highlighting the natural, technical, organizational, and human resource conditions involved.

The objectives set to achieve the stated goal are as follows:

1. Study on the administrative framework conditions that will highlight the geographical location of the Tecuci vegetable-growing area and the four localities renowned for vegetable production.
2. Study on natural-pedological and climatic conditions as basic factors in achieving sustainable vegetable production.
3. Case study for three locations in the Tecuci vegetable-growing area, successful locations for sustainable vegetable production.
4. Assessment of disruptive factors with major implications for sustainability, based on interviews.

The material and working methodology are presented separately for each of the four objectives, as follows:

- for objective 1, information collected locally in the towns of Cudalbi, Matca, Cosmești, and Tecuci was used.
- to achieve objective 2, the soil, agrochemical, and methodological conditions during the experiments were analyzed.
- to achieve objective 3, the case study method was applied to three family associations: A.F. Istrate, A.F. Crihană, and A.F. Condrache, analyzing technical equipment, cultivation technologies, economic situation and SWOT analysis.
- to achieve objective 4, interviews were conducted with 260 respondents involved in administrative and technical-economic activities within the vegetable-growing area under study. The questionnaire used has four sections: general data, disruptive factors, agricultural production, and sustainability and access to resources.

The doctoral thesis "**Research to evaluate the main impact factors on the sustainability of vegetable production in the Tecuci area, Galati county**" is structured in two parts:

Part I - Current state of knowledge on sustainable vegetable production.

Part II - Results of our own research.

Part I is structured in two chapters:

Chapter 1. The importance of sustainable agriculture.

Chapter 2. The technological foundations of sustainable agriculture.

Part II comprises the following chapters.

Chapter 3. Purpose and objectives of the thesis. Material and working method.

Chapter 4. Results on the administrative and natural conditions in which the research was conducted.

Chapter 5. Results regarding the case study.

Chapter 6. Conclusions and recommendations.

This summary analyzes the main content aspects of each chapter.

Chapter 1 presents the importance of sustainable agriculture, highlighting the following content elements.

- historical circumstances, with reference to the historical stages of Romanian agriculture at the current stage of sustainable vegetable growing, unconventional agriculture (biodynamic agriculture, organic agriculture, biological agriculture, and ecological agriculture) and sustainable agriculture (with a presentation of the premises for the development of sustainable agriculture in Romania and strategies for sustainable agriculture in Romania) .
- the principles of sustainable agriculture.
- methods of sustainable agriculture.

The information presented in this chapter provides a fundamental basis for the importance of sustainable agriculture for its promotion and practice in our country.

Chapter 2 presents the biological, ecological, and technological foundations of organic farming, with a particular focus on the technological foundations. In this regard, a general technology for growing vegetables in a sustainable system is presented. This technology includes the following steps: choosing cultivars, choosing land, land preparation, soil preparation, establishing vegetable crops, general and specific care, harvesting, conditioning, and packaging vegetables.

Chapter 3 presents the purpose and objectives of the thesis, the material, and the working method. The content of this chapter has been developed. It has already been presented at the beginning of the thesis. After the elements introduced.

Chapter 4 presents the results regarding the conditions under which the research was conducted, namely the administrative, pedological, and climatic conditions.

The administrative conditions refer to four important locations for defining the vegetable-growing area studied: the commune of Cosmești, the commune of Matca, the commune of Cudalbi, and the municipality of Tecuci. Information is presented on the geographical location, land connections with other localities in the area, the population of each locality, and the availability of inhabitants for various professions specific to the area.

An analysis of the area's soil factors shows that the predominant soils are chernozems and alluvial soils. In terms of agrochemical properties, the soils have a humus content of 4,5%, a pH of 7,7, and a good supply of potassium, calcium, magnesium, and phosphorus.

The study of climatic factors shows that the area has favorable conditions for vegetable crops in terms of temperature (with an annual average ranging between 10,8°C and 13,0°C).

Annual precipitation averages 514 mm, but during the period studied, it varied between approximately 347 mm and 528 mm. Persistent droughts require irrigation to ensure favorable conditions for vegetable cultivation.

Chapter 5 presents the case study conducted in three locations.

The first location is **the Istrate family farm** in Cudalbi. The farm covers an area of 2,2 hectares and specializes in growing watermelons and cantaloupes.

The soil is chernozemic, well supplied with nutrients. The technical equipment is relatively good, essentially including a drip irrigation system and the necessary equipment for phytosanitary protection. To prepare the land, he rents a tractor with a plow and harrow. The farm relies on family labor, and during the harvest season, it hires well-trained seasonal workers.

The predominant crops are watermelons and cantaloupes. Planting is done by direct sowing or by seedlings. Watermelon cultivars are open-pollinated (Crimson Sweet) or hybrids (Black Spot F1 and Arashan F1). They are productive, drought-resistant, and well-liked by consumers.

The Raymond hybrid is used for yellow melons, which is particularly productive and resistant to powdery mildew and fusarium wilt. This cultivar is also resistant to cracking under irrigation conditions and during transport.

When preparing the soil, basic fertilization with complex chemical fertilizers is carried out, and during the growing season, phasic root and extra-root fertilization is carried out.

Harvesting begins at the end of June and ends in September.

Late spring frosts, excessive heat waves, and precipitation deficits are mentioned as natural disruptive factors. Biological disruptive factors include specific pathogens and pests. In addition to these disruptive factors, economic factors (low market prices, high prices for seeds, fertilizers, and pesticides) and technical and organizational factors (labor shortages and relatively low investment) are also mentioned.

The success of the entire activity stems from a thorough understanding of the technology and the use of family labor. The economic activity ends with a profitability rate of around 30%.

The second location for the case study is *the Crihană family farm* in Cudalbi. The farm currently covers approximately 0,5 ha and specializes in bell pepper cultivation. The farm has gradually developed on the basis of personal funds (self-financing) and occasional non-reimbursable support through a de minimis program for vegetables from A.P.I.A.

The farm has exemplary technical equipment: a 16,5 HP tractor, plow, tiller, pump, irrigation and fertilization system, small greenhouse for seedling production, agricultural shelter and tool shed, mulching system, and equipment for phytosanitary treatments. The farm does not have a cold storage facility, which would be very necessary.

To ensure the sustainability of the farm, measures are planned to improve the technological base (automated irrigation system, expansion of the greenhouse area, etc.).

The predominant crop is bell peppers. The most productive hybrid varieties (Blancina F1, Piedone F1) are used, which are well suited to the conditions in Cudalbi, productive, and highly appreciated by consumers.

High standards of cultivation technology are applied: the greenhouse is traditional and covered with double foil, with a UV layer for protection against excessive solar radiation. Basic fertilization is carried out with compost (manure) in quantities of 30-40 t/ha, applied once every two years. The crop is established with 50-60-day-old seedlings at the end of March or beginning of April.

The recommended care measures are those recommended in the specialist literature and traditional practices: mulching, fertilizing, pruning, staking, aerating, and combating diseases and pests.

Harvesting begins around May 15-20 and continues until October. The wholesale price varies between 2 and 5 lei/kg.

Disturbing factors are mainly climatic and, to a lesser extent, diseases and pests.

The economic profitability is exceptional, given that there are no labor costs, as the entire activity is carried out by family members. Production, calculated per hectare, is approximately 90-100 tons.

A SWOT analysis shows that the strengths are: over 20 years of experience, adaptation to market requirements, use of a high-performance greenhouse, and stable commercial relationships. Opportunities include diversifying the range of crops, automating irrigation, and direct relationships with retailers. Weaknesses include monoculture of peppers, dependence on seasonal workers, and the danger of pathogens. Threats include soil diseases, competition from imported products, and rising input prices.

The third location analyzed was *the Condrache family farm* in Matca, Galați County.

The farm covers an area of 0,35 ha, mainly cultivated with cucumbers (0,10-0,15 ha) and tomatoes (0,20-0,25 ha).

The farm is very well equipped: drip irrigation systems, water storage tanks, heating system, agricultural machinery and tools for maintenance work in greenhouses, rotary tillers, sprayers, water pumps, honeycomb pallets, thermometers, etc.

The crops are grown from seedlings specially produced in a small greenhouse for this purpose. The farm also has a space for sorting and packaging the harvest.

All farm work is carried out by family labor. Crops are grown with tomatoes, Melonet F1, and cucumbers, Ilonara F1.

Melonet F1 is a semi-determinate hybrid with medium vigor and good fruit set continuity. It has genetic resistance to the main economic pathogens.

Ilonara F1 is a parthenocarpic cornichon-type cucumber, well suited to the conditions in Matca in the first and second crop cycles.

Vegetable cultivation is carried out in two cycles in the greenhouse, starting in December with sowing in alveolar trays and planting seedlings in February.

Maintenance work includes: pruning, staking, pinching out tomatoes after 5-6 inflorescences, drip irrigation, defoliation of plants, phytosanitary treatments, chalking, etc. Tomato harvesting begins at the end of March, and cucumber harvesting in mid-March.

Cycle II of cultivation is similar to cycle I in terms of greenhouse preparation and crop maintenance. Activities begin in the last ten days of May with sowing to obtain seedlings. Planting in greenhouses takes place between June 25 and July 15.

Climatic factors that disrupt tomato crops are: cold winters, strong winds, and high atmospheric humidity.

Biological factors with disruptive effects are: greenhouse whitefly, thrips, red spider mites, and some vascular diseases.

Disruptive economic factors include the price of electricity, rising input prices, and additional seasonal labor costs.

The SWOT analysis shows that the strengths are the two-cycle technology, high-yield hybrids, irrigation system, and controlled microclimate. The weaknesses are the relatively small area and sensitivity to temperature fluctuations. Opportunities include increased demand for vegetables, the use of smart technologies, and direct sales to HORECA chains. The main threats are diseases and pests, high competition for tomatoes, and high energy costs.

The results of the interview-based *assessment of disruptive factors* highlight the relatively small size of vegetable farms (between 0,5 and 2 hectares). The main vegetables grown in the Tecuci area are tomatoes, cucumbers, peppers, and eggplants. The main disruptive factors are: excessive drought, pests, diseases, and late frosts. Due to disruptive factors, losses ranged between 10 and 30%.

The most common methods to control diseases and pests were: chemical treatments, crop rotation, and biological treatments.

The main types of fertilizers were organic (manure and compost), accounting for over 73%, chemical fertilizers accounting for 18,5%, and about 7-8% did not use fertilizers. Water is mainly applied through drip irrigation.

Agrochemical soil analysis is carried out every 2-3 years, annually or less frequently. Most growers are interested in participating in vegetable growing courses.

Chapter 6 is dedicated to general conclusions and recommendations, which show that the aims and objectives of the thesis have been fully achieved. These conclusions also show that there are real possibilities for practicing sustainable vegetable farming that preserves the vegetable farming agrosystem, ensures efficient economic activity, and provides the conditions for obtaining healthy crops for consumers.

This sustainability is validated by the maintenance of high levels of profitability in vegetable production in the Tecuci area.