

Original Research Article

Case Study of Organically Produced Mint (*Mentha piperita*) in the Republic of Macedonia

ABSTRACT

Aims: The objective of this paper is to present the soil and climate conditions, applied production technology and to demonstrate the economic viability of irrigated, organically grown Mint (*Menthapiperita*). The obtained yield results are in reference to the open field growing conditions

Methodology:In this paper the following analysis methods were applied: analytical, mathematical, statistical and comparative.

Results:The results that are presented in this paper are from the two-year trials (2009 and 2010) in the region of Ovche Pole - central part of the Republic of Macedonia. In the first growing season (2009), two cuttings were performed and the yield of 3500 kg / ha above-ground dry mass has been recorded. In the second growing season, there were three cuttings, yielding 5155 kg / ha of above-ground plant dry mass.

Economic analysis proves that profitability in organically produced Mint (*Menthapiperita*) is obtained in the second growing season year, recording profit of 8125 € ha⁻¹.

Conclusion: Non-invasive independent predictors for screening esophageal varices may decrease medical as well as financial burden, hence improving the management of cirrhotic patients. These predictors, however, need further work to validate reliability.

Keywords: Mint, organic farming, yield, profitability

1. INTRODUCTION

The origin of peppermint species cannot be determined. Dried leaves were found in ancient times, in the Egyptian pyramids. Two species of mint were used by the ancient Greek physicians. However, some writers debate whether one is the modern peppermint, though there is evidence that *M. x piperita* was cultivated by the Egyptians [1]. It is thought to be a natural hybrid between spearmint (*M. spicata* Linn. emend. Nathh.) and water mint (*M. aquatic* Linn), the later itself being a hybrid of *M. longifolia* (Linn.) Huds, and *M. rotundifolia* (Linn.) Huds., so *M. piperita* is a triple hybrid [4]. Mint is popular medicinal plant in several traditional system of medicine. Medicinal, aromatic and the spice plants are widely used in pharmaceutical, food, cosmetics and alcoholic beverage industries as well as in chemical (pesticide) industry. Up to the mid '50's of the last century, these plants were used as raw material from wild flora of these species, and some plants still are used how growing wildplants [7]. The World Health Organization has estimated that morethan 80% of the world's population indeveloping countries when satisfying basic healthcareneeds depend primarily on herbal medicine. Approximately two thirds of the 50000 different medicinal plant species which are in use are collected out in the wildernes [2].

In Europe only 10% of medicinal species that are in commercial use are cultivated. Cultivation of some herbs has proved difficult because of low germination rate or specific ecological requirements [8].

Three of the largest producers of mint and mint related products, (such as essential oils) are the United States, India and China [9]. The U.S. and India produce the largest supplies of mint oil used in chewing gum, toothpaste, mouthwash and several other products. Republic of Macedonia has very favorable geographic position, diversitysoil types and low contamination of the natural resources which providesconditions for cultivation of

aromatic, spicy and medical plants. The advantages of the Macedonian territory for organic cultivation of the medicinal aromatic and spicy plants are: Areas with low degree of pollution or unpolluted resources (soil, water, air); Favorable geographical position, diverse landscape; fertile river valleys, flat lowlands and mountain slopes; diverse types of the soils. Naturally, there are weaknesses and these are: Unused agro-environment potentials; Lack of Macedonian literature; Lack of exploration experience in this area; Lack of skills on farmer level on growing methodology for certain aromatic spices and medicinal plants; Lack of devised strategy for cultivation medicinal plants that can penetrate on the market; Lack of information on potential yields, prices and markets for this group of the plants.

2. MATERIAL AND METHODS

Peppermint *Mentha piperita* L. (*Lamiaceae*), which are used in flavors, fragrances, and pharmaceuticals, were investigated for their antimicrobial properties against human and plant pathogenic microorganisms. Major Components of *Mentha piperita* Essential Oils Identified by Gas Chromatography (GC) and Gas Chromatography-Mass Spectrometry (GC/MS) are: limonene 1-2.1%, 1,8-cineole 3.4-5.3%, menthone 18.4-27.9%, menthofuran 1.3-5.5%, isomenthon 2.9-3.8%, linalool 2.5-4.8%, β -caryophyllene, 1.5-4.2%, terpinen-4-ol 1.2-3.8%, menthol 27.5-42.3%, pulegone 1.0-14.4%, α -terpineol/borneol 0.7-2.4%[5]. Difference in the values of the percentages of individual components in peppermint oil due to the different places of production of mint i.e. the different agro-ecological conditions. Ovche Pole valley (Coordinates: N 41°49', E 21° 59'), suffers negative effect by being overlapping area of two climate types. The Mediterranean and Continental climate, which are the main reason for inconsistent and uneven precipitation, especially in the summer when there are significant low precipitation values [3]. The soil on the field on which Mint was cultivated according to the principles of organic farming, belongs to vertisol type (total area of 2 ha⁻¹). Production of dried herb material respond very strongly to good irrigation and fertilizer management, as was the case in the areas subject to analysis. Planting was mechanized, with certificated quality propagation material with a length of 10-15 cm. For one hectare of between Spacing between the rows was at 70 cm, hence the number of plants per ha was 2000 kg propagation material from a nursery site. Width of rows should be designed so that vehicles can straddle the crop without damaging it during mechanized weed control, harvesting procedures etc. In our case Peppermint was planted by the end of October 2008. The new plants were watered immediately after transplanting. During the vegetation, the prevention of the weeds was conducted with 2 treatments between rows with cultivator. In-row weeds were reduced manually. Between each mowing, irrigation was applied using sprinklers providing 50 l/m² of water. In the first year of cultivation (2009), due to youthfulness of the growing crop only two mowing were performed. The next the number of mows increased by one. In this research the following methods were applied: analytical, mathematical, statistical and comparative.

3. RESULTS AND DISCUSSION

3.1. Biomass productivity

As [3] illustrates, the area of Ovche Pole is characterized by low average annual rainfall (450–500 l/m²), which affects the yield of studied crop. Production of dried mint herb in these analyses ranged from 3500 kg ha⁻¹ in first year of exploitations (2009), up to 5155 kg ha⁻¹ in the following year (2010), as presented in Table 1 below, where it is presented and the ratio between dry leaves and stems.

Table 1. Yield of dried mint herb (kg ha⁻¹)

Year	Leaves	Stems	Leaves +	Ratio
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			Stems	Leaves : Stems
2009	1900	1600	3500	1.2 : 1
2010	3682	1473	5155	1.4 : 1

The analysis of organic mint production (baleddrymass), subject of this paper are grouped in accordance and mutual dependence of applied specific agricultural techniques and administrative expenses.

3.2. Calculation of the costs in the Year of establishment (2008), and first year of exploitation (2009)

To succeed in production and finding optimal solutions, it is necessary to determine the economic effects of the cultivation of each crop [6]. Calculation of the economic effects of the production of organic mint, provides opportunities for greater visibility, monitoring and planning of all activities in accordance with cost operations. Calculation of costs and the incomes in the production of organic mint in the year of establishment 2008 and in first year production includes many elements. These can be grouped depending on the price of certain agro-technical measures and certain administrative costs (Table 2).

Table 2. Revenues and incomes in the year of establishment 2008 and in first year of utilizing (2009).

	Unit	Qty	Price per unit (€)	Total (€)	Part of total income/cost (%)
2008-2009					
Income obtained from production	kg	7000	1.77	12390	93.9
Income from subsidies	ha	2	400	800	6.1
Total revenues				13190	100.0
Soil cultivation costs	ha	2	310	620	6.1
Costs for Organic manure and application	t	60	30	1800	17.9
Costs for propagating material		4	1300	5200	51.7
Transplanting costs	ha	2	150	300	3.0
Irrigation costs	ha	2	250	500	5.0
Harvesting and collection costs (two mowing: 2 x 233 €)	ha	2	466	932	9.3
Crop insurance costs	ha	2	250	500	5.0
Certification costs	ha	2	100	200	2.0
Total costs				10052	100.0
Cost of production unit (€/kg)		1.9			
Profit per unit area (€/ha)		1569			

Table 2. Presents that the overall cost structure, costs for propagating material, (underground stolons) are with biggest share (51.7 %). Due to the large volume of investments in the first year of establishment, the cost per unit is high (1.9 €/kg, Table 2). For

all the reasons mentioned previously, in the first year of utilizing profit is significantly lower (1569 €/ha) compared to the second year (2010). Lower yield/profit in the first year of utilization, due to incompletely developed crop growing, and the lower number of mowing.

3.3. Calculation of the expenses in the second year of utilizing the crop (2010).

In the second year of utilizing the crop, the total costs (€/ha), and the **costs per unit** (0.15 €/kg), are **significantly smaller**. The **total income** is 19050 €, (Table 3).

Table 3. Costs and incomes in the second year of utilizing the crop (2010).

	Unit	Qty	Price per unit (€)	Total (€)	Part of total income/cost (%)
Income obtained from production	kg	10310	1.77	18250	95.8
Income from subsidies	ha	2	400	800	4.2
Total income				19050	100.0
Irrigation cost	ha	2	250	500	17.9
Harvesting and collection cost (three mowing: 3 x 233 €)	ha	2	700	1400	50.0
Crop insurance cost	ha	2	250	500	17.9
Certification cost	ha	4	100	400	14.2
Total costs				2800	100.0
Cost of production unit (€/kg)				0.15	
Profit per unit area (€/ha)				8125	

The income per unit area is 8125 €/ha⁻¹. Calculation of costs and incomes in the second year of production of organic Mint is presented in Table 3. Data in this table do not refer to costs for: soil cultivation, organic manure, its application, costs of propagating material and transplanting costs. In the second year of the utilizing the crop, the costs for harvesting and collecting, account for biggest share (50.0%), in the overall cost structure. **When out of the** total income (€ 19050), total costs are deducted (€ 2800), obtained value refer for second year profit (2010), which amounts to total of € 16250 or profit per unit area of € 8125 ha⁻¹.

4. CONCLUSION

The analysis of investments (costs) and income gives visibility to the economic profitability of growing organic Mint. The advantages of this production mode consist in:

- The characteristics of the obtained product is suitable for extended storage in controlled conditions, provide opportunities for monitoring and market analysis and possibly getting a higher price.
- The excluded application of synthesized chemicals for nutrition and protection of the growing crop, providing agro ecosystem sustainability through maintenance of biodiversity and antipollution impact on natural ecosystems for future generations.
- The benefit of growing Mint are: opportunities to optimize yield and achieve uniform high quality product.

- 134 - Due to the relatively high profit, through organic way of growing, can be a great business
- 135 idea for the farm and family business.
- 136 - From agricultural engineering point of view growing Mint can successfully become a part of
- 137 multi annual crop-rotation system in organic farming.
- 138 - At last, but no less important, following the profitability results of growing organic Mint it
- 139 appears that this production orientation could be of great business opportunity for
- 140 Macedonian farmers, especially for those whose properties have soil type are less favorable.

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