**Mentha piperita**: Energy and Economic Aspects

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**Abstract**

This study analyzes the energy and economic sustainability of the production of *Mentha × piperita* L. var. *officinalis* Sole f. *rubescens* Camus, also known as Mentha Italo-Mitcham (Black Mint or English peppermint) to equip farmers and processors with better information for market pricing. As background, we describe its principal production processes from transplantation to essential oil. Afterward, the focus is on the economic sustainability based on detailed costs and analysis of the energy consumed during crop production. Economic data from 2015 were collected directly from two farms in one of Italy’s areas of traditional cultivation (Pancalieri and its surroundings, Piedmont Region), while the energy data were sourced from a combination of farm data and ‘standardized’ measures. These early results show that the production of essential oil of mint from Pancalieri is not profitable, which likely results from its few and relatively low energy input activities required during its cultivation cycle.

**Keywords:** *Mentha × piperita*, Cultivation; Energy; Profitability; Production cost

**Introduction**

This study aims to evaluate the energy consumption and economic results for sustainable production of *Mentha × piperita* L. var. *officinalis* Sole f. *rubescens* Camus, also known as Mentha Italo-Mitcham (Black Mint or English peppermint) [1]. The area of study is the municipality of Pancalieri and its surroundings, in the Northwest of the Piedmont Region, Italy. Mint has been cultivated in the study area since the 18th century, while the Mentha Italo-Mitcham (Menta of Pancalieri) species began its cultivation in the early 19th century. In Italy, Piedmont Region is one of the most important for MAP cultivation with 248 farms covering 870 ha (2010) amongst the 2,938 farms and 7,191 ha Italy-wide (2010). Of the Piedmont Region MAP crops, mint is the preeminent species [2,3]. Regional data indicates that mint is of interest to about 40 farms and 100 ha between the provinces of Torino and Cuneo [2]. Mint from Pancalieri-known for its superior quality-is used almost entirely (99%) for essential oil production. Pancalieri mint is unusual in that about 80% of it is purchased by a single food producer in the region (2015), making its ‘market’ essentially non-existent. After a brief description of the production process, this work evaluates and discusses energy consumption during the production process, followed by evaluation and discussion of some economic aspects.

**The production processes**

The mint production process begins in November with soil preparation (ploughing, harrowing) of a field, after which stolons are taken from the field on which they had been cultivated in the previous year and transplanted. Planned weeding occurs during pre-emergence in March, followed by alleyway clean-up in May. Fertilization is in March (2) and September (1), and the first irrigation takes place in May with an additional one in June. Harvest occurs with a single cut in August followed by distillation (whole plant, ‘green herb’). The two to three-year cultural cycle follows a consistent production process throughout the area of study, with slight alterations in fertilization (a single one in spring) or irrigation. Additionally, some farmers recently have substituted the top of the plant to stolon's in the transplantation.

**Energy and economic aspects**

**Energy consumption:** The energy consumed to produce mint was derived from the fuel and lubricant amounts consumed as well as from farm machine manufacturing energy consumption [4]. To calculate actual energy input, we employed several coefficients: machine with engine 92.0 MJ kg⁻¹, equipment without engine 69.0 MJ kg⁻¹, fuel 37.0 MJ L⁻¹, and lubricant 83.7 MJ kg⁻¹ [5,6]. For the fuel and lubricants, 1.2 MJ kg⁻¹ was added to account for their distribution [7,8], while 55% of the total energy content in each machine was added for maintenance and repair [9]. The fuel consumption calculation used a ‘topping-off system’, in which the machine tank is re-filled after each work cycle [6]. Finally, lubricant consumption was estimated with a value of 2% of fuel consumption [10].

Results for mint cultivation and management, we derived a total consumption use of 16.7 GJ ha⁻¹ per year. Across all work phases, the harvest operation required the highest input (23.8%), while rolling and harrowing operations (carried out at the start of the vegetative cycle in the second and third years) resulted in the lowest value (0.8%). Soil preparation (fertilization, ploughing, and harrowing) represented 54.8% of the total energy input (Graph 1). The energy required for cultural operations (weed control) represented 8.3%. The energy analysis highlighted the high amount of direct energy consumed by fuel and lubricants (84% of total energy input).
which is based on production cost [11]. We collected the following
labour was calculated according to the concept of opportunity cost
Farmers provided temporary employee costs, while the cost of family
several annual operating costs: i) inputs; ii) operating machinery
information provided and reviewed by the farmers, and included
distillation cost. Taxes were not included in the calculated production
Machinery costs were calculated on the basis of ‘hourly
cost, while the next highest cost portion is attributable to overhead

Economic aspects: Economic data were collected at the beginning of
from Pancalieri operators that provided technical, economic data, and
from previous research. A previous version of this work

Specific cost calculations are described below. Area farmers
Machinery costs were calculated on the basis of ‘hourly
cost by machine type, and was then adjusted for depreciation, interest
machinery capital (“the present value of machinery by the rate of
land (rent) 1,150.45 19,10
Cost of capital 105.01 1,74
Total specific costs 3,526.48 58,55
Total overhead cost 1,342.40 22,28
Total production cost (‘green herb’) 4,868.88 80,85
Distillation 1.154.00 19,20
Total cost (essential oil) 6,022.00 100,00
Total output (essential oil, raw) 5,949.00
Profit -73.00

Table 1: The calculated production cost of Pancalieri mint essential oil
for 1 ha (2015).

Conclusion
These early results show that the production of mint from Pancalieri
is not profitable. From an energy perspective, this crop seems to
require little energy to produce, given the few and low energy input
activities needed during its cultivation cycle. Note this study will be
expanded to more farms to enhance its results. It has already benefited
from the cooperation of Pancalieri operators and from previous
research.

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