Research Concerning the Economic Efficiency of Four Species of Medicinal Plants Grown in the Western Part of Transylvanian Plaine

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ABSTRACT

In this paper we present the economic efficiency of four species of medicinal plants grown in the experimental field of Jucu, belonging to the University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca.

Through the conducted research we wish to emphasize the cultivation profitability of the four studied species of medicinal plants.

Economic efficiency was established by calculating the following economic indicators: its output per hectare, production value, average price recovery, cost of production, valorization cost, the cost per unit of output, gross margin and gross margin change.

We evaluated from an economic profitability point of view in terms of 2014, the 4 studied crops. Expenditure on maintenance, harvesting and conditioning of the production was balanced against the income earned by selling the raw materials plants.

Technological sheets were developed, income and expenditure budgets and cost-benefit analysis was done for each species.

It appears that the largest share of total variable costs is the expense of temporary labor (day laborers) over 75% according to the obtained yield.

In conclusion, the greatest profit could be obtained by cultivating catnip.

Taking into account that medicinal plants are very suitable to organic growth and provided they are certified as, economic efficiency is the greatest in these conditions, due to higher price for valorizing their production (4-5 eur / kg) and higher subsidies granted 460 euros / ha in 2015.

Keywords: *Agastache foeniculum*, *Nepeta cataria*, *Melissa officinalis*, *Lavandula angustifolia*, economic efficiency.

INTRODUCTION

This paper is presenting the economic efficiency of four perennial medicinal plant species grown for 7 years in the experimental field of Jucu, belonging to the University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca.

The four medicinal plant species studied are: giant hyssop (*Agastache foeniculum*), catnip (*Nepeta cataria*), lemon balm (*Melissa officinalis*) and lavender (*Lavandula angustifolia*), all perennial species belonging to family *Lamiaceae*.

Agastache foeniculum (Pursh) Kuntze belongs to the tribe *Menthae*, genus *Agastache*, sin. *Brittonastrum*, which includes about 30 species of aromatic perennial plant, among them the best known being: *Agastache aurantiaca*, *A. Barberi* (syn. *Agastache pallida*), *A. cana*, *A. foeniculum*, *A. mexicana*, *A. rugosa*, *A.* and *A. urticifolia scrophulariifolia*. *Agastache foeniculum* is the most frost-hardy of the agastache species.

In therapeutic purposes, mainly herba is used, against cardiovascular, nervous, gastrointestinal

disease or as treatments for colds. It also has properties to prevent vomiting, antibacterial, antifungal and reduces the acid in the stomach. It relieves throat ache and symptoms of colds (Estrada-Reyes et al., 2004).

***Nepeta cataria* L.** is cultivated for herba (shoots and flowering tops) containing 0.3 - 1% of essential oils (nepetalactone terpenoids), which can be extracted by steam distillation of water (Junwei et al., 2010). Catnip is a traditional remedy for colds and flu. Due to the carminative and antispasmodic actions, the plant relieves stomach disturbances, constipation, flatulence and colics. It is a perfect remedy for treating diarrhea in children. It also has anti-anxiety, antispasmodic, antitussive, astringent, carminative, diaphoretic, emmenagogue, nervine, refreshing, sedative, stomachic effect and tonic aperitif (<http://www.pfaf.org>).

***Melissa officinalis* L.** is grown for leaves (*Melissae folium*) or the entire aërian part (*Melissae herba*), containing volatile oil (Muntean et al., 2007).

In therapeutic purpose is used in digestive disorders and vomiting, spasms, stomach and intestinal neurosis. Externally is used as baths, helping to heal wounds, having healing properties, antiseptics (Muntean et al., 2007).

***Lavandula angustifolia* Mill.** is cultivated mainly for inflorescences (*Lavandulae flos*) used fresh or dried. In medicinal purpose, vegetal raw material of lavender has antispasmodic, carminative, analgesic, sedative, hypotensive, wound healing, antiseptic, antimicrobial, antifungal, antitussive, cholagogue, choloretic, diuretic, general tonic, cardiogenic action and tonic aperitif. It is considered one of the most tonics plants for the nervous system. Lavender tea removes headaches and insomnia. Externally it can be used for superficial wounds and burns, oral hygiene etc. (Muntean et al., 2007).

MATERIALS AND METHODS

In this paper we evaluated, from economically point of view, the profitability of those four crops studied, in conditions of 2014 year, for two variants: the first year of vegetation and seventh year of vegetation. For both variants we weighed expenditure on maintenance, harvesting and conditioning the production, with the incomes earned through the sale of vegetal raw material.

Unlike the second variant, the first one includes also the costs of establishing the crops.

In market competition, to achieve an average profit, it is important to practice a competitive sale price, using in the process decision-making, opportunity costs.

In economic theory and practice, a special role has the opportunity cost. The opportunity cost is important to choose the most profitable crops depending on market demand. It allows us to place the crops and make the best choice of resources. For this we need to calculate the gross margin of each crop or species. Opportunity cost is synonymous with cost of production, as long as there is no monopoly control over resources.

Economic efficiency was established by calculating the following economic indicators :

- production realized per hectare – it was considered the production of dried herba

- production value – it was calculated based on the obtained yield and the average sales price; $V = Q_t \times P_v$, where:

V – value of commercial production;

P_v – the selling price per kilogram;

- average selling price – represents the average market price in each year;

- production cost – it is one of the indicators that characterizes the economic activity of an agricultural farm.

- the cost per unit of product represents the monetary expression of all charges of alive work done and materialized in the farm per unit of product (per kilogram of herba). This establishes reporting total production costs to total production achieved, namely:

$$C_p = \frac{\sum C_h}{Q_t},$$

where:

C_p – the production cost for one kilogram of herba;

C_h – total costs of production;

Q_t – total production of herba.

- gross product – it is obtained by summing the value of production with subsidies, in the culture budget and to computers per hectare.

- gross margin – represents the difference between gross product (PB) obtained, and the proportional expenses (ChDP), which are also called variables, per unit area.

MB = PB - ChDP

changing the gross margin (%) - represents the percentage ratio between gross margin and gross margin witness (the first year of vegetation);

changing the cost per unit of product (%) - represents the percentage ratio between the cost per unit of product and the cost per unit of witness product (the first year of vegetation), (Merce Elena et al, 2009).

RESULTS AND DISCUSSION

Harvesting is done manually twice a year, with agricultural workers, usually daily basis, with an average tariff in the summer of 2014, 65 lei / day, which includes share (tax) 16% on income and CASS. Daily norm work / man set for hoeing and thinning is 0.15 ha; for harvesting vegetable raw material, 125 kg and 300 kg for conditioning. Conditioning (clean and dry) vegetable raw materials was made naturally, in the attic of a house.

Subsidies were granted under GD 863 / 07.10.2014. Payments are made in lei, at the exchange rate of 4,41 lei for one euro set by the European Central Bank on 30 September 2014 and

published in the Official Journal of the European Union, Series C, no. 342 of October 1, 2014.

General management expenses were 0.35% of average variable costs for the four species. In establishing permanent labor costs took into account a percentage of the salary of an engineer, an accountant and a worker.

The selling price of a kilo of dried vegetal raw material was established like an average of market prices, taking into account the price offered by Plafar SA, S.C.D.A. Secuieni, online agricultural market and other companies of taking over vegetal raw material. Thus for giant hyssop it was 10,5 lei / kg, for catnip 10 lei / kg, for lemon balm 12 lei / kg and 20 lei/kg for lavender. For each specie, technological estimates of revenue and expenditure budgets were developed.

Tables 1 - 4 show, centralized, cost - benefit analysis of the four species studied for two variants: the first year of vegetation and seventh year of vegetation.

In the first year of vegetation largest share of total expenditure is represented by costs with seedlings and cuttings, between 79.88% and 90.21%.

Tab. 1. COST-BENEFIT ANALYSIS – variety *Agastache foeniculum*

		The first year of vegetation			The seventh year of vegetation			
	UM	Quantity	Unit price (lei)	Total (lei)	Quantity	Unit price (lei)	Total (lei)	
INCOMES								
Dried herba (flos)	kg	700	10.5	7,350	3,500	10.5	36,750	
The subsidy/ ha				692			692	
TOTAL INCOMES				8,042	37,442			
EXPENSES								
I. VARIABLE EXPENSES				76,903			14,560	
1. Raw materials and supplies				69,665			970	
- the seed	seedling	45,000	1.50	67,500			0	
- inventory objects and materials				1,965			970	
- organic fertilizers	t	20	10	200			0	
2. Mechanical work expenses				1,466			631	
- loading, transport and use of org. fert.	No. /year	1	435	435			0	
- plowing, processed with rotary hoe	No. /year	1	400	400			0	
- mechanical hoeing between the rows	No. /year	3	160	480	3	160	480	
- sowing	No. /year			0			0	
- herba (flos) transport	No. /year	2	75.60	151	2	75.60	151	
3. Supply costs				1,742			24	
4. Temporary workforce expenses		day	62	65	4,030	199	65	12,935
II. FIXED COSTS				580			580	
- Permanent work force expenses				83			83	
- Management and general expenses				296			296	
- Redemption for building and equipment				201			201	
TOTAL EXPENSES (I + II)				77,483	15,140			
Indicators								
Gross margin				-68,861	22,882			
Cost per unit of product				110.69	4.33			
COMPARATIVE ANALYSIS								
Change (%) of gross margin					133,23			
Change (%) cost per unit of product					3,91			

Tab. 2. COST-BENEFIT ANALYSIS – variety *Nepeta cataria* L.

	UM	The first year of vegetation			The seventh year of vegetation		
		Quantity	Unit price (lei)	Total	Quantity	Unit price (lei)	Total
INCOMES							
Dried herba (flos)	kg	820	10.0	8,200	4,100	10.0	41,000
The subsidy/ ha				692			692
TOTAL INCOMES				8,892			41,692
EXPENSES							
I. VARIABLE EXPENSES				77,319			16,536
1. Raw materials and supplies				69,665			970
- the seed	seedling	45,000	1.5	67,500			0
- inventory objects and materials				1,965			970
- organic fertilizers	t	20	10	200			0
2. Mechanical work expenses				1,492			657
- loading, transport and use of org. fert.	No. /year	1	435	435			0
- plowing, processed with rotary hoe	No. /year	1	400	400			0
- mechanical hoeing between the rows	No. /year	3	160	480	3	160	480
- sowing	No. /year			0			0
- herba (flos) transport	No. /year	2	88.56	177	2	88.56	177
3. Supply costs				1,742			24
4. Temporary workforce expenses	day	68	65	4,420	229	65	14,885
II. FIXED COSTS				580			580
- Permanent work force expenses				83			83
- Management and general expenses				296			296
- Redemption for building and equipment				201			201
TOTAL EXPENSES (I + II)				77,899			17,116
Indicators							
Gross margin				-68,427			25,156
Cost per unit of product				95.00			4.17
COMPARATIVE ANALYSIS							
Change (%) of gross margin							136,76
Change (%) cost per unit of product							4,39

Tab. 3. COST-BENEFIT ANALYSIS – variety *Melissa officinalis* L.

	UM	The first year of vegetation			The seventh year of vegetation		
		Quantity	Unit price (lei)	Total	Quantity	Unit price (lei)	Total
INCOMES							
Dried herba (flos)	kg	640	12.0	7,680	3,200	12.0	38,400
The subsidy/ ha				692			692
TOTAL INCOMES				8,372			39,092
EXPENSES							
I. VARIABLE EXPENSES				99,763			13,944
1. Raw materials and supplies				92,165			970
- the seed	seedling	60,000	1.5	90,000			0
- inventory objects and materials				1,965			970
- organic fertilizers	t	20	10	200			0
2. Mechanical work expenses				1,459			624
- loading, transport and use of org. fert.	No. /year	1	435	435			0
- plowing, processed with rotary hoe	No. /year	1	400	400			0
- mechanical hoeing between the rows	No. /year	3	160	480	3	160	480
- sowing	No. /year			0			0
- herba (flos) transport	No. /year	2	72.00	144	2	72.00	144
3. Supply costs				2,304			24
4. Temporary workforce expenses	day	59	65	3,835	190	65	12,350
5. Assurances				580			580
II. FIXED COSTS				83			83
- Permanent work force expenses				296			296
- Management and general expenses				201			201
- Redemption for building and equipment				100,343			14,524
TOTAL EXPENSES (I + II)							
Indicators							
Gross margin				-91,391			25,148
Cost per unit of product				156.79			4.54
COMPARATIVE ANALYSIS							
Change (%) of gross margin							127,52
Change (%) cost per unit of product							2,89

Tab. 4. COST-BENEFIT ANALYSIS – variety *Lavandula angustifolia* Mill.

The first year of vegetation					The seventh year of vegetation		
	UM	Quantity	Unit price (lei)	Total	Quantity	Unit price (lei)	Total
INCOMES							
Dried herba (flos)	kg	260	20.0	5,200	1,300	20.0	26,000
The subsidy/ ha				692			692
TOTAL INCOMES				5,892	26,692		
EXPENSES							
I. VARIABLE EXPENSES							
1. Raw materials and supplies							
- the seed	cuttings			33,800			7,096
- inventory objects and materials				29,165			970
- organic fertilizers							
2. Mechanical work expenses	t						
- loading, transport and use of org. fert.							
- plowing, processed with rotary hoe							
- mechanical hoeing between the rows							
- sowing	No. /year						
- herba (flos) transport							
3. Supply costs	day						
4. Temporary workforce expenses							
II. FIXED COSTS							
- Permanent work force expenses							
- Management and general expenses							
- Redemption for building and equipment							
TOTAL EXPENSES (I + II)				34,380	7,676		
Indicators							
Gross margin				-27,908	19,596		
Cost per unit of product				132.23	5.90		
COMPARATIVE ANALYSIS							
Change (%) of gross margin					170,22		
Change (%) cost per unit of product					4,47		

Tab. 5. SWOT analysis of cultivating the four species of medicinal plants

S/ Strengths <ul style="list-style-type: none"> - the four species, being perennials, have founding expenses only once (in first year) at 10-12 years, in the other years remaining only maintenance expenses; - high productivity starting year two-three of vegetation; - crops are not demanding to humidity and soil; - are searched products on the market in pharmaceutical, cosmetics and food industries; - can grow in ecological system, contributing to maintaining a clean environment; - providing irredeemable funds; - subsidies from the state 	W/ Weak points <ul style="list-style-type: none"> - high costs with temporary work force; - the rate of mechanization is reduced; - high costs of establishment culture; - difficulties relating to profitability almost nonexistent in the first year of vegetation - weak marketing system for these products.
O/ Opportunities <ul style="list-style-type: none"> - expanding market of selling, including export; - the staff necessary to harvest does not require a higher qualification; - through the new PNDR 2014-2020, the Ministry of Agriculture dedicated to the development of medicinal plants and aromatic, package 5 of the Measure 11 - Organic farming. - increasing consumer preference for organic products. 	T/ Threats <ul style="list-style-type: none"> - Implementation of new standards (regarding the quality of production) increased production costs.

In the seventh year of vegetation it is found that the largest share of total variable costs is the temporary labor expense (day laborers) between 78.78 % and 90.02% depending on the yields per hectare. The cost per unit of product varies between 4.17 and 5.90 lei / kg. Gross margin (MB)

is estimated at 19.596 – 25.156 lei / ha depending on the species.

After doing the experience and capitalizing the obtained production, it can be performed a SWOT analysis (Table 5) of cultivating the four medicinal plants in ecological system.

CONCLUSION

SWOT analysis shows that there are several strengths and opportunities to develop and encourage farmers to invest in the cultivation of medicinal and aromatic plants. To improve and develop the sector, weaknesses and threats for each case should be considered.

The higher primary cultivation costs are at the species *Melissa officinalis* L. due to more seedlings required per hectare. The cost per unit of output in seven vegetation decrease by more than 90% from the first year.

Founding crop costs are recovered from the year 3-4, depending on the species.

The highest profit was achieved in the case of *Nepeta cataria* L. species, due to higher production per hectare, but the biggest demand on the market was for *Lavandula angustifolia* Mill species.

Given that medicinal plants are very suitable to grow organically, provided they are certified, economic results would be much better if the production were sold with the label "organic" due to higher price offered (4 - 5 eur / kg) and higher subsidies granted 350 euros in 2015, according to the PNDR 2014-2020.

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