

RESEARCH CONCERNING THE INCREASE OF THE AMOUNT AND QUALITY OF ESSENTIAL OIL IN CULINARY SAGE (*Salvia officinalis* L.) UNDER THE IMPACT OF FERTILISATION AND OF PLANT ROW ORIENTATION IN THE CONDITIONS OF THE DIDACTIC STATION IN TIMIȘOARA (ROMANIA)

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Abstract: Production of medicinal and aromatic plants is reflected in the quality of content of active compounds. The quantity of active compounds of plants is conditioned by ecological factors, the zoning of the species, culture technology, the biological value of the cultivar, the means of processing raw materials obtained. The essential oil and infused from *Salvia officinalis* L. leaves, has many applications in medicine due to antibacterial properties, antiviral and cytotoxic of essential oil. Because antioxidant properties, and its aroma oil is used in food and beverage industry. The study aims on the role of literacy enrichment characteristics of cultivation technologies *Salvia officinalis* L., to achieve improved performance of their production to a high of essential oil of a high quality, thus the study of the possibility expansion of cultivation areas within Sage. In this paper have been monitoring the vegetation factor, light. Experience was located on land that belongs to SDE USAMVB

Timisoara. Biological material used was variety Răsmirești (*Salvia officinalis* L.) obtained from SC PRONATURA srl Zalau, the certified seed. Content of essential oil compounds and determination to Sage was monitored laboratories SC Laboratoarele Fares Bio Vital SRL, Orastie (ISO 9001: 2000). Changes in essential oil content in *Salvia officinalis* L. and its components differ depending on the plant parts: herba or leaves, the orientation of plant rows. Mineral fertilizers applied have resulted in increased production of essential oil, fertilizer management is economically sustainable. The results of this study are part of a doctoral program, with as theme: "Opportunities to improve cultivation technologies in order to increase the amount of herba, film and volatile oil in Sage (*Salvia officinalis* L.)", funded by the MECT the IOD U.S.A.M.V.B. Timisoara under the distinguished university Professor Valeriu Tabara.

Key words: sage yield oil, fertilization, plant row orientation

INTRODUCTION

Sage oil is the essential oil made from the culinary herb sage, *Salvia officinalis*. In addition to its valuable flavoring characteristics, it has been suggested that culinary sage oil can contain as much as 50% thujone by weight. The exact amount varies based on the time in the season and which part of the plant tested (PERRY *et al.* 1999). Thujone is traditionally regarded as one of the active ingredients in absinthe distinguishing it from "less controversial" alcoholic beverages. It has been suggested that culinary sage oil boosts short-term memory performance in many using it as a dietary supplement (HANTMAN 2003). Culinary sage oils can be toxic and may trigger abortions as well as "cause dizziness, rapid heartbeat, and provoke epileptic seizures" (www.thefreelibrary.com).

Although this oil has a high thujone content, and can therefore cause convulsions when used in high concentrations, it is effective to stimulate the digestion and especially a bad appetite and due to its hormonal regulatory effect, it is most useful for menstrual problems, as well as the pain associated with rheumatism.

It helps to deal with grief and depression and quickens the senses and has been used to combat female sterility, as well as menopausal problems and has a tonic effect on the urinary tract as well as the liver and kidneys.

Sage oil also stimulates the lymphatic system and thereby boost glandular function while it also has value to treat dermatitis, atonic wounds, sores, ulcers, as well as insect bites and reducing large pores.

On the muscular system it can be used to ease stiff muscles and particularly fibrositis and torticollis (stiff neck) and eases trembling and palsy.

MATERIAL AND METHODS

To obtain volatile oil from folia and herba of *Salvia officinalis* L. we collected vegetal material from this plant. The vegetal material used was represented by the aerial parts harvested in September 2007 during the budding period of culinary sage.

The samples of vegetal material of culinary sage (*Salvia officinalis* L.) were air dried. After drying, the samples of herba were subjected to laboratory analyses. Content of essential oil was monitored in the laboratories for the control of quality of the S.C. Fares S.A. Orăștie (FARES Bio Vital Laboratories).

In laboratory measurements, we used the method of hydro-distillation. We hydro-distilled 20 g of vegetal material of culinary sage *Salvia officinalis* L. in a Clevenger type apparatus for 4 hours. The essential oil was dried with an anhydrous Na₂SO₄ and stored in a brown glass balloon at 4°C.

RESULTS AND DISCUSSION

Culinary sage is rather demanding in light.

In semi-shadow conditions, culinary sage grows well, but their content of volatile oil is slightly higher (COICIU & RACZ, 1962).

According to laboratory data, we can see that, from the point of view of the content of volatile oil from herba of *Salvia officinalis* L. depending on the plant row orientation system (E-W, N-S), there are differences of volatile oil content (%): thus, plants oriented E-W have a lower volatile oil content than plants oriented N-S (Table 1, Figure 1).

Table 1.

Volatile oil content of herba of culinary sage (*Salvia officinalis* L.) depending on the plant row orientation system in 2007 (Didactic Station in Timișoara)

Sample code	Sample type	Volatile oil content (%)
* A ₁ 1	Herba	0.86
A ₁ 2	Herba	0.58
A ₁ 3	Herba	0.93
A ₁ 4	Herba	0.64
A ₁ 5	Herba	0.83
A ₁ 6	Herba	0.97
** A ₂ 1	Herba	1.09
A ₂ 2	Herba	0.91
A ₂ 3	Herba	0.74
A ₂ 4	Herba	0.84
A ₂ 5	Herba	0.85
A ₂ 6	Herba	0.98

* A₁: plant row orientation E-W

** A₂: plant row orientation N-S

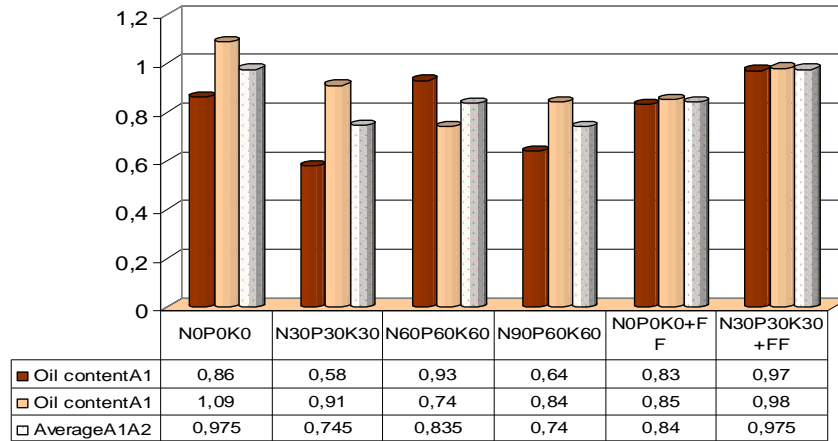


Figure 1. Volatile oil content of herba of culinary sage (*Salvia officinalis* L.) depending on the plant row orientation system and on the fertilisation factor in 2007 (Didactic Station in Timișoara)

In the shadow, the leaves of culinary sage are larger, the secretory glands are rarer, and the rate of volatile oil evaporation is lower than in the sun (Cucu *et al.* 1982). Volatile oil from herba points out the value of the culinary sage plants and differentiates depending on plant row orientation (two sowing directions, E-W and N-S).

The results of volatile oil production from herba of *Salvia officinalis* L. depending on the fertilisation factor and on plant row orientation are shown below.

Volatile oil content of culinary sage varies depending the harvesting period and on geographical location (Kolodzeiyski, quoted Ciulei I et al, 1993).

The synthesis of volatile oil yield in culinary sage depending on plant row orientation and on fertilisation is as shown below.

The results show that, when plant rows are oriented N-S (Figure 2), the level of volatile oil yield from herba of *Salvia officinalis* L. is higher than when plant rows are oriented E-W.

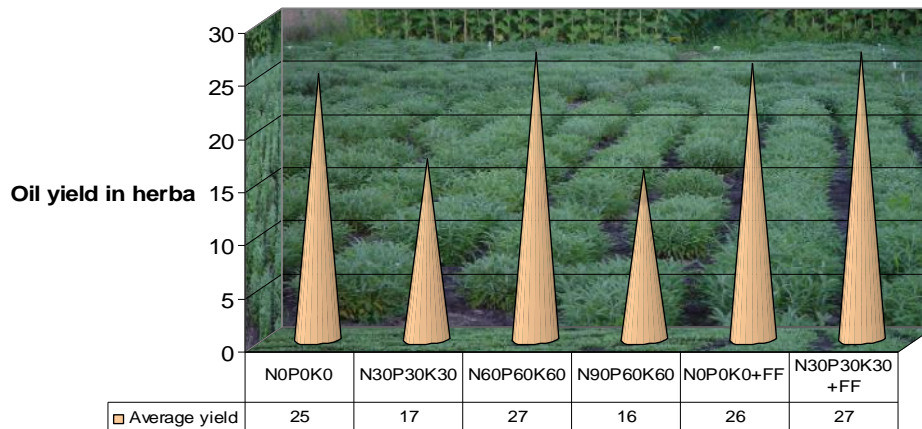


Figure 2. Variation of volatile oil yield from herba of culinary sage (*Salvia officinalis* L.) depending on the fertiliser factor when plant rows are oriented E-W in 2007 (Didactic Station in Timișoara)

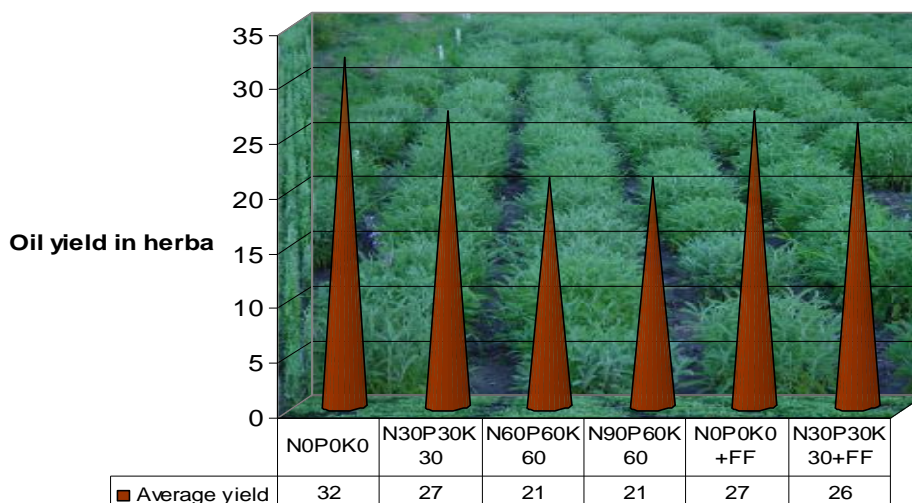


Figure 3. Variation of volatile oil yield from herba of culinary sage (*Salvia officinalis* L.) depending on the fertiliser factor when plant rows are oriented N-S in 2007 (Didactic Station in Timișoara)

Table 2 presents volatile oil yields from herba of *Salvia officinalis* L. obtained from the two cultivation systems with different plant row orientation: E-V (A₁) and N-S (A₂) and under the impact of the fertiliser factor.

Table 2.

Volatile oil content of herba of culinary sage (*Salvia officinalis* L.) depending on plant row orientation and fertilisation in 2007 (Didactic Station in Timișoara)

Factor	Factor B Fertiliser						Averages of Factor A			
	b ₁	b ₂	b ₃	b ₄	b ₅	b ₆	Mean yield (kg/ha)	Relative yield (%)	Difference (±)	Significance
Factor A										
a ₁ E-V	26	17	27	16	25	27	23	100	-	
a ₂ N-S	32	27	21	21	27	26	26	113	3	XXX
	Averages of Factor B						DL 5.0% = 1.09 kg/ha; DL 1.0% = 1.46 kg/ha; DL 0.1% = 1.92 kg/ha			
Mean yield (kg/ha)	29	22	24	19	26	27	DL 5.0% = 0.45 kg/ha, DL 1.0% = 0.60 kg/ha, DL 0.1% = 0.78 kg/ha			
Relative yield (%)	100	76	83	66	90	93				
Difference (±)	-	-7	-5	-10	-3	-2				
Significance	Mt	000	000	000	000	000				

Analysing data, we can say that plant row orientation (sowing direction) played an important role in the increase of volatile oil yield from herba of *Salvia officinalis* L. When the plant rows were oriented E-W (a₁), mean volatile oil yield was 23 kg/ha, and when the plant

rows were oriented N-S (a_2), the volatile oil yield was 26 kg/ha, an increase not ensured statistically.

When culinary sage (*Salvia officinalis* L.) plant rows are oriented E-W, in the shadow, culinary sage yields better from the point of view of the herba yield, compared to the plant rows orientation N-S (in the sunlight), with an increase in volatile oil yield from herba of 3 kg/ha which is not statistically ensured. Depending on the factor fertilisation, culinary sage crop sowed in 2007 in the two plant row orientation systems (E-W and N-S) had the following variants: the most productive variant was the control variant (29 kg/ha). This variant is followed by the variant in which we used $N_{30}P_{30}K_{30} + FF$ 27 kg/ha and by the variant in which we used $N_0P_0K_0 + FF$ 26 kg/ha.

It is important to note that in all the variants fertilised, despite the fact that the yield of herba of *Salvia officinalis* L. is stimulated positively and even results in increases in yield statistically ensured as distinct or as very significant, volatile oil yield was below that in the control variant. This is due mainly to the high content of volatile oil of the plants in the not-fertilised variant.

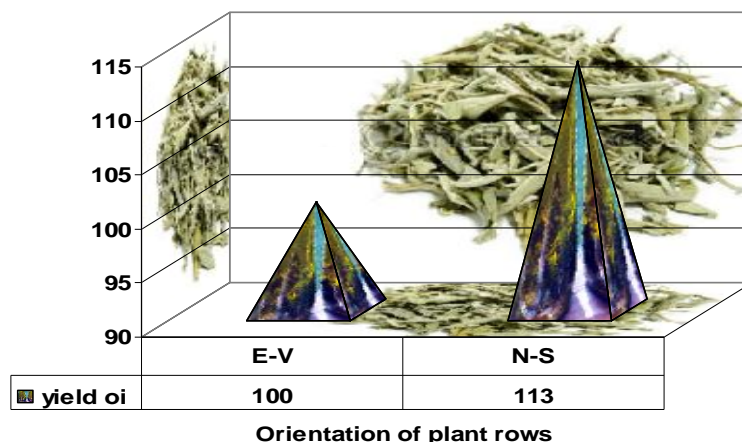


Figure 4. Impact of plant row orientation on volatile oil content of culinary sage (*Salvia officinalis* L.) in 2007 (Didactic Station in Timișoara)

Figure 5 points out the negative impact of fertilisation on volatile oil yield. The diagram show that foliar fertilisation results in a positive supply of oil compared to that produced by soil fertilisation at different N:P:K rates.

CONCLUSIONS

Climate conditions in the year 2007 had, on the whole, a favourable impact on the level of culinary sage yield.

Accumulation of volatile oil in culinary sage is differentiated, as in the case of the herba, depending on both plant row orientation and on fertilisation variants. When plant rows oriented E-W, volatile oil yield from herba of *Salvia officinalis* L. was lower than when plant rows were oriented N-S, i.e. 32 kg/ha in the former case and 27 kg/ha in the latter case.

The value of the volatile oil content in the area makes possible the exploitation of the De Răsmirești culinary sage (*Salvia officinalis* L.) variety to obtain a high-quality raw product.

The De Răsmirești culinary sage (*Salvia officinalis* L.) variety cultivated in the Western Plain of Romania is highly valuable due to the fact that is valorises salty soils

improper for cropping. These results could be useful to medicinal plants processing enterprises from Western Romania with a view to valorisation.

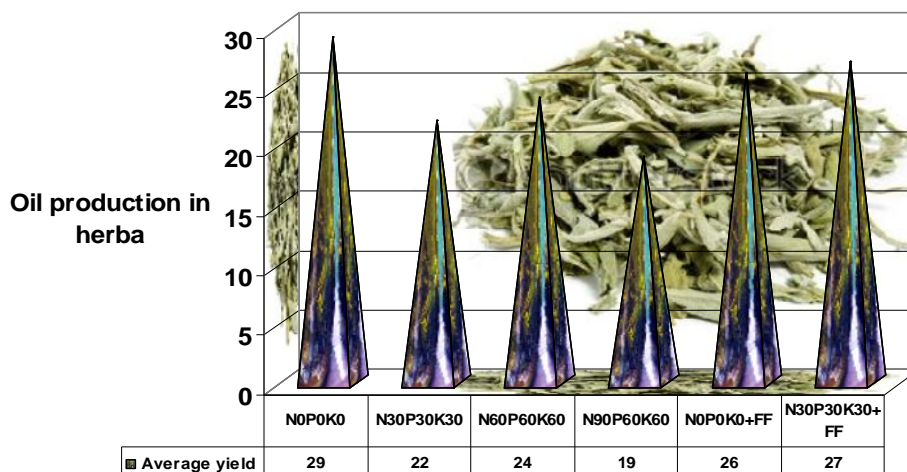


Figure 5. Impact of fertilisation on volatile oil content of culinary sage (*Salvia officinalis* L.) in 2007 (Didactic Station in Timișoara)

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