

RESEARCH CONCERNING THE INCREASE OF HERBA OF CULINARY SAGE (*Salvia officinalis* L.) THROUGH CERTAIN CULTIVATION TECHNOLOGIES IN THE CONDITIONS OF THE DIDACTIC STATION IN TIMIȘOARA IN 2007

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Abstract: Herbs have always been part of people's lives and is undoubtedly a close relationship between plants and humans. Man depends on plants in existence and this relationship must be sustainable. To ensure that medicinal plants are always available to us, we must ensure that we learn to cultivate. World consumption of Sage is the order of 100-150 tonnes / year dry leaves and 250-300 tonnes / year herba for volatile oil extraction. In Romania, a growing area of 15-20 hectares, providing domestic needs, a rămânăd available for export (Switzerland, Italy, France).The present study proposes the role of knowledge enrichment characteristics of cultivation technology in increasing production efficiency in Sage herba. Research contribute to improving opportunities for expansion of cultivation areas of medicinal and aromatic plants, the establishment of cultivation technology with improved performance. It was also aimed at guiding factor of vegetation, light, so human intervention is as close to the studied plant biology.Production of any crop plants is the result of interaction of all factors involved in

the formation yield. Level harvest herbs and spices is in relation to the degree to which each factor and all in one place is close to optimal values required for plant biology. The overall condition is rare in the natural living environment.Biological material (*Salvia officinalis* L.) used was obtained from variety „Răsmirești” SC PRONATURA S.R.L. Zalau, the seed is certified. Experience was located on land that belongs to S.D.E. Timisoara, in the U.S.A.M.V.B. Timisoara.In the experimental field there were good results herba green mass production. Herba yields vary from one version to another guidance system plant rows and when the various reports of N: P: K, application of mineral fertilizers to *Salvia officinalis* L., led to increased production of herba, is in this 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 Tabară.

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

INTRODUCTION

Salvia officinalis is a small perennial evergreen subshrub, with woody stems, grayish leaves, and blue to purplish flowers. It is a member of the mint family, *Lamiaceae*. It is native to the Mediterranean region and commonly grown as a kitchen and medicinal herb or as an ornamental garden plant. The word sage or derived names are also used for a number of related and unrelated species. Primary use is medicinal plant: the Latin name for sage, *salvia*, means "to heal". Although the effectiveness of Common Sage is open to debate, it has been recommended at one time or another for virtually every ailment. Modern evidence supports its effects as an anhydrotic, antibiotic, antifungal, astringent, antispasmodic, estrogenic, hypoglycemic, and tonic. In a double blind, randomized and placebo-controlled trial, sage was found to be effective in the management of mild to moderate Alzheimer's disease (AKHONDZADEH S, 2003).

Culinary: as an herb, sage has a slight peppery flavour. Culinary sage contains generous quantities of vitamins A and C and can be used in a myriad of recipes. Although used

since ancient times for medicinal purposes and food preservation, sage was not used as food flavouring until the 17th century (ObeWise Nutriceutica, 2008).

MATERIAL AND METHODS

The experiment was set on a field within the Didactic Station in Timișoara, at the Banat University of Agricultural Science and Veterinary Medicine.

The experiment was of the bi-factorial type with annual replication, set after the randomised block method, on a single row with 3 replications in which we randomised Factor B. We studied the following experimental factors: - Factor A – row orientation along the cardinal points E-W (a_1) and N-S (a_2). Studying Factor A allowed the quantification of the factor lighting with a view to increase herba amount in culinary sage; - Factor B was the proper rate of NPK with a view to increase herba yield. Factor B had six graduations: $b_1 = N_0P_0K_0$, $b_2 = N_{30}P_{30}K_{30}$, $b_3 = N_{60}P_{60}K_{60}$, $b_4 = N_{90}P_{60}K_{60}$, $b_5 = N_0P_0K_0 + \text{foliar fertilisation}$, $b_6 = N_{30}P_{30}K_{30} + \text{foliar fertilisation}$. The cultivation technology we applied in our experiment was the current one.

The biological material we used was the De Răsmirești variety supplied by the S.C. PRONATURA S.R.L. Zalău (Bihar County). The seeds came from typical, vigorous plants, with high content of oil, purity 90%, germination 65%, and MTG 7.5 g.

RESULTS AND DISCUSSION

Characterisation of climate conditions of research in Timișoara.

Ecological conditions for the development of culinary sage are dictated by its Mediterranean origin. The main ecological factor is temperature, since the seeds sprout at +10°C, and then, during vegetation, the plants need heat during the summer and mild, short winters or, if the winters are frosty, no temperature variations and a soil covered with snow. Thermal regime: the culinary sage crop at the Didactic Station in Timișoara found there a perimeter with an excellent climate. Climate data we present came from the Meteorological Station in Timișoara.

The summer of the year 2007 was extremely hot. Average temperatures in June, July and August reached 24°C, and daily temperature reached up to 40°C. In correlation with moisture, these temperatures had a negative impact on herba yield in culinary sage.

Duration of sunlight: culinary sage is very sunlight demanding. Analysis of the duration of sunlight per decades for the year 2007 shows that the longest periods of sunlight in Timișoara were April, June and July.

Rainfall regime: culinary sage (*Salvia officinalis* L.) is not very moisture demanding: moreover, starting from the second year, the plants face drought very well. The months most affected by drought were April, June and July (Table 1).

Table 1.

Climate conditions of the year 2007
(Meteorological Station in Timișoara)

2007	J	F	M	A	M	J	J	A	S	O	N	D
Air temperature (°C)	4	6	9	13	18	23	24	23	12	11	4.2	0.1
Rainfall (mm)	26	92	57	4	69	65	46	65	62	53	86	23
Lighting duration (h)	77	92	183	277	219	270	278	244	163	133	81	48

Culinary sage (*Salvia officinalis* L.) is not very soil demanding due to its deep root system. The best results were, nevertheless, on fertile, clayish, deep, permeable, and limey soils. The soil on which we set our experiment has the following characteristics: cambic chernozem, moist phreatic (poorly gleyed), poorly decarbonated, on loessoid deposits, clayish-dusty argyle, and almost neuter soil reaction between 0 and 20 cm (6.55). At depths over 43 cm, soil reaction is basic. Results of herba yield depending on plant row orientation (E-W) depending on the factor fertilisation

In the first experimental year, culinary sage (*Salvia officinalis* L.) did not flourish. Thus, the first yield of herba occurred at the end of the third decade in August 2007.

Figure 1 presents mean yields of herba of culinary sage in plant row orientation E-W. Analysis of results shows the following: unbalanced fertilization with N:P:K leads to a diminution of the herba yield in culinary sage (*Salvia officinalis* L.). In the variant fertilised with N₉₀P₆₀K₆₀, herba yield is 285 kg/ha smaller than that in the control (not treated) variant. The best results in herba yield were when the soil was fertilised with N₆₀P₆₀K₆₀, followed by the variant N₀P₀K₀+FF with 989 kg/ha above the yield of the control variant 10,104 kg/ha, N₃₀P₃₀K₃₀ + FF with 10,888kg/ha. All the fertilisation variants, except for the variant in which the nitrogen rate was 90 kg/ha active substance, had a positive impact on herba yield in culinary sage.

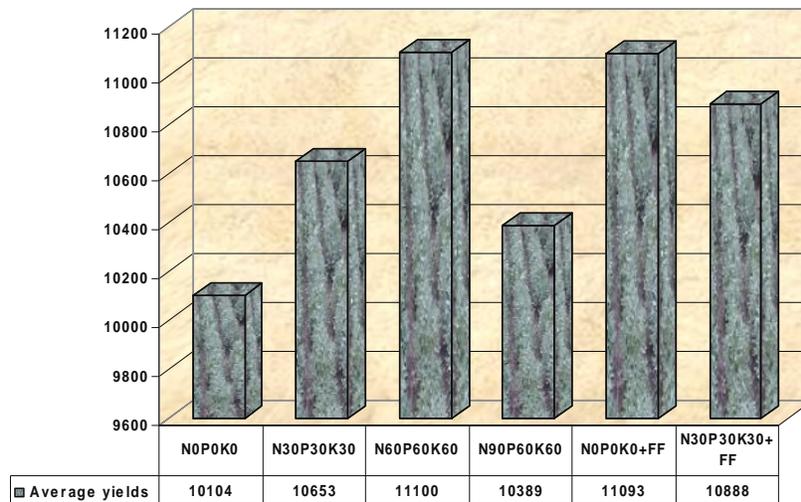


Figure 1. Variation of herba yield in culinary sage (*Salvia officinalis* L.) in the variant E-W (a₁) under the impact of fertilisation in 2007 (Didactic Station in Timișoara)

Results of herba yield depending on plant row orientation

Results of herba yield depending on plant row orientation (N-S) depending on the factor fertilisation. When the plant rows orientation was N-S, total mean yield was different from the yield obtained when plant rows orientation was E-W. The best yields when plant rows orientation was N-S were in the fertiliser variant N₀P₀K₀ + FF with 11,352 kg/ha, N₃₀P₃₀K₃₀ with 10,640 kg/ha, N₉₀P₆₀K₆₀ with 10,621 kg/ha and N₃₀P₃₀K₃₀ with 10,501 kg/ha.

Plant row orientation per different directions of the cardinal points (a₁: E-V and a₂: N-S) led to increases of the mean yields of 110 kg/ha, 10,705 kg/ha compared to 10,595 kg/ha when plant rows were oriented N-S.

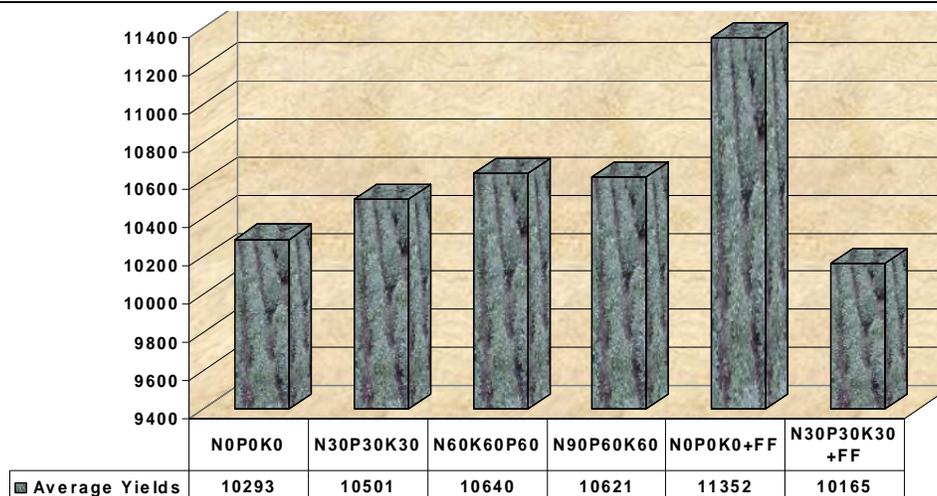


Figure 2. Variation of herba yield in culinary sage in the variant N-S (a_2) under the impact of fertilisation in 2007 (Didactic Station in Timișoara)

Synthesis of the results of herba yields of culinary sage under the impact of plant row orientation and of fertilisation in 2007 at the Didactic Station in Timișoara

Table 2 presents culinary sage yield data with the two plant row orientation systems. Orientation of plant rows has an impact on the culinary sage herba yield level. When the plant rows were oriented E-W (a_1), mean yield was 10,705 kg/ha, while when plant row orientation was N-S (a_2) mean yield was 10,595 kg/ha.

Table 2

Culinary sage (*Salvia officinalis* L.) herba yields under the impact of plant row orientation and of fertilisation in 2007 (Didactic Station in Timișoara)

Factor B \ Factor A	Factor B Fertilisation						Averages of Factor A			
	b_1	b_2	b_3	b_4	b_5	b_6	Mean yield (kg/ha)	Relative yield (%)	Difference (\pm)	Significance
a_1 E-V	10,104	10,653	11,100	10,389	11,093	10,888	10,705	100	-	
a_2 N-S	10,293	10,501	10,640	10,621	11,352	10,165	10,595	99	110	
Averages of the Factor B										
Mean yield (kg/ha)	10,199	10,644	10,887	10,505	11,223	10,693	DL 5.0% = 442 kg/ha; DL 1.0% = 590 kg/ha; DL 0.1% = 774 kg/ha			
Relative yield (%)	100	104	107	103	110	105				
Difference (\pm)	-	445	688	306	1,024	494				
Significance	Mt	***	***	**	***	***				

DL 5.0% = 181 kg/ha; DL 1.0% = 241 kg/ha; DL 0.1% = 316 kg/ha

Depending on fertilisation, culinary sage crops with different orientations of the plant rows (E-W and N-S) in the conditions of the year 2007 had the following variants: the most productive variant is the one fertilised with $N_{30}P_{30}K_{30} + FF$ with 11,223 kg/ha with a difference of 1,024 kg/ha compared to the control variant (not treated). The increase in yield is ensured as very significant. This variant is followed by the variant fertilised with double rates of NPK, with $N_{60}P_{60}K_{60}$, which resulted in 10,887 kg/ha, i.e. an increase of 688 kg/ha compared to the control variant. The increase in yield in this variant is statistically ensured as very significant. The fertilisation variant $N_{30}P_{30}K_{30} + FF$ resulted in an average of the herba yield with the two plant row orientation systems of 10,693 kg/ha with an increase in yield compared to the control variant of 494 kg/ha, an increase statistically ensured as very significant.

In the variant in which the soil was fertilised with 60 kg/ha of active substance NPK and foliar fertilisation during vegetation, the mean yield is 10,693 kg/ha with an increase in yield compared to the control variant is 494 kg/ha, ensured statistically as very significant. The variant fertilised with low rates of NPK (30:30:30) also resulted in a very significant increase in yield, i.e. a yield of 10,644 kg/ha and an increase in yield of 445 kg/ha.

In the case of the variants fertilised with 90 kg/ha nitrogen active substance on an agri-fund of $N_{60}P_{60}K_{60}$, the yield is 10,505 kg/ha: in this case, the increase in yield was 300 kg/ha, statistically ensured as distinctly significant.

Figure 3 presents the levels of mean yields with the two plant row orientation systems (E-W and N-S). There are significant differences in yield.

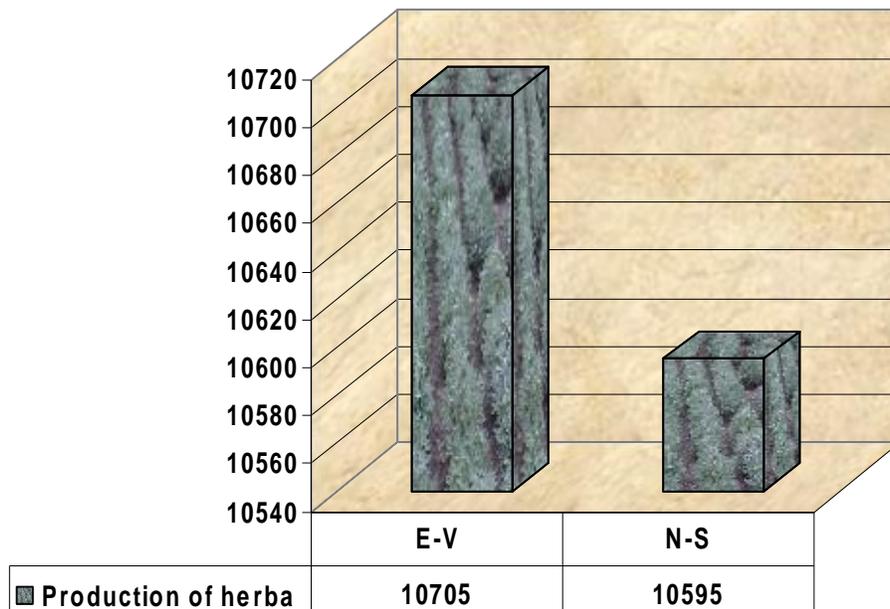


Figure 3. Impact of the plant row orientation system on the yield of culinary sage (*Salvia officinalis* L.) herba in 2007 (Didactic Station in Timișoara)

Figure 4 presents the levels of herba yield depending on fertilisation. We can note the favourable effect of balanced fertilization with NPK and the contribution of foliar fertilization on yield when applying foliar fertilizer without basic fertilization ($N_0P_0K_0$).

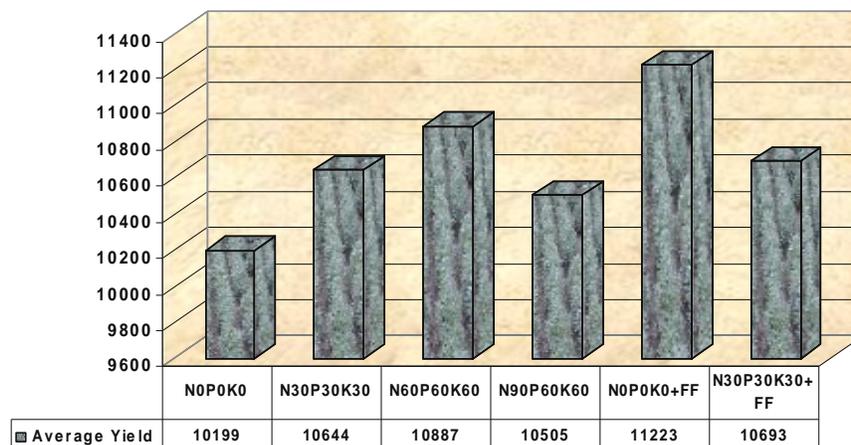


Figure 4. Impact of fertilisation on the yield of culinary sage (*Salvia officinalis* L.) herba in 2007 (Didactic Station in Timișoara)

CONCLUSIONS

Climate conditions in the year 2007 largely influenced the level of culinary sage yield.

We obtained good yields of herba of culinary sage from the experimental field at the Didactic Station in Timișoara.

Culinary sage yields differed from one variant to another of the plant row orientation system and depending on the different types of N:P:K fertilisers. In the variant sowed in shadowy conditions (a_1 : E-W), herba yield was higher than in the variant with plenty of sunlight (a_2 : N-S). The most considerable yields were when fertilising with $N_{30}P_{30}K_{30}$ + FF with 11,223 kg/ha.

The De Răsmirești culinary sage (*Salvia officinalis* L.) variety cultivated in the Western Plain is particularly valuable because it valorises salty soils not fit for other crops. These results could be used by medicinal plants processing facilities in Western Romania.

BILBLIOGRAPHY

1. AKHONDZADEH S, NOROOZIAN M, MOHAMADI M, OHADINIA S, JAMSHIDI AH, KHANI M. (2003). "Salvia officinalis extract in the treatment of patients with mild to moderate Alzheimer's disease: a double blind, randomized and placebo-controlled trial". J Clin Pharm Ther 28 (1): 53–9. doi:10.1046/j.1365-2710.2003.00463.x. PMID 12605619.
2. ObeWise Nutriceutica Applied Health 2008-02-04