

COMPARATIVE INVESTIGATION OF ORGANIC CHAMOMILE PRODUCTION IN DIFFERENT AGRO-ECOLOGICAL REGIONS OF GREECE AND SERBIA

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INTRODUCTION

Chamomile [*Matricaria chamomilla* L. syn. *Matricaria recutita* (L.) Rauschert and *Chamomilla recutita* (Franz, 1993)] is a herb grown for its flowers, which are dried and used as a medicinal tea, as well as for essential oil production. It can be cultivated successfully with adequate quality of the drug in tropical areas of Ethiopia up to Central Europe (Letchamo and Vömel, 1992). Because the crop is new to Greece aspects of production require further research, especially the adoption of organic cultivation of this crop in the near future in both countries. In Italy for instance the half of chamomile production is produced through principals of organic farming (Vender, 2004).

The aim of this project was to study the performance of dry drug and oil yield of chamomile in different agro-ecological factors, as they are in Serbia and Greece, cultivated according to organic farming principals.

MATERIAL AND METHODS

The cultivar tested was the Serbian "Banatska" (selection of the Institute for Medicinal Plant Research "Dr. Josif Pančić", Belgrade). Sowing was done in fall as chamomile needs to be sown as early as possible to ensure adequate growth before it commences flowering (Falzari, and Menary, 2003). Particularly, in Serbia was conducted on 05.10. 2004 (Graph 1), at rate 10 kg/ha and in Greece during the period 1-7.11.2004 (Graph 2), at sowing rate 6 kg/ha.

Field experiment in Serbia was conducted under dry farmyard conditions, in vicinity of Pančevo, (South Banat, Serbia), located at 81 m a. s. l., latitude 44°N, 52', 20" and longitude 20°E, 42', 25". Soil type is chernozem, on loess, of loamy-clay texture (ca. 35% clay), pH = 7.1, moderately supplied with humus and phosphorous and rich in potassium. The temperature and precipitation conditions of Pančevo are presented in Graph 1. In the experiment the following variants of chamomile fertilization were tested:

1. Organic fertilization with cattle FYM – at 50 m³ / ha rate

2. Mineral N at 30 kg/ha rate

3. Control treatment – without fertilization

FYM was incorporated in soil in August 2004., during plowing. Nitrogen mineral was applied as a top dressing in ammonium-nitrate form, by beginning of April 2005. The field was previously cultivated with St. John's Wort the production of which was conducted in two years period without any application of fertilizer (period of conversion). Basic soil tillage was done in August, while the pre-sowing soil preparation took place in September, 2004.

Additional care measures, except for the application of Nitrogen manure on variant 2, were not performed. A single harvest at full blossom stage was conducted on 24th May, 2005. All measurements were taken in 4 replications.

In Greece overall experimental approach to this project was a small-scale pilot field trials. In November of the year 2004 four experimental cultivations of chamomile were installed: two in Macedonia [Thermi (located at 5 m a. s. l., latitude 40°N, 31' and longitude 22°E, 58'). And Kalindria), one in Thessaly (Stefanovikio) and one in Sterea Hellas (Ag. Konstatinos). The temperature and precipitation conditions of Thermi are presented in Graph 2. Basic soil tillage of the fields was done during summer, while the pre-sowing soil preparation took place in late October, 2004 just a week before sowing. The locations in Ag. Konstantinos, Stefanovikio and Thermi were fertilized with commercial organic fertilizer Agrobiosol (70-80% organic matter, N 6-8%, P₂O₅ 0.5%, K₂O 0.5%) at rate 500 kg/ha and Acidam AVC 50 (50% element S and 10% element C) at rate 500 kg/ha. Both applied a week before sowing and they certified by official organizations, which certify organic farming in Greece. In table 1, the soil analysis of these locations are presented.

In the cultivation of Kalindria no fertilizer or manure were applied but the field was uncultivated the previous year. A single harvest at full blossom stage was conducted in all fields during the first half of May. Particularly, on 5th May in Ag. Konstantinos 6th May in Thermi and on 13th May in Stefanovikio and Kalindria. To obtain essential oil yield, three samples of dry flowers of each locality were steam distilled for four hours.

RESULTS AND DISCUSSION

The yield of dry chamomile flowers in the first harvest (24. 05.2005) was presented in table 1.

Table 1. Soil texture and chemical analysis of three locations in Greece

Depth (0-0cm)	Soil texture	pH 1:1	Free CaCO ₃	Organic matter %	P (Ols.) ppm	K ppm	B ppm	Ca /100g	Mg /100g
Thermi	SCL	7.73	2.64	1.43	44.57	520	0.57	2.47	0.36
Stefan	CL	7.69	15.8	1.40	7.96	180	0.68	4.93	0.85
Ag. Kon.	SCL	7.65	15.0	1.07	8.44	260	0.57	4.28	1.21

The highest average yield of chamomile was obtained in treatment with FYM in the first year following the application (interval of variation between replications being 725-931 kg/ha).

The lowest yield was, as expected, in control treatment, while the treatment with mineral Nitrogen fertilization gave the increase of the yield half less in comparison to increase of yield obtained with FYM treatment. Since it is well-known that chamomile is not demanding crop regarding mineral nutrition (Bomme und Nast, 1998), it is obvious that the increased biological activity of the soil caused by application of FYM significantly improved water/air/heating soil regime.

This brought about noticeable better and faster plant development during cold winter months and early spring days, what consequently resulted in higher chamomile flower yields.

Content of essential oil in chamomile flowers was presented in table 2.

Table 2. The yields of dry chamomile flowers under different fertilization treatments

Fertilization treatments	Yield of dry chamomile flowers	
	Kg/ha	%
Cattle FYM - 50m ³ /ha	778,4	178,8
Mineral N manure 30 kg/ha	586,8	134,8
Control (no fertilization)	435,3	100
LSD 5%	197,00	

Chamomile plants in FYM treatment contained the highest percentage of essential oil, what reinforces already positive impression about the FYM treatment efficacy on chamomile yield.

In treatment with mineral nitrogen, the content of essential oil in chamomile flower was the lowest,

what points out on potentially harmful effects that imbalanced nutrition (nutrition with N only) may have on quality of chamomile flower.

Table 3. Content of essential oil in chamomile flowers under different fertilization treatments

Fertilization treatments	Essential oil from dry chamomile flowers %	
	%	Interval of variation
Cattle FYM - 50m ³ /ha	0,340	0,27 – 0,41
Mineral N manure 30 kg/ha	0,247	0,21 – 0,29
Control (no fertilization)	0,298	0,24 – 0,35

Average yield of dry chamomile flowers obtained in Serbia was 778 kg/ha (ranging 725 – 931 kg/ha) and in Greece from 4 localities was 767 kg/ha (ranging 615 – 1027 kg/ha). The average content of essential oil in dry chamomile flowers cultivated in Serbia was 0,34 % (ranging 0,27 – 0,41%) and in Greece was 0,44 % (ranging 0,32 – 0,65%).

In Greece the average yield of dry chamomile flowers, estimated from 4 localities data, was 767 kg/ha. The yield of dry chamomile flowers and essential oil of each locality are presented in Table 4.

Table 4. Yield of dry chamomile flowers and essential oil in four localities in Greece

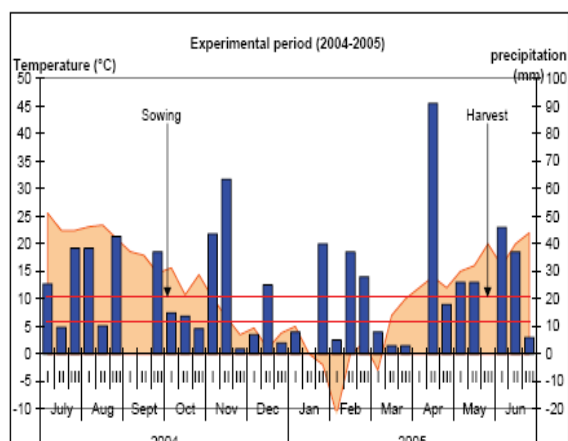
Localities	Yield of dry chamomile flowers		Essential oil from dry chamomile flowers %
	kg/ha	fresh/dry %	%
Thermi	1027	24.00	0,35
Stefan.	615	30.00	0,33
Ag. Kon.	675	30.95	0,34
Kalindria	750	33.00	0,65

The yield of flowers in both countries was similar except for the locality of Thermi where the yield of dry chamomile flowers was more than 1000 kg/ha. Falzari and Menary (2003) also reported yield of about a ton/ha. In Kalindria locality, where no fertilizer of any kind was applied but was uncultivated the previous year, the yield of dry chamomile flowers and essential oil obtained, pronounces the importance of a year rest field for soil fertility, which was the usual practice of traditional farming enhancing soil fertility.

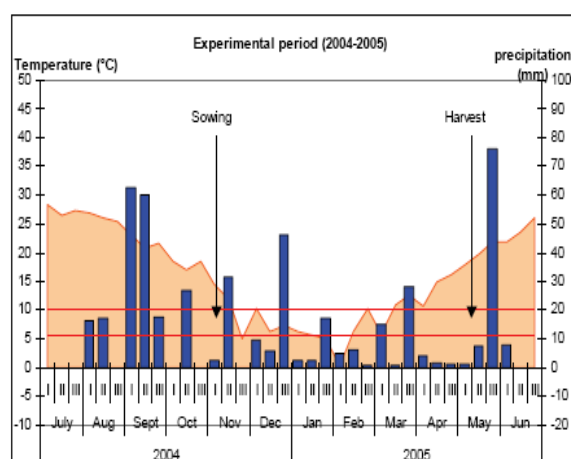
The differences in essential oil yield between the two countries, even if the data defy statistical analysis, are obvious and might be attributed to climate differences.

Annual temperature and precipitation data of Thermi locality (representative of Greek climate) (Graph 2) and the respective data of Pančevo (representative of Serbian climate) (Graph 1) have big differences.

In Greece the winter is milder than Serbia and the annual precipitation is almost the half as much as in Serbia. It seems that these conditions are favorable for high oil yield.



Graph. 1. Diagram of 10 days average temperature and precipitation for locality of Pančevo, South Banat, Serbia



Graph. 2. Diagram of 10 days average temperature and precipitation for locality of Thermi Macedonia Greece

In conclusion, the results showed that between two tested agro-ecological regions (Serbia and Greece), there are no significant differences regarding the obtained yield of dry chamomile flowers but the content of essential oil appeared to be significantly higher in chamomile cultivated in Greece.

ABSTRACT

The organic model of cultivation of the Serbian chamomile (*C. recutita* (L.) Rausch) cv "Banatska", and essential oil yield was monitored throughout field experiments conducted in Serbia and Greece. Average yield of dry chamomile flowers obtained in Serbia was 778 kg/ha and in Greece was 767 kg/ha. The average content of essential oil in dry chamomile flowers in Serbia was 0,34 % and in Greece was 0,44 %. The results showed that the content of essential oil appeared to be significantly higher in chamomile cultivated in Greece.

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