Volatile profile of *Salvia fruticosa* growing in different cultivation conditions in the region of Attica, Greece

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INTRODUCTION

Greek sage is an important medicinal and aromatic plant as it contains significant bioactive compounds [1]. It is used as raw material in cosmetic, pharmaceutical and food industry [2], and it is used worldwide as infusion. It is known that volatile components of aromatic plants are affected by environmental conditions, such as soil fertility and water status, as they influence their metabolic functions [3], [4]. In particular, the interaction between fertilization and irrigation seems to affect significantly the composition of the essential oils of aromatic plants. The aim of this study is to determine the effect of nitrogen fertilization and irrigation on the quantity (%) and quality of volatile components of Greek sage's organic extracts and infusions by using GC-MS.

MATERIALS AND METHODS

The samples of sage were grown under irrigated and not-irrigated conditions with four different nitrogen treatments (0 units, 5 units, 10 units, 15 units). The organic extracts of sage were prepared by adding 2,5 g of dry powdered plant material to 50 mL of diethyl ether, using an ultrasound bath for 45 min. Also, infusions of sage were prepared by extracting 0,5 g of dry powdered plant material with 50 mL boiled water (~70ºC) for 10 min. Extraction of infusions with diethyl ether was followed, in order to isolate the volatile components.

The volatile compounds of sage diethyl ether extracts and infusions were analyzed using GC-MS and the quantitative determination was based the method of internal standard.

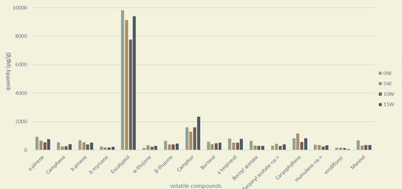

Figure 1: Concentration (μg substance/g plant material) of the main components of sage's organic extracts in irrigated sage cultivation with different nitrogen fertilization treatments [0 units(0W), 5 units(5W), 10 units(10W), 15 units(15W)].

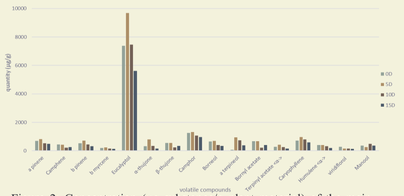

Figure 2: Concentration (μg substance/g plant material) of the main components of sage's organic extracts in non irrigated sage cultivation with different nitrogen fertilization treatments [0 units(0D), 5 units(5D), 10 units(10D), 15 units(15D)].

RESULTS

In the diethyl ether extracts of sage (Figure 1&2), zero fertilization combined with water seems to increased the concentration of eucalyptol (9814μg/g), *α*-pinene (937μg/g), *β*-myrcene (244μg/g), camphene (536μg/g), *β*-thujone (643μg/g) and manool (690μg/g). Combination of irrigation and fertilization had a positive impact of the quantity of camphor (2348μg/g) and caryophyllene (1160μg/g). On the other, low fertilization and lack of irrigation heighten the concentration *β*-pinene (716μg/g), *α*-thujone (790μg/g), borneol (700μg/g), *α*-terpineol (933μg/g) and humulene (399μg/g). In case of infusions (Figure 3&4). Eucalyptol (2427μg/g), *β*-thujone (114μg/g), *α*-terpineol (349μg/g), cuparene (79μg/g) and caryophyllene oxide (249μg/g) were increased under irrigation and zero fertilization conditions. Moreover, the amount of camphor (768μg/g) was increased by raising fertilization. Finally, *α*-thujone (121μg/g) and borneol (280μg/g) had better results under dry conditions.

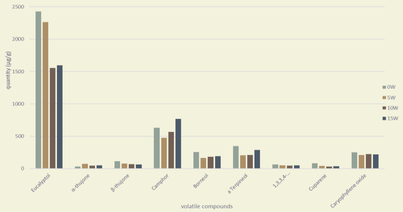

Figure 3: Concentration (μg substance/g plant material) of the main components of sage's infusions in irrigated sage cultivation with different nitrogen fertilization treatments [0 units(0W), 5 units(5W), 10 units(10W), 15 units(15W)].

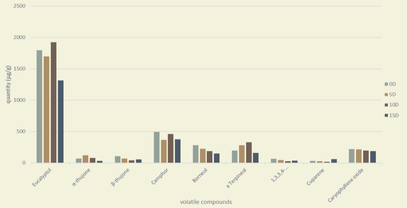

Figure 4: Concentration (μg substance/g plant material) of the main components of sage's infusions in non irrigated sage cultivation with different nitrogen fertilization treatments [0 units(0D), 5 units(5D), 10 units(10D), 15 units(15D)].

CONCLUSION

Eucalyptol was the major ingredient under all treatments. Irrigation has a positive effect on the percentage of most components. On the other hand, fertilization seems to be insignificant factor for the synthesis of secondary metabolites. On the contrary, nitrogen fertilization increases the quantity of camphor, which is undesirable due to its toxicity. In conclusion, an irrigated cultivation combined with low levels of nitrogen fertilization is suitable to produce quality essential oil that conforms to the recommended standards concerning to camphor (ISO 9909:1997).

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