# EFFECT OF FERTILIZATION LEVELS, METHODS OF DRYING AND PERIODS OF STORAGE ON THE SWEET MARJORAM HERB YIELD AND ITS ACTIVE INGREDIENTS.



BY

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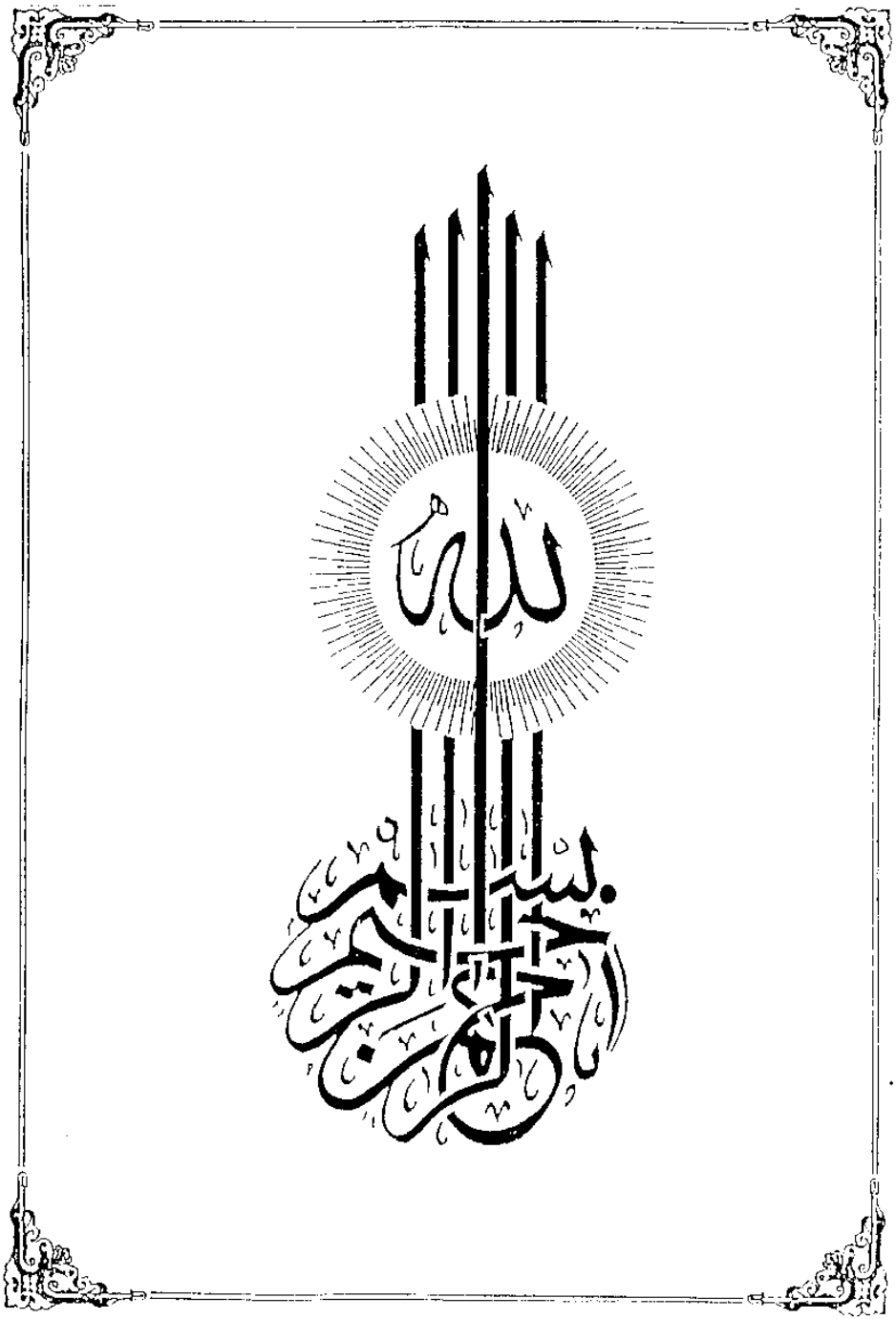

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# INTRODUCTION

Sweet marjoram (Majorana hortensis Moench) is gaining a growing economic importance among medicinal and aromatic crops in Egypt. The informations available at the Egypt Organization of control of Import and Export show that Egypt exported about 1475, 1267, 1796, 2017.6 and 1862 tons of dried leaves in 1982, 1983, 1984, 1985 and 1986 respectively, to Europe and America with respective values of about L.E. 1320, 1360, 2856, 2340 and 2903.

Sweet marjoram is used medicinally as carminative and stimulant due to its strong, highly aromatic, spicy and pleasing odour and flavour. Its dried leaves are widely used as condiment for seasoning soups, stews, and especially certain types of sausage and food production in general. (Guenther, 1961).

Marjoram oil contains major components as : terpinenol-4, $\gamma$-terpinene, D-limonene linalool, linalyl acetate, P-cymene, B-pinene and $\alpha$-terpineol. Whereas the peaks number 1,2,8 and $\alpha$-pinene represent the minor components.

Some of these components are used for scanting cosmotics and soap. Others are used for flavouring pharmaceuticals such as D-limonen and linalool.

Because of the low price of ∝-terpeniol and its typical lilac odour, it is used in the synthetic products. (Balbaa, et al., 1981).

For all these uses there are great demands in the local and international markets for marjoram herb and oil.

This study was conducted to throw more light on the effect of N,P,K fertilization on the growth and yield of sweet marjoram plant, and the quality improvement of the oil through the fertilization programs.

The relative effects of the drying methods of the leaves such as shade, sun and oven drying were also studied and storage periods and their effects on the oil content in marjoram leaves were investigated.

Since the physiochemical properties of essential oils play a significant role in their evaluation, the study included both the chemical constituents and the chemical characteristics as effected by temperature, air, light and the container material during the oil storage period.

An anatomical study was also carried out for its importance in this respect.

# REVIEW OF LITERATURE

## I. EFFECT OF THE FERTILIZATION LEVELS ON THE YIELD AND VOLATILE OIL CONTENT OF SWEET MARJORAM PLANTS

No doubt that the production of medicinal and aromatic plants and their essential oil is greatly affected by the application of fertilizers.

Nitrogen is one of the essential elements for its vital effect on all growth processes in the plant.

Many workers found a positive relationship between the application of nitrogen fertilizer and the increment in the yield of marjoram plant, among them Barner, 1938, El-Beltagy, 1966, Nofal, 1976, El-Gamassy et al., 1977 and El-Sharkawy, 1981.

Similar results were obtained by Purdue 1950, Baird, 1957, Dutta et al., 1961 on Mentha arvensis, Shrubis 1964, Etman 1965, on mint, Nelson et al., 1970, on spearmint, and Lammerink and Manning 1971, on peppermint.

Putievsky and Kuris 1976, applied four levels of N (normal, twice, 3 times and 4 times of normal rates) to Origanum vulgare plants for 2 years. They noticed that the highest level which was applied after each harvest almost doubled the total yield compared with the control.

While Duhan et al., 1977, found that there was no difference in the yield of Mentha arvensis herb between 60 and 90 kg nitrogen/ha. application.

The effect of nitrogen fertilization and harvest time were studied by Skrubis 1964, who reported that nitrogen fertilizer had a significant effect on peppermint, yield of the first harvest (Aug.) than that found in the second one (Nov.).

Regarding the effect of nitrogen fertilization on the percentage of volatile oil, Barner, 1938, stated that adding nitrogen fertilizer had increased the oil percentage of sweet marjoram. Wyile, Putievsky and Kuris, 1979, found that the level of nitrogen fertilizer had no effect on the percentage of essential oil of the Origanum majorana L. plant.

Concerning the effect of nitrogen fertilization on the essential oil yield, Nelson et al., 1970, found that nitrogen fertilization at 400 Lb/acre had significantly increased the oil yield of spearmint plants Franz 1972, mentioned that peppermint plants which were grown in pots and had been fertilized with 0.75-6.00 mgN./pot, the essential oil content was raised by 35% over the control.

Many workers found the favorable effect of nitrogen on the oil yield, among them, Rai et al., 1977, Duhan and Bhattacharya 1977, Shelke and Morey 1978, on Mentha arvensis, Singh et al., 1979 on Mentha citrata.

The composition of the essential oil as affected by nitrogen fertilizer was reported by many investigators, among them Clark and Menary, 1980. They found that oil of Mentha piperita fertilized plants contained high levels of menthol, menthyl acetate, menthofuran and limonene, and low levels of menthone and cineole.

The correlation between the nitrogen fertilizer and the increment in menthol and menthyl acetate content was reported by Singh et al., 1981, on Mentha arvensis and M.piperita plants.

The effect of the form of nitrogen on the yield of herb and oil was studied by Hotin, 1951, who reported that applying nitrogen in the form of ammonium, had increased the yield of Ocimum gratissimum herb. Also, Karawya et al., 1977, working with Mentha piperita, reported the same trend of results.

Singh 1978, found that ammonium nutrition reduced the shoot height, number of branches and the dry weight of Mentha arvensis plants. Khotin 1950, reported that the application

of ammonium sulphate on peppermint nearly doubled the oil yield in comparison with the unfertilized plants, especially when the fertilizer was applied at the early stage of growth. On the other hand, Karawya et al., 1977, found that applying the lower level of ammonium sulphate (150 kg/feddan) was favorably increased the oil production of Mentha spicata plants than the higher levels.

Singh and Singh 1979 studied the effect of nitrogen in the nitrate form on the yield of Mentha arvensis plants grown in sand culture. They found that the growth was increased by applying nitrate at 16 mg./liter, but above this rate yield was decreased. Concerning the effect of nitrate fertilization and the composition of the essential oil, Baslas 1970, found that adding sodium nitrate decreased the menthol content in the oil of Mentha piperita plants, grown in sandy soil.

Latypov 1960, made a comparison between the effect of the ammonia form of nitrogen and nitrate form and found that the ammonia form stimulated the production of Mentha piperita essential oil than the nitrate form.

Neubauer et al., 1974, found that urea application had increased the peppermint yields, improved quality and was economic.

Phosphorus is important and is needed by the plant as much as nitrogen. It inters in the composition of nucleoprotein and plastids which form vital parts of the living compounds, cytoplasm and nucleus. (Thus phosphorus have a good effect on increasing the yield of herb).

The increase in herb yield as a result of adding phosphorus fertilizer was found by Putievsky, 1978, on Origanum vulgare and El-Sharkawy 1981, on Majorana hortensis. Singh and Singh 1970, stated that the application of $P_2O_5$ at the rate of 90 ppm. had increased the fresh weight of Mentha arvensis leaves.

Baird 1957, found that phosphorus fertilization only caused small increase on the yield of mint herb. Skrubis 1964, also found that phosphorus had no significant effect on the peppermint yield in the first harvest.

Considering the effect of phosphorus fertilization on the oil yield, Baslas 1970, reported that adding phosphorus had raised the oil yield of Mentha piperita grown in sandy soil. The positive effect of phosphorus fertilization was proved by other workers such as Singh 1970, on Mentha piperita and Gupta et al., 1974, on M. arvensis. Baird 1957, found that