PHYSIOLOGICAL STUDIES ON THE GROWTH AND ESSENTIAL OIL PRODUCTION OF OCIMUM

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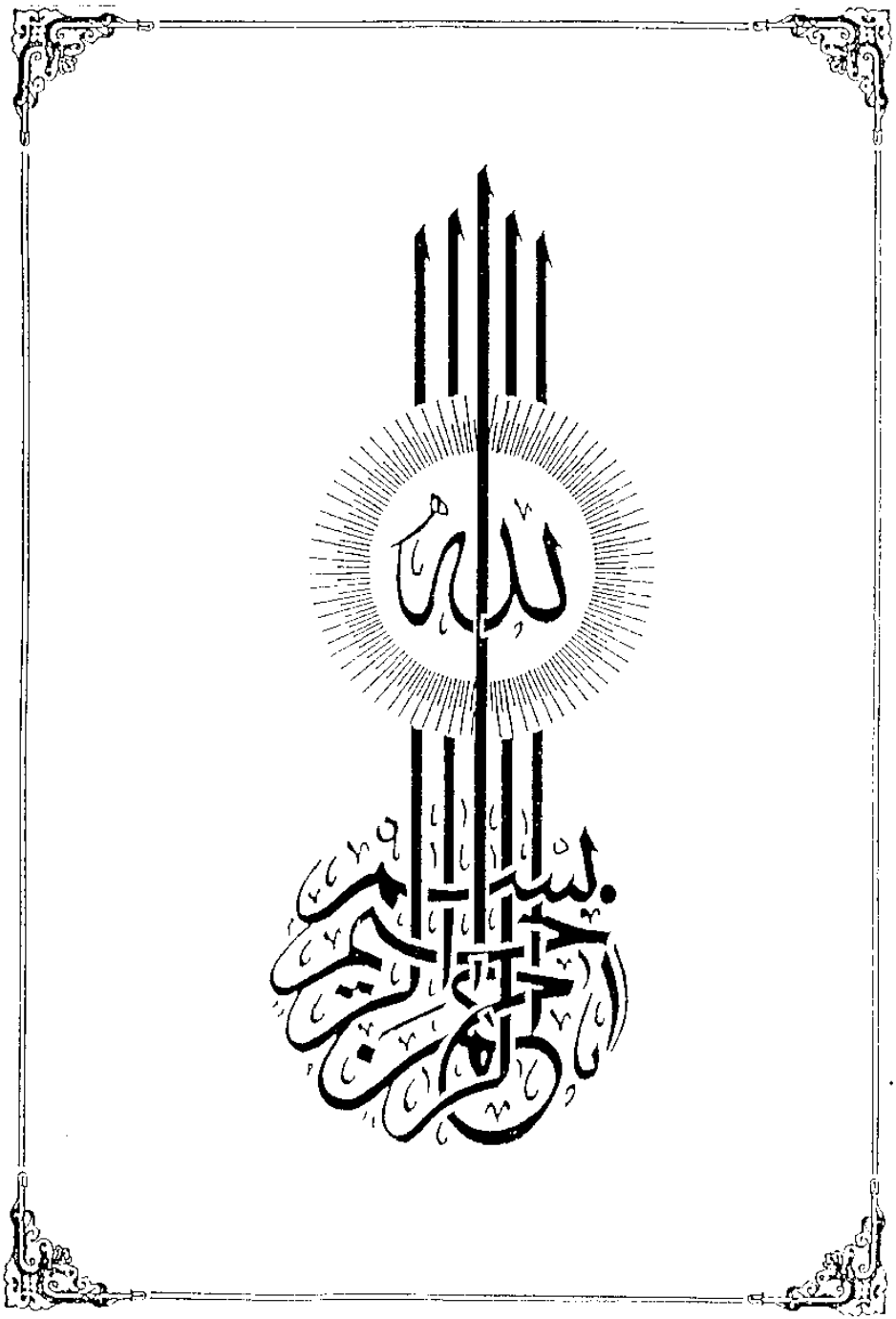

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C O N T E N T S

INTRODUCTION

In Egypt a considerable attention has recently been directed towards various aromatic and medicinal plants, where the climatic and cultural conditions specially the cheap of hand workers are comparatively quite favourable in view of the economical cultivation.

Among these aromatic plants that can be produced for export to Europe and America are: jasmine, peppermint, neroli, geranium and basil.

Among the European types, Ocimum basilicum var. purpurascens, is grown in Egypt under the name of red basil or fine basil.

The production of basil oil of high quality requires skilled management experience in plant requirements of mineral nutrition and the constituents of the essential oil which determine its value, sufficient to make their production profitable.

For the previous reasons with addition to the increase of the area planted with aromatic plants; where the planted area with basil increased from 6 to 117 feddan during the period of 1970-1975*, it is necessary to study the means to

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* Report of Agricultural economics and statistics Dept. Ministry of Agriculture (1976).

produce a high quality of basil oil. One of the most important factors in the plant management is preparing enough and economic nutritional programme to produce a high essential oil quality.

Thus, this investigation aimed to study the effect of N and P nutrients at different levels, and their combinations on the growth and essential oil productivity of basil plant, as well as carbohydrate contents, soluble and insoluble nitrogen forms, P and K contents.

REVIEW OF LITERATURE

The review of literature cited in this part will deal with some aromatic plants rather than basil plant, since the investigations with the latter plant are almost scarce in the field of mineral nutrition.

I. Effect of Fertilization on the Growth and the Yield of Plants:

1. Effect of N fertilization:

Cilly (1948) observed that N fertilization increased the yield of marjoram and lemon oil, while only minor changes were observed with oils of thyme, basil, sage, tarragon, savory, dill and fennel.

Schratz and Wiemann (1949) indicated that optimal N fertilization principally increases the proportion of Mentha piperita leaves. Leaf fresh weight may be increased as much as 352%. Leaf dry weight is not increased to the same extent because on better N supply, the water content of the leaves is greatly increased (maximum 60%), so that the gain of leaf dry substance is only 26%.

Khotin (1950) revealed the fertilization with sodium nitrate and ammonium sulphate nearly doubled the oil yield in comparison with unfertilized Mentha piperita particularly when fertilization was done in early growth period of the plant.

Baird (1957) reviewed that peppermint grown in Central Washington markedly increased hay and oil yields by nitrogen fertilization.

Latypov (1960) observed that ammonium sulphate was more effective than ammonium chloride for increasing oil production of mint and improved its composition.

Dutta and Chetterjee (1961) mentioned that the green yield of Mentha arvensis increased by increasing nitrogen level, but the yield of oil was maximum at 50 lb. N/acre.

Guenther (1961) demonstrated that the amount of geranium herb produced, was greatly increased by nitrogen fertilization. The use of such fertilizer increased the yield of oil from a a unit area by stimulating growth although it apparently does not noticeably affect the percentage of oil.

El-Gengaihi (1964) claimed that nitrogen fertilizer produced significant increase in the yield of fresh herb as well as oil yield of geranium.

Skrubis (1964) indicated that N applied at 14.3 g/sq.m. had a significant effect on the green matter yield of the first harvest peppermint.

Etman (1965) stated that increasing N fertilization to peppermint produced significant higher rate of growth, oil content and yield compared to unfertilized mint.

El-Beltagy (1966) indicated that increasing N supply to marjoram resulted in a corresponding increase in the dry weight of leaves. The low N supply (150 kg ammonium nitrate per feddan) gave the optimum herb yield and oil for plant in comparison to control. The high N levels (450 kg ammonium nitrate) did not produce a significant increase in dry weight of the leaves comparing with the medium supply of N (300 kg ammonium nitrate).

Hamza and El-Mahmoudi (1966) revealed that additional N to geranium did not significantly increase the fresh yield except when only two harvests were taken in the year. They also indicated that the level of N did not affect the oil yield.

Naryana et al. (1967) mentioned that geranium fertilized by 70 kg ammonium sulphate/ha. produced the maximum yield of herbage and oil per unit weight of plant material.

Atanssov (1968) reviewed that a single application of ammonium nitrate at an early stage of growth gave higher yields of lavender flowers.

Hotin and Segal (1968) working on chamomile plant in pot experiments claimed that different forms of N had no marked effect on the essential oil content of the plant.

Khotin (1968) mentioned that treating basil, clary sage (Salvia sclaria), and lavender with ammonia N increased the oil yield of the plants but this depended on the quality of the soil.

Raafat et al. (1970) illustrated that increasing the nitrogen supply (20, 40, 60 kg N/feddan/cut) to Mentha piperita increased the plant high markedly. Plants supplemented with higher nitrogen levels were always taller than others.

Erysheva and Ivanchenko (1971) stated that clary sage treated with NH_4NO_3 and urea yielded 11.8-12.6 quintal/ha, while the yield of plants treated with $(NH_4)_2SO_4$ was 5.2 quintals/ha. Similarly the yield of essential oil was increased by NH_4NO_3 and urea treatments by 22-23%, while $(NH_4)_2SO_4$ increased it only by 12%.

Nelson et al. (1971) mentioned that average yields of peppermint increased with N up to 200 lb/acre.

Franz (1972) reported that adding nitrogen alone at the rate of 4.5 g N/mitscherlich vessel, increased peppermint yield by 150%.

Oda (1972) stated that fertilizing Rosemary by N had no significant effect on plant height while it had significant effect on branching where the higher level of N treatments (32 g. ammonium sulphate per plant) resulted in the greatest number of branching. He added that N fertilization had significant effect on the fresh weight of leaves, stems and herb. The higher level of N treatments (32 g. ammonium sulphate per plant) resulted in the greatest values.

Neubauer et al. (1974) reported that urea applications increased yields of peppermint and the best results were obtained with split doses (100 kg/ha total) applied when the shoots reached 8-10 cm. and after the first harvest.

2. Effect of P fertilization:

Kalinkevich (1946) reported that decrease of P applications to Ocimum canum decreased the yield of leaves.

Schratz and Wiemann (1949) reported that fertilizing Mentha piperita by P aloneincreased remarkably the formation of fresh matter by 477%. The relation between leaf weight and stem weight was only slightly influenced. The increase of the leaf fresh and dry weights were 473% and 515% respectively.

Baird (1957) mentioned that there was a small increase in the yield of peppermint occurred on P fertilized plants.

Esponda and Sivory (1961) mentioned that P deficiency stunted the growth of Tropeolum majus and retarded or completely inhibited flowering.

Kuchuloriya (1961) stated that the best results on the crop of green mass and the ratio of leaves to stalks of geranium were obtained by spraying the leaves with 3% superphosphate extract. The results showed the good effect of supplementary feeding plants with P during the vegetative period.

El-Gengaihi (1964) claimed that phosphorus fertilizer had a slight effect on the fresh weight of geranium herb.

Ivanova and Gogija (1965) stated that P fertilizers increased oil accumulation in the leaves of geranium plants, but as they also tended to reduce green matter production, essential oil yields per ha. were only increased slightly.

El-Beltagy (1966) mentioned that P fertilization had a negligable effect on the oil yield of marjoram plant.

Jaskonis (1966) indicated that fertilizing mentha plants with P only decreased yield of dry leaves to 76% comparing to control.

Karl'Cénko (1967) reviewed that P alone increased lavender yield slightly.

Weiss (1967) reported that placing superphosphate in the planting holes used for geranium cuttings greatly increased yields of green material in the first two years only, but there was little difference in the effect between applications of 40 and 120 lb. P_2O_5 per acre. P had no significant effect on the yield of oil per ton/cut, or its quality.

Singh and Singh (1969) indicated that P deficiency increased essential oil content of Japanese mint during winter and summer, and reduced plant height, number of branches, number of stolons, number of leaves, total leaf area, fresh weight of component parts and growth rate.

Baslas (1970) revealed that P applications to the soil increased the oil yield of Mentha piperita.

Singh and Singh (1971) observed that P deficiency reduced the rate of Japanese mint dry matter accumulation. Deficient plants recovered to some extent when they were supplied with P after 40 days.

3. Effect of NPK fertilization:

Macku (1927) found that K and PO_4 ions in sand culture were active in the production of oil peppermint while, NO_3 and PO_4 were active in the production of both vegetative materials and essential oil.