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PHYSIOLOGICAL STUDIES ON THE GROWTH, OIL YIELD AND CHEMICAL CONSTITUENTS IN BASIL PLANT, OCIMUM BASILICUM, L.

By

AWAAD MOHAMMED ABD ALLA KANDEEL

B. Sc. Agric. (Horticulture), Ain Shams University 1974

M. Sc Agric. (Horticulture), Ain Shams University 1982

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Name : AWAAD MOHAMMED ABD ALLA KANDEEL

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Ph.D. Thesis approved by:

M. B. Mostafa

Abo Dahab

M. R. Sheleed

Committee in Charge

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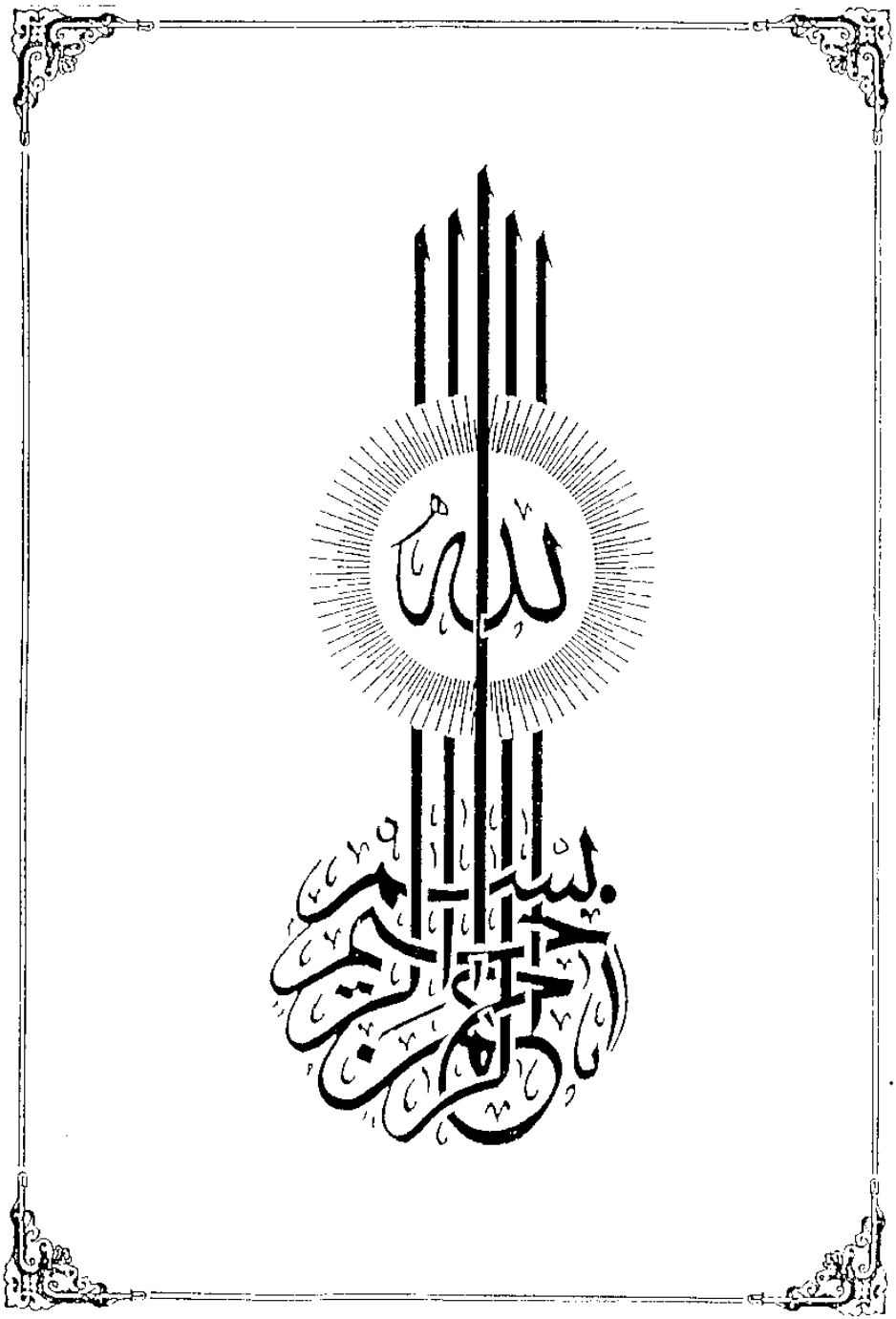

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CONTENTS

INTRODUCTION

Recently, medicinal and aromatic plants considered as one of the most important sources of income in Arab Republic of Egypt. Its importance resembles in offering the raw material for pharmaceutical and perfume industries. So, nowadays, considerable attention has been given for more areas planted with such plants, besides raising the yield of these crops.

Sweet basal plants (Ocimum basilicum L.) is one of the important crops with high production and manifold applications. The plant belongs to the family Labiatae. The ancient Egyptian name was called "Shma" (Ministry of Agricultural Museum, 1963). There are about 50-60 Ocimum species in tropical Asia, Africa and America, where the herbs are annual or perennial.

The local varieties of basil plants in Egypt are: White Basil (Ocimum basilicum L.), Red Basil (Ocimum canum) and Camphor Basil (Ocimum Sims). These names refer to the colour of flower of the plant. While, the camphor basil plants are characterized by the camphor odour of the crushed leaves and flowers. The main crop of the white basil is planted locally in large scale and occupied the largest area. Its oil is used for export abroad, while, the red basil is exported as dried leaves. The comphor basil is planted in Egypt in a scattered limited areas.

Generally, the basil plants have an economic value among plants producing essential oils. Guenther, (1961) and Eid, (1964)

reported that the essential oil of basil is found mainly in leaves and flowers, but only traces in stems. The oil is employed quite extensively in many kinds of flavours, including confectionary, backed foods and condimentary, (Guenther, 1961). It is also used in beverages, tastes in certain proportions, meat products, canned foods and in certain dental and oral products as tooth pastes and mouth washes, in which it is used for removing the disagreeable odours. Kirtikar, (1918) mentioned that the juice of Ocimum basilicum L. forms an excellent cure for ring worms and scorpion stings, while basil flowers possess stimulant, diuretic and expectorant properties. The oil is used also in remedy against the heart diseases, and in manufacture of soaps, perfume and in many pharmaceuticals. The infusion of the fresh herb is used as carminative.

Due to the demands in the foreign markets on basil essential oil, especially Europe,it is essential to have more work to obtain high yield with good quality of oil. Actually, few work was done to improve the commercial standing of the local varieties of basil oil. So these experiments were conducted to study the effect of some growth materials as Gibberellic acid (GA_3), Kinetin and B-9 on the growth, yield of herb and oil content of basil plants. Where the quality of an essential oil depends mainly on its chemical constituents and their relative amounts, since each oil is characterized by a particular ingradient,

which plays a decisive role in determining its quality and subsequently its market price or commercial value. The present investigation is mainly concerned to study in detail the main chemical constituents of such oil and to throw more light on its composition as affected by the growth regulators as it is a major object of this work.

REVIEW OF LITERATURE

1- Effect of Growth Regulators on Growth :

1-A- Effect of Gibberellic acid (GA_3) on Growth :

The response of medicinal and aromatic plants to GA_3 application was studied by many investigators, since gibberellins were recognized as universal plant growth factors within several years after their discovery.

Phinney and West (1958), suggested that the growth responses currently thought to be induced only by the gibberellins, may ultimately be found to be associated with other substances quite unrelated in structure to gibberellins.

Gibberellins are biologically active in stimulating cell division or cell elongation or both characters in plants. Gibberellin like substances having biological property of inducing shoot elongation for many plant species. Strafford (1970), mentioned that, GA_3 applied to plants and markedly increases the length of stems due to cell elongation rather than cell division as the number of internodes remains approximately constant.

It was noted by Pochua, (1966), that spraying GA_3 at concentration of 0.02% on young plants of Hibiscus abelmoschus; Pelargonium roseum and Ocimum gratissimum caused that Hibiscus abelmoschus grew to a height of 108 cms, compared with 74 cms. in the control plants, and produced about twice as many buds. He also found that green matter production in Pelargonium roseum

and Ocimum gratissimum did not increased by GA_3 treatment.

Eid and Ahmed (1977), with Ocimum basilicum, stated that GA_3 treatments lowered the dry weight of the plant leaves.

Abou-Zied, (1979) found that, GA_3 resulted in higher values of plant height and number of branches of Ocimum gratissimum plants.

El-Leithy (1983), pointed out that the GA_3 application to Ocimum basilicum plants at the rate of 50, 100 and 200 ppm gave the highest plants in the second cut (August) when compared to the untreated plants. However, in the first cut of the first year, GA_3 at 100 or 200 ppm concentration significantly decreased the plant height. He also cleared that, GA_3 at all concentrations did not affect the number of branches in June cut, whereas, in the second cut in August of the first season, GA_3 at 200 ppm concentration significantly decreased the number of branches. In the second cut (August) of the second season, GA_3 at the rates of 100 or 200 ppm significantly increased the number of branches. A remarkable decrease was found in leaf area specially when spraying GA_3 at the higher rate of 100 or 200 ppm concentration. He added that GA_3 application had no significant effect on plant fresh weight in June cut in the two seasons. The reduction was significant in plants treated with GA_3 at the rate of 100 or 200 ppm in August cut in the first season and highly significant in GA_3 treatment at the rate of 100 ppm in the second season.

Mousa and El-Emary (1983), sprayed Ocimum basilicum plants with GA_3 at 50, 100 or 200 ppm concentrations. They found that these treatments considerably reduced plant height, number of branches per plant and herbage yield of the plant.

Gonzalez and Gjerstad (1961), found that a single foliar spray of GA_3 at 50 ppm concentration increased linear growth of spearmint plants by 258%, increased dry matter while it decreased water content in the leaves. No significant differences in response were observed between the treatments of 10,50 or 100 ppm of GA_3.

Ogzewalla (1961), with peppermint (Mentha piperita)found that when the plants were sprayed weekly with 10 and 100 ppm of GA_3, the fresh weight of herb was reduced, while the dry weight was similar to that of control plants.

Krys'kov and Skurat (1961), mentioned that GA_3 at 0.0001 % and 0.01% was applied to peppermint in the laboratory by the drop method and out of doors by spraying. The treated plants grew much better than the controls but had less dense filiage. On the other hand, Leh (1964) stated that gibberellin (GA_3) promoted shoot growth but reduced root development of both peppermint and sunflower plants in water culture.

Kaul and Kapoor, (1966) pointed out that spraying solutions of GA_3 at (10-200 ppm) concentrations induced 30-50% increases in the total yield of herbage of Mentha arvensis var. piperascens at the pre-flowering stage. A part from the elongation

of internodes the leaf area was also increased. They found also that the stage of development of the plant at the time of treatment appeared to be a significant factor in obtaining favourable effect.

Zderkiewicz (1971), mentioned that the treatment with GA_3 at 0.01 and 0.02% stimulated growth and development in peppermint plants which were finally some 28 cms taller than the normal plants.

Bosela and Smik (1978), stated that the application of gibberellin to both Mentha piperita L. and Mentha crispa L. increased plant height, stem shoot and leaf numbers when the concentration used was 3×10^{-4}.

Mahmoud (1980), with mint and geranium plants found that, GA_3 at (5,10 and 20 ppm) stimulated plant height, number of total branches and number of leaves per plant.

El-Keltawi (1981), reported that the maximum yield of herb, fresh weight of leaves, stems weight and number resulted from the combined effect of applying of 25 ppm GA_3 + 50 ppm boron to spearmint plants. Generally, the application of GA_3 at various levels (25 or 50 ppm) increased the plant height, internode length and weight of stems.

Sleem (1973), found that GA_3 application on sweet marjoram plants (Majorana hortensis Mnch) at 25, 50 and 100 ppm increased plant height, fresh and dry weights of plant herb.

El-Antably et al. (1976), studied the effect of some growth hormones added to Majorana hortensis plants. Among those was GA_3, which used at the rates of 50 or 100 mg/L. They reported that the plant height increased when the plants were treated with GA_3 at 100 mg/L only over the untreated controls. However, both GA_3 rates increased plant dry weight.

El-Sharkawy (1981), working with sweet marjoram plants, found that the GA_3 treatments showed a promotive effect on the plant growth. The auther noticed also that the increase of this promotive effect was in line with the increase in the GA_3 concentration, till the 400 ppm, then this effect was decreased with 600 ppm. Remarkable effects were obtained as the application of GA_3 were with the concentrations of 200 and 100 ppm, while, the 600 ppm gave lower weight of the mean fresh weight of herb.

Harridy (1982), on Calamintha officinalis var nepetoides stated that using GA_3 was found to be effective in stimulating the growth in term of plant height. The optimum concentration, in this respect, was 20 ppm followed by 40 ppm, while, 100 ppm concentration mostly gave the same effect as the untreated plants. GA_3 had no stimulating effect on branching with the concentration of 10 ppm which was relatively similar to that of the control plants.

Brummett and Sciuchetti (1961), mentioned that gibberellic acid was applied as single 100 mcg. doses to the surface of the