COMPARATIVE STUDIES CONCERNING FOLIAR AND SOIL NITROGEN APPLICATION ON BANANA PLANTS

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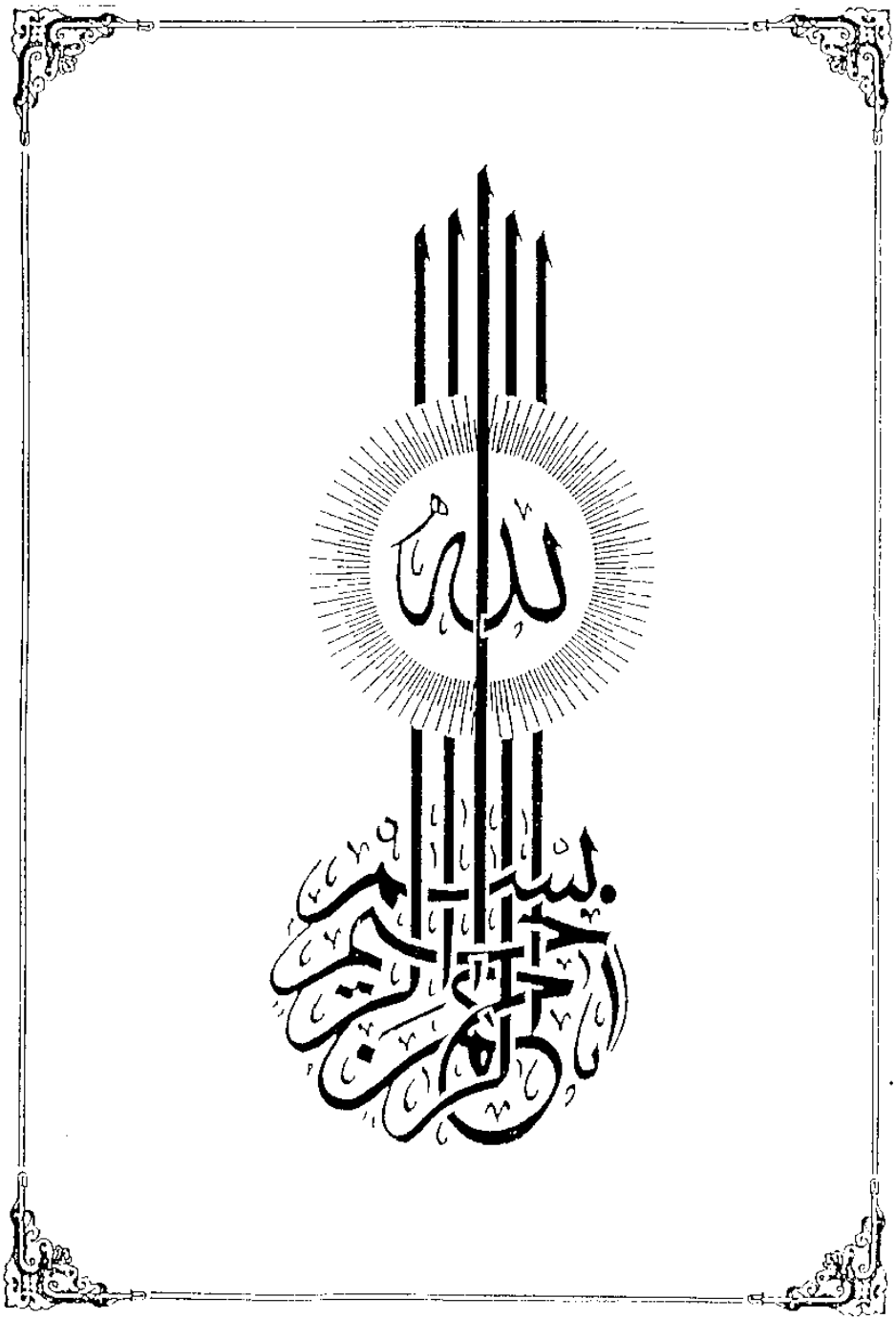

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INTRODUCTION

The banana fruit is considered one of the most popular edible fruits where about half of the world production is eaten fresh and the other half is eaten after being cooked. Bananas also yield a number of minor edible products.

The total world production of banana fruit reached about 26 milion metric tons in 1969 (according to the FAO bulletin, 1970). In Egypt the total area of banana plants reached about 11,000 feddans producing about 97,000 tons*.

Vertical expansion in banana production is one of the major objectives of the horticulturists. This expansion can be realized through better cultural practices. One of the major practices that affects the yield markedly is nitrogen fertilization.

Recently some investigators found that urea could be used as a nitrogenous fertilizer that could be applied to the foliage of banana plants (Minessy and Baghdadi 1958 and Pan 1963).

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* Bull. of Hort. Service Section, Ministry of Agric.,1971.

The banana plant is a good field for this investigation for the following reasons :

1- Its greatest demand of nitrogen fertilizers (Swidan 1972).

2- Its broad leaves which are suited to foliar sprays.

3- Foliar sprays with urea may save a lot of nitrogen loss that takes place through leaching when applied to the soil.

4- High urease activity in the growing point of the banana plant (Freiberg and Payne 1957).

Thus the major purpose of this investigation was to study the comparative effects of soil and foliar nitrogen applications on both yield and growth of banana plants to lead us to the best procedure of nitrogen application to banana plants.

The investigation involved also a study concerning the distribution of some major elements namely: N, P and K in different parts during the banana leaf life to lead us to the proper site for sampling.

REVIEW OF LITERATURE

Part I- Soil fertilization of banana with nitrogen :

a) In relation to yield :

Many workers studied the effect of soil fertilization on yield of banana plants.

In Jamaica, the Agriculture Dept. (1950), found that nitrogen fertilization of Lacatan banana increased yield by 10 - 20 % at three stations, and shortened maturing time by 1 - 2.6 months at two of these stations.

Alexandrowiez (1955), concluded that in the first phase of banana's life (*Musa sinensis*), the plant absorbed freely to form reserves of mineral elements in order to develop meristematic tissue commensurate with those reserves, however in the second phase it employed the reserves, and the meristem in the formation of flowers and fruit. He added that the number of fruits thus depended on the amounts of nutrients absorbed in early life but their size depended largely upon the level of nutrients at the late stage of growth life. Yield could therefore be

increased by proper treatments both before and after floral initiation.

Bhan and Majumdar (1956), revealed that banana plants (Var. Martaman) cropped earlier and yielded better when heavy applications of nitrogen were used, but did not respond to phosphorus (as super phosphate) or potassium (as sulphate of potash). They added that heavy nitrogen application also had a significant effect on the number of hands and fingers per bunch.

Butler (1960), in his experiments on banana (var. Gros Michel) noted that economic response to fertilizing could be expected only from the use of nitrogen. However potassium and phosphorus alone and in combination, or in conjunction with nitrogen, produced no statistically significant increase in production over nitrogen used alone.

El-Mahmoudi (1961), in his study on the Cavendish banana revealed that yield varied according to the age of plantation. The average yield of Cavendish banana was 2 - 3 tons of small bunches per acre for the mother plants of 300 plant per acre and approximately of 8 - 10 tons per acre for the first ratoon plants (800 stems) and

10 - 12 tons per acre for the second ratoon plants (800 stems). There-after the yield decreased gradually and slightly as the plantation age advanced.

Srivastava (1961), tested three forms of nitrogen each at four levels on Basrai banana plants and found that the larger fingers, the heaviest bunches, the earliest flowering and ripening were obtained by a mixture of 1.5 Ib. ammonium sulphate, 30 Ib. farmyard manure and 3 ½ Ib. of caster cakes.

Bhango et al. (1962), in their investigation on banana in Honduras, mentioned that in medium to strongly acid alluvial soils, little or no response was obtained from nitrogen, phosphorus or potassium fertilizers when these were applied singly. In mixtures however, they caused significant responses, and a 350 - 160 - 180 formulation of N, P_2O_5 and K_2O greatly increased yield, bunch weight, number of hands per bunch and marketing quality when compared with 350 Ib. of nitrogen alone. Meanwhile, leaf and soil nutrient contents increased in proportion to the amount of fertilizer applied, and yield were related to them. The minor elements tested singly, however caused no significant yield response.

Munaioli (1962), in Somalia examined the effect of seven different treatments on the yield and average bunch weight of Dwarf Cavendish banana for 2 years. He found that yield responsed to nitrogen application alone.

Hewitt and Osborne (1962), in their investigation at Jamaica on leaf analysis of Lacatan bananas, as a guide to the nutrition of the plant, mentioned that three applications of nitrogen in spring, summer and autumn, gave highest yields and in the presence of adequate nitrogen and phosphorus the yield could be doubled.

Venkatesam et al. (1965), studied the effect of nitrogen, phosphorus and potassium separately on Korpura Chakarakeli banana plants. The results revealed that the nutrients had little effect on the number of days required for the maturing of the bunches, but the daily rate of increase in buch weight rose with increasing levels of nitrogen. Yield was increased 15.3 % and 46.2 % over the control by the low and the high nitrogen rates, respectively.

Valmayor et al. (1965), investigated the influence of fertilizers on the yield of bananas reported that

no response was obtained to phosphorus or potassium, but the single dose of nitrogen (120 g. per stool per year) increased yields by 75.73 % over the controls, and the double dose (240 g.) by 166.77 %.

Hassan (1966) in Egypt, found that the effect of nitrogen fertilization on Hindi banana yield was much greater than the effect of potassium. He also reported that the best results, as far as yield increase was concerned, were obtained under the combination of the high levels of both nitrogen and potassium (6 kg. ammonium nitrate + 2 kg. potassium sulfate). These increases were about 38 % and 56 % in the 1964 and 1965, respectively. Here again, he claimed that the highest percentage increase in the number of hands and fingers per bunch over the controls was obtained under the above mentioned treatment. The percentage increase in the number of fingers per bunch was 27 and 41, in the 1964 and 1965 respectively.

Youssef (1968) in Egypt, found that nitrogen fertilizer (calcium nitrate 15.5 %) per stool (3 plants per stool) increased yield to about 75 % and 77 % for the Hindi variety in 1964 and 1965, respectively. He also added that there were about 25 % and 24 % increases in

mean number of hands per bunch and about 20 % and 38 % increase in mean number of fingers per bunch for the Hindi variety in 1964 and 1965 respectively due to the high nitrogen level. Moreover, he noted that increasing nitrogen level caused earlier bunch shooting and reduced number of days required for bunch maturity.

Swidan (1972) in Egypt, studied the effect of nitrogen levels on the number of hands/bunch, number of fingers/bunch and number of fingers/hand in Hindi banana. He found that the best treatment was 4 kg. ammonium sulphate, followed by 2 kg. and 8 kg. ammonium sulphate. The recommended treatment yielded the heaviest bunches. Furthermore, he showed that usually, the more hands there were on a bunch the more fruits there were in a hand.

b) In relation to growth :

Tanaka (1937), studied the effect of nitrogen, phosphorus and potassium upon the banana plant. He stated that nitrogen proved to be the most important nutrient and its omission resulted in a very poor growth.

Simmonds (1958) indicated that, with regard to the total number of leaves produced, healthy bananas normally had about 10 - 15 (exceptionally 20) green leaves, the number falling towards maturity of the bunch, at a time when leaf loss was no longer balanced by leaf production. He noted also that in tropical conditions nitrification of ammonia and leaching of nitrate were rapid processes. Therefore, in order to ensure regular availability of nitrogen throughout growth, and also to minimize waste of nitrogenous fertilizers, they should be applied in small doses at short intervals of time, and to be placed near the roots.

El-Mahmoudy (1959) in Egypt, revealed that the application of nitrogen at the rate of 1200 kg. ammonium sulphate per feddan (4 kg. per stool) in small amounts at different intervals, was satisfactory for Cavendish banana production. He added that, there was a relationship between the height and the circumference of pseudostem at time of bunch shooting. In the Hindi variety the height

was about twice as much as the circumference of pseudostem. He also found that increasing the amount of nitrogen fertilizer caused an earlier time of bunch shooting and reduced time to bunch maturity. The percentage of bunch shooting during the period from 1 till August 15 was about 40%, 54%, 63% and 70% of plants receiving 600 gr., 1200 gr., 1800 gr. and 2400 gr. of absolute nitrogen per stool respectively.

Battikhah and Khalidy (1962), in their investigation on Cavendish banana plants, each receiving single superphosphate (400 g.) and potassium sulfate (200 g.) and were treated with 0, 100, 200 or 400 g. of ammonium nitrate in three split application at 45 days intervals, found that stem length, leaf area, leaf production rate and leaf nitrogen content increased with nitrogen applications. They noted also that any application of more than 200 g. nitrogen per plant did not substantially increase plant growth.

Higuera Escobor (1962), found that the effect of N, P, K and minor elements, separately or in various combinations on the production of sucker of banana (Musa paradisiaca) was not significant.