بسم الله الرحمن الرحيم

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ALEXANDRIA UNIVERSITY
Faculty of Agriculture
(Saba Basha)
Plant Production Dept.

EFFECT OF NITROGEN SOURCES AND BIOFERTILIZER ON MAIZE PLANT IN CALCAREOUS SOILS

A THESIS

Presented to the Graduate School
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BY

HANY ABD EL-ATI ABD El-RAHMAN DARWESH

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ALEXANDRIA UNIVERSITY
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INTRODUCTION

Maize is the very important cereal crop, in Egypt, next to wheat, it is mainly used, by Egyptian farmer, for animal feed as well as human food. Such importance has kept the maize acreage without reduction compared to the other cultivated crops. For the period of 1950 to 1999, maize area, in our country, relatively increased from 0.61 to 0.78 million hectare, or about 27.9% (Agricultural Agric. Econom., 1979-1999).

Therefore there is a need to raise productivity of maize. In Egypt, among various N-fertilizer sources ammonium sulphate, calcium nitrate and urea are the most common essential forms required for growth and yield of maize plant. The effect of three N-sources are being evaluated in different locations and under various conditions.

Biofertilizer by N-fixing bacteria could contribute to the nitrogen requirements for maize plants. Therefore, the importance of the present study was justified according to the following reasons.

1. Limitation of N-fertilizers technology pollution losses of N-fertilizers, the destructive effects of dinitrefication products on ozone, application costs and production difficulties (Madkour *et al.*, 1987 and Zaid, 1992).

2. Inoculation with N-fixing bacteria increasing yield of field crops even in agricultural systems where mineral N-supplementation is not a major problem (Mitkess *et al.*, 1996).

❸ Using mixtures of microorganisms is a promoting trend for increasing the efficiency of N_2-fixing bacteria (Belimov *et al.*, 1995).

❹ At present we can satisfy N-requirements of plants grown in desert ecosystems, via mineral N-fertilization or inoculation with N_2-fixing organisms (Fayez, 1990).

Therefore, the objective of the present work was to study the effect of biofertilizer (N_2-fixing bacteria), and nitrogen sources and the interactions effects between nitrogen sources and biofertilizers on maize crop.

REVIEW OF LITERATURE

1- Effect of nitrogen sources :

Among the great number of nitrogenous fertilizers, ammonium nitrate, ammonium sulphate and urea usually are used in Egyptian corn plantations. This, the evaluation of these form to chose the best of them with regard to their effect on maize productivity is of great importance.

Power *et al.* (1972), found that corn production was the highest for ammonium sulphate and ammonium nitrate at 110 kg N/ha in dry land regions of the Northern Great plains.

Jackson *et al.* (1976), indicated that when both NH_4^+ and NO_3^- are present in the growth medium as (in $NH_4^+NO_3^-$) total N uptake is increased.

Rathore *et al.* (1986), reported that nitrogen application had positive significant effect on maize plant height and number of grains per ear.

Shalaby and Makhail (1979a), showed that increasing nitrogen level from 72 up to 216 kg N/ha, significantly increased both plant height and area of the sixth leaf blade on plant, on the other hand; opposite trend was obtained with the mean number of days to 50% of silking. Data published by the same author; Shalaby and Makhail (1979 b), revealed that some yield components namely; percentage of two-eared maize plant upper, most ear length, number of kernels per row and seed index, significantly increased as nitrogen level increased from 72 up to 216 kg N/ha.

Hageman (1980), reported that from the physiological considerations, either NO_3^- or NH_4^+ can serve as an adequate source of N for plant growth and productivity.

Shalaby and Omar (1981), noticed that grain yield, number of ears per plant, ear weight, plant height and number of green leaves at 75% of silking increased with increasing nitrogen level, while number of barren plants per hectare showed a reverse trend.

Khalifa *et al.* (1983), reported that nitrogen level of 107 kg/ha caused a significant increase in maize plant height, ear height, number of leaves below the main ear and leaf area. Meanwhile, the same level caused a significant reduction in the percentage of barren plants, increasing nitrogen level above 107 kg/ha did not cause any significant changes in the above mentioned characteristics. In addition, increasing nitrogen fertilizers up to 214 kg/ha, significantly increased grain yield, ear length, number of kernels per row, ear weight, kernel weight per ear and 100-kernel weight per ear and 1000-kernels weight. Moreover, that level significantly reduced the number of days to 50% silking.

Bashir *et al.* (1984), obtained the highest yield of grain sorghum when using calcium nitrate with Giza 15.

Boswell *et al.* (1985), concluded that N fertilizer can increase, decrease leaves or soil pH unchanged depending on (i)whether the form of N NH_4^+ or NO_3^-, (ii) the accompanied anion or cation, (iii) the crop grown, and (iv) the ultimate fate of the fertilizer N ammonium sources produce acidity during nitrification. The final acidity may be greater if the NH_4^+ is

associated with an acidic anion such as sulphate (SO_4^-). Thus, the ammonium sulphate is usually the most acidic N source. On the other hand, they also concluded that nitrate sources accompanied by basic cations such as Na^+ or Ca^{++} may raise the soil pH. Most plant roots in the soil absorb N as NO_3^- since that form occurs in higher concentration than NH_4^+ and is free to move to plant roots, primarily by mass flow.

Kanyong and Impithuksa (1985), found no significant differences in sorghum grain yield when applying different sources of nitrogen (ammonium sulphate, ammonium chloride and urea).

Ashoub *et al.* (1987), found that increasing nitrogen rate up to 142.9 kg/ha caused such significant increase in plant height at 60 days after planting, leaf area, dry weights at 45 and 60 days from planting, ear weight percentage, grain yield percentage, seed index and ear length.

Seif *et al.* (1988) showed that the tallest plant length, stem diameter and grain yield of grain sorghum was obtained by using ammonium nitrate followed by using urea and followed by using ammonium sulphate.

Alexander *et al.* (1991), found that dry matter and grain yield increased for two hydroponically grown maize hybrids (Pioneer-3925 and Pioneer-3949) when plants were supplied with an NH_4^+ enhanced nutrient solution (31 percent of total N) compared with a control (4 percent of total N as NH_4^+). The major difference in yield developed between silking and 2 weeks post silking and silking and 4 weeks post silking for the P-3925 and P-3949, respectively.

Mahli (1991) reported that significant reduction in soil pH due to N fertilizer, primarily in the 0-15 cm layer. The amount and depth of depression in soil pH was the greatest with ammonium sulphate followed by ammonium nitrate and a small effect by urea.

Gouda *et al.* (1992), found that N application up to 150 kg N/Fad caused a significant increase in number of green leaves, leaf area plant, ear height, ear length and diameter, number of grains/row as well as/ear, 100-grain weight and grain yield/fad. Number of days to 50% silking was significantly reduced by nitrogen application up to 150 N/fad. While, number of rows/ear was not affected by nitrogen fertilization.

El-Koumey (1993), found that farm yard manure and N-fertilizer sources Ca $(NO_3)_2$ or $(NH_4)_2SO_4$ showed an increase of dry matter yield, grains and nutrients uptake. The application of Ca $(NO_3)_2$ increased Ca-uptake by corn plants more than $(NH_4)_2$ SO_4 application.

Salem (1993), found that increasing nitrogen rate from 40 to 120 kg/Fad increased stem diameter, number of leaves/plant, leaves and stem fresh and dry weight, leaf area index, grain number/row, ear weight, grain weight/ear, 100-grain weight as well as ear yield/Fad.

Salwau (1993), indicated that different sources of nitrogen fertilizer had no effect on plant height, ear height, ear diameter and number of rows/ear, whereas number of ears/plant, ear length, shelling % and 100-grain weight were significantly affected by nitrogen sources in one season out of two. Application of ammonium nitrate and urea were similar and both gave higher number of grains/row, ear weight and grain weight/ear in