RESPONSE OF SOME MAIZE VARIETIES TO ORGANIC FERTILIZER AND MINERAL NANO FERTILIZER UNDER SALINE CONDITIONS AT SIWA OASIS

By

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B.Sc. Agric. Sc. (Agronomy), Ain Shams University, 2007

M.Sc. Agric. Sc. (Crop Production), Ain Shams University, 2014

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ABSTRACT

Mohamed Hassan Khalil Hassan, Response of some Maize Varieties to Organic Fertilizer and Mineral Nano Fertilizer under Saline Conditions at Siwa Oasis. Unpublished doctor of Philosophy Dissertation, agriculture in desert and salt affected areas, Ain Shams Univ., 2019.

The Two field experiments were conducted during two seasons, 2015 and 2016 at Experimental Station of Desert Research Center at Tegzerty, Siwa Oasis, Matroh Governorate. The principal aim was to study the effect of organic fertilizer (15 and 30 m^3/fed.), mineral and nano nitrogen fertilizers (100% mineral N from the recommended dose (120 kg N/fed., as ammonium sulphate),75% mineral + 25% nano N fertilizers,50% mineral + 50% nano N fertilizers, 25% mineral + 75% nano N fertilizers and 100% nano N from the recommended rate) on two maize hybrid varieties (Single hybrid 131, Triple hybrid 329) . Each experiment was laid out in a splilt-split plot design with three replicates. Organic fertilizer were arranged in the main plots, maize varieties were allocated in the sub plots, and mineral nano N fertilizer treatments were assigned in the sub-sub plots.

The increase in organic manure fertilizer leads to increase in plant height by 24.81% , 8.31%, increase in leaf area index by 27.7%, 11.8%. and increase in specific leaf weight 5.7%, 3.1% in 1^{st} and 2^{nd} season respectively.

The highest value of plant height was obtained from 100% mineral nitrogen, in the 1^{st} season, and 75% mineral plus 25% nano nitrogen fertilizers in the 2^{nd} one.The increased in 100% mineral nitrogen fertilizer level leads to increase in plant height. by 14.2%, 5.5% and LAI 25%, 9.3% compared with 100% nano nitrogen in 1^{st} and 2^{nd} seasons respectively.

Triple hybrid maize cultivars had significant increase for the above growth traits by used 100% organic manure except leaf area index in the

1st season. On the other hand, at 50% organic manure, triple hybride maize cultivar gave the lowest values of plant height, leaf area index and specific leaf weight in the 1st season. While, in the 2nd season, this was true for single hybrid maize cultivar.

The interaction between maize cultivars and mineral, nano nitrogen fertilizers had a significant effect on plant height, leaf area index, total chlorophyll content in two seasons as well as specific leaf weight in the 2nd season

Fertilized Triple maize hybrid cultivar by 100% mineral N or 75% mineral plus 25% nano nitrogen fertilizers gave the highest values of plant height in the 1st and 2nd seasons, respectively as compared with the other single maize hybrid cultivar.

Fertilized triple maize hybrid cultivar by 100% organic manure with 100% mineral nitrogen or 75% mineral plus 25% nano nitrogen fertilizers produced the higher values of plant height and total chlorophyll content in two seasons. Whereas, the lowest value of plant height were obtained from triple maize hybrid cultivar which fertilized by 50% organic with 25% mineral plus 75% nano nitrogen fertilizers, in the 1st season, or 50% mineral plus 50% nano nitrogen fertilizers, in the 2nd one.

Harvest index scored significant increase with adding 100% organic fertilizer to single hybrid plants in the first season.

Applying 25% nano nitrogen fertilizer + 75% mineral nitrogen fertilizer to triple hybrid maize plants caused the greatest grain yield in the first season while adding 100% mineral nitrogen caused the highest grain yield/fed. in the second season.

Maize triple hybrid plants fertilized 100% organic fertilizer with 25%nano nitrogen plus 75% mineral nitrogen fertilizer scored the highest values of ear yield/fed. and grain yield/fed.

Highest values of biological yield were obtained when triple hybrid plants were fertilized by 100% organic nitrogen fertilizer and 100% mineral nitrogen (12.92 ton/fed) in season 2015 or 20.24 ton/fed. in season 2016), Whereas harvest index% record the highest values (37.27%

in 2015 and 22.27% in 2016), when plant fertilized by 25% nano nitrogen + 75% mineral nitrogen or 100% mineral nitrogen in 2015 and 2016, respectively.

Highest protein yield/fed. resulted in maize triple hybrid fertilized by 100% organic and 25% nano nitrogen + 75% mineral nitrogen (396.8 and 296.4 kg/fed.) in the two studied seasons, respectively.

Highest significant carbohydrate% were obtained when single hybrid maize plants were fertilized by 50% of organic and fertilized by 100% of nano nitrogen particles.

It could be concluded that application of 30 m^3/fed. organic manure with 100% mineral N (120 kg N/fed.) or 75% mineral + 25% nano N fertilizers on maize triple hybrid 329 gave the higher grain yield and yield attributes in the two season.

Key words: Maize varieties, Organic fertilizer, Nano fertilizer, Mineral fertilizer, Growth, Yield and quality.

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INTRODUCTION

Maize (Zea mays L.), as the highest yielding cereal crop in the world, occupies a key position as one of the most important cereals for human and animal consumption and is grown under irrigated conditions of arid and semi-arid regions of the world. Moreover, it is one of the most important staple food crops in the most African countries. Maize grain has high food value and its oil is used for cooking purposes while green fodder is quite rich in protein. Hence it is also called as miracle crop‘ and also as queen of cereals. Being a C4 plant, it is very efficient in converting solar energy in to dry matter. In Egypt, maize is the third most important cereal after wheat and rice crops grown as a dual purpose such as food, feed, and fodder crop. Total area under cultivation of maize in Egypt is 1027682 hacter which is about 25.17 % of the total cultivated agricultural land while average yield is 7.60 ton ha^{-1}. It is about 21.9 % of the total cereals production **(FAO, 2016).**

Siwa Oasis, as a depression in the Western desert of Egypt, is located within the extrmely arid zone. Which characterized with low rainfall, very high midday solar radiation, flux densities, abundant sunshine, temperature extreme, high evaporation potentials and a paucity of good quality water for irrigation where salinity and heat are the main problems to cultivate maize crop. So, Siwan farmers are not acquainted with such crop. Therefore, their needed of maize crop is imported from Delta Governorates. The scarcity of fresh water sources forces to use of saline groundwater for the agricultural purposes, but this increases the risk of soil salinization **(Ma *et al.*, 2008).** Soil salinity is one of the most serious problems for irrigated agriculture using either fresh and/or brakish water, which drastically affect crop productivity throughout the world.

Most of the crops tolerate salinity to a threshold level and above which yield decreases as the salinity increases **(Khan *et al.*, 2006)**. Plant scientists have adopted various strategies to overcome the salinity. One of

the important of them is to exploit genetic variability of the available germplasm to identify a tolerant genotype that may

sustain a reasonable yield on salt affected soil **(Ashraf *et al.*, 2006)**. In this respect, according to **Maas and Hoffman (1977)**, the threshold of maize; the maximum allowable salinity without grain yield reduction, is approximmately 1.7 dSm^{-1}, as a moderately salt sensitive crop plants. They added that the amount of yield reduction as salinity increased above the yield threshold was estimated as between 7.4 and 12.0% per dSm^{-1}. In another study of **Hoffman *et al.* (1983 and 1986)**, on organic soils, the threshold and percentage slope decrease have slightly higher values of 3.7 and 14.0% per dSm^{-1}, respectively. Moreover, according to **Flowers and Yeo (1995)** one of the important ways to develop salt tolerant crop in shorter time is to use the variation already present in the existing crops. Maize is a highly cross-pollinated crop and has become highly polymorphic through the course of natural and domesticated evolution and thus contains enormous variability in which salinity tolerance may exist **(Carpici *et al.*, 2010)**.

The organic manure improves soil fertility by influencing its physical, chemical and biological properties. It improves water circulation and soil aeration, and increases the soil moisture holding capacity **(Soltner, 1985).** According to **Brady *et al* (2008),** the organic manure also improves the soil by the formation of clay humic complexes which increase the soil adsorbent capacity of basic nutrients (calcium, magnesium and potassium) and enhances the activity of microorganisms involved in the mineralization process. Horeover, the rising cost of inorganic fertilizers coupled with their inability to condition the soil has directed attention to organic manures in recent times. Some maize farmers, vegetable growers and horticulturists, are aware of the beneficial effects of organic manure and its release of nutrients for a good response in plant growth.