MAXIMIZING UTILIZATION FROM ORGANIC, INORGANIC AND BIOFERTILIZERS IN IMPROVING THE PROPERTIES OF ALLUVIAL SOILS

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A thesis submitted in Partial Fulfillment
Of
The Requirement for the Master Degree
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Environmental Science

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2013

APPROVAL SHEET

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Acknowledgement

All praise to ALLAH, the Almighty GOD, the absolute source of knowledge and wisdom. His grace and help were the two main factors that made the completion of this work possible.

Grateful thanks and deep appreciation are due to ***Prof. Dr. Ezzat Mohammad Soliman,*** Professor of Soil Sciences, Institute of Environmental Studies & Research, Ain Shams University, Agricultural Science Department**,** for his supervision, encouragement, valuable guidance, valuable advices, and constructive criticism which made the completion of this work possible.

Deep thanks are also presented to ***Prof. Dr. Usama Salah El-Dean El-Bialy,*** Prof. of Soil Sciences, Soil, Water and Environmental Research Institute, Agriculture Research Center, Giza, Egypt**.** for his encouragement, sincere helps, valuable guidance throughout the preparation of this research work.

Abstract

This study was carried out at Mashtool El Souk, Al-Sharkia Governorate during two successive seasons and 2010 and 2011 to investigate the effect of organic fertilizer (farmyard manure, FYM) and crude mineral fertilizers, i.e. rock phosphate (RP) and rock potassium (RK) as natural sources in presence or absence of bio-fertilizers with different levels of NPK as artificial sources on the productivity of corn and to know some nutrients availability in soil as well as some chemical properties.

The experimental soil included 16 treatments i.e. four crude fertilizers namely RP, RK, FYM and control and two levels of NPK, 50% and 75% of recommended doses added alone and/or accompany with bio-fertilizers, i.e. nitrogen fixer, phosphate dissolving and potassium dissolving bacteria.

The most important results could be summarized as follows:

- Some yield attributes of ears weight/plant, grain weight/ear and shelling percentage seamed to be unaffected by crude fertilizers where control treatment gave the best significant values of these characters in the two growing seasons. Rock phosphate (RP) surpassed the other crude fertilizers for ears No./plant and rock potassium (RK) achieved the best significant values of 100 grains weight in the two growing seasons.
- The addition of chemical fertilizers of 50% NPK and /or 75% NPK alone or accompany with bio-fertilizers didn't show any significant differences on ears No./Plant and grains weight / ear in the two growing seasons. On the contrary, addition of 50% NPK alone or with bio-fertilizers gave the best significant values of ears weight / plant, 100 grains weight and shelling % in the two seasons.

- As general, the combined treatments of crude and chemical fertilizers in the presence or absence of biofertilizers achieved positive effect on most yield attributes under study where the combination of RK and 50% NPK + Bio and also FYM and 75% NPK were remarkable for giving the best significant values during the two growing seasons.
- In most cases, addition of crude mineral fertilizer (RK) to corn plants produced the best significant values of grains yield, ears yield, Stover yield and biological yield, but control and FYM treatments resulted in the best values of harvest index% in the two growing seasons.
- Chemical fertilizer of 50% NPK added alone or accompany with biofertilizers achieved the best significant values of grains, ears, stover and biological yields as well as harvest index% of corn plants in the two growing seasons compared to the other chemical ones.
- The combined treatment of RK and 50% NPK + Bio seamed to be the best for producing the highest values of grain, ears, stover and biological yields of corn plants compared to the other reacted treatments in the two growing seasons. Harvest index % responded positively under the combination between control and the treatment of 50% NPK + Bio in both seasons.
- The addition of RK and/or FYM had the best values of nitrogen, phosphorous and potassium uptake of corn grains, stover and biological yields in the two growing seasons. Protein percentage in grains was the highest affecting by using RK in both seasons.
- Corn plants that received chemical fertilizers of 50% NPK alone or accompany with biofertilizers had better values of N, P and K uptake in most cases of grains, stover and biological yields in both seasons. Protein percentage in corn grains was the best when the plants treated with 50% NPK alone in both seasons.

- Combined the treatments of RK and 50% NPK + Bio together achieved best values of N, P and K uptake of most corn yields followed by the treatments of FYM and 75% NPK alone in both seasons. The interaction effect between RK and 50% or 75% NPK + Bio and also the treatments of FYM and 75% NPK had positive effect on protein % in corn grains in both seasons.
- Significant increases in available N, P and K in soil were detected by the addition of RK and FYM in both seasons.
- Available N in soil wasn't affected significantly by the addition of chemical fertilizers in both seasons. Available P in soil responded positively to the addition of 50% NPK alone in both seasons. Addition of 50% and/or 75% NPK alone or accompany with biofertilizers improved significantly available K in soil during season 2010 while in season 2011, there wasn't any effect of chemical fertilizers on such nutrient.
- The interaction effects of RK and 50% NPK; and between FYM and 75% NPK together in the presence or absence of biofertilizers increased significantly available N, P and K in soil in both seasons.
- As general, the estimated values of EC, pH and O.M % in the experimental soil were improved after cultivation compared to its values before sowing in both seasons.

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INTRODUCTION

Egypt like all developed countries is facing a critical food problem and unless concentration efforts are directed to maximize the agricultural production, the problem will develop to be crisis.

The nature and the characteristics of nutrient release of chemical, organic and biofertilizers are different, and each type of fertilizers has its advantages and disadvantages with regard to crop growth and soil fertility. The sound management and safeguarded environment, therefore a balanced fertilization strategy that combines the use of chemical, organic or biofertilizers must be developed and evaluated.

Most countries have traditionally utilized various kinds of organic materials to maintain or improve fertility and productivity of their agricultural soils .However, several decades ago ,organic recycling practices in some countries were largely replaced with chemical fertilizer that were applied to high yielding cereal grains that responded best to high level of fertilizers.

Organic manure is a rich and slow release fertilizer .The usage of which leads to a clean product of plants. Organic fertilizers have advantages as they enhance the soil biological activity, which improves nutrient mobilization from organic and chemical sources and decomposition of toxic substance, enhance root growth due to better soil structure, increase the organic matter content of the soil

Nutrients of chemical fertilizers are soluble an immediately available to the plants, therefore the effect is usually direct and fast and they are quite high in nutrient content only relatively small amounts are required for crop growth.

Rock P and K materials may be agronomical more useful and environmentally more feasible than soluble P and K. Rock P and K

materials are cheaper sources of P and K; however most of them are not easily to plant because the minerals are released slowly

Biofertilizer is frequently recommended firstly for improving biological, physical and chemical properties of soil and secondly to get clean agricultural products free of undesirable doses of heavy metals and other pollutants. Rock P and K materials either applied singly or in combination did not significantly enhance soil availability of P and K, but inoculation of phosphorus and potassium with PSB (phosphorus solving bacteria) has increased higher soil P availability then KSB (potassium solving bacteria) which was recommended as a K-solubilizer. Inoculation of these bacteria in conjunction with amendment of its respective rock P or K materials increased the availability of P and K in soil.

The corn is considered a very important plant since it is used to feed human as well as animals and industrial production of starch, protein and oil. The grains contain vitamin A,C,E and number of amino, acids and salt as well as rare elements. About 25% of the world production of corn grains has been used as human food either as flour or oil. The corn starch and dextrin have been used in the industry of acetone and alcohol.

Sound fertilization programs in Egypt should satisfy plant needs and minimize the harmful effects on environment. Substituting of the expensive mineral fertilizers for plant needs of nitrogen, phosphorous and potassium are most. This can be argued through using organic sources, applying bio-fertilizers and practicing of particular nature fertilizers such as rock phosphate and rock potassium to create a good medium for plant growth under different conditions.

According to the above mentioned factors, the current study spots light on the importance of using such artificial chemical and natural fertilizers with the consideration of the vital role of biological one on the productivity of corn plants grown on alluvial soil.

2. REVIEW OF LITERATURE

2.1. Effect of organic fertilizer on :

2.1.1. Plant growth and yield

Biswas et al., (1971) pointed out that organic manures increased the yield of maize.

Balasundaram and Khann (1973) found that application of waste as soil conditioner at the rate of 20 tons /acre with chemical fertilizers (NPK) increased the grain yield of maize plants.

Drija and Kazakove (1975) indicated that grain yields of maize and winter wheat during 3 years were increased by 33% from the direct and residual effect of the application of 10 ton FYM/hectare.

Yagodin (1984) cleared that maize plants manured with organic matter outyielded those fertilizered with inorganic nitrogen.

Sakr (1985) in Egypt, found that addition of farmyard manure (FYM), town refuse and poudrate (dried sewage refuse) with superphosphate, to different types of soils significantly increased the uptake of phosphorus and yield of plants.

Rongjing and Mackenzie (1986) showed that organic manure could be more effective than inorganic fertilizers in increasing grain yield of maize.

El-Garhi and Mohamed (1991) in Egypt, found that increasing addition of mineral fertilizers (NPK) combinations associated with rabbit wastes manure gave an increase in grains of maize by 106% and 74.3% over control,respectively.

Sakr et al., (1992) found that the addition of nitrogen fertilizer increased dry matter and grain yield of maize and this increase was more pronounced when it was added after the addition of FYM to soil which can be due to the enhancing effect of nitrogen fertilizer on the decomposition of FYM**.**

Khanday et al., (1993) in India, found that farmyard manure (FYM) application up to 20 ton /ha increased number of grains /cob and grain yield /ha of maize plant.

Abd-El Hameed (1997) in Egypt reported that application of 25 ^{m3}farmyard manure (FYM /fad) steadily increased maize grain yield potential compared to the application of N fertilizer alone.

Radwan et al., (1999) studied the response of single cross 10 corn cv to bio -and organic fertilizers in newly reclaimed sandy soil. They found that 100-grain weight increased from 16.89 with the rate of NPK fertilizer to 18.9 and 20.4 with either 20 or 40 m3/fad composted sawdust, respectively, meantime, combining the bio-fertilizer with either organic or chemical fertilizers gave a marked increases in grain and straw yield /fad compared with their single effect under different treatments.

Pattanashetti et al., (2002) in India, studied the effect of organic amendments (FYM, vermi-compost and poultry manure and inorganic fertilizers (100%, 75% and 50% form recommended rate of NPK/ha 25:35:25 kg NPK) on some agronomic characters of maize. The results cleared that, higher cob length, number of rows /cob, grain number/row, grain weight /plant and 100- grain weight were recorded with the organic manure application if compared with the control and vermi -compost fertilizer and was at par with poultry manure.They, also added that grain and stover yields/ha were higher with FYM application than the control and vermi -compost, and was at par with poultry manure.

El-Maddah (2005) foundthat, grain yieldofwheat and corn grown in silty clay loam soil and their yield components such as (1000 seed weight, plant height, spike length and dry matter of wheat plants and 100-seed weight, plant height, ear length, ear diameter, number of rows per ear, number of kernels per row and dry matter for maize plants) were increased with adding FYM and rock phosphate.