EFFECT OF SOME MICRONUTRIENTS ON GROWTH, YIELD AND FIBER QUALITY OF EGYPTIAN COTTON

By

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B.Sc. Agric. Sci. (Agronomy), Fac. Agric., Cairo Univ., 2007

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APPROVAL SHEET

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ABSTRACT

Two field experiments were carried out in Giza Agricultural Experimental and Research Station, Faculty of Agriculture, Cairo University in two seasons (2012 and 2013) to study the effect of foliar application of micronutrients (boron, zinc manganese and iron) on growth, yield and fiber quality of some Egyptian cotton cultivars (Giza 88, Giza 90 and Giza 92). The experiment was laid out in a split plot design in a randomized complete block design arrangement with four replications. Treatments included three cultivars were applied in main plots and nine foliar applications of micronutrients (control, boron 500, 1000 and each of zinc, manganese and iron 100, 200 mgl^{-1}) were applied in sub-plots. Spraying took place twice, at the beginning of the flowering stage and 15 days later. Cotton cultivars were planted during the first week of April and harvested in October for both seasons. The results showed that, cultivars varied significantly in the studied parameters except position of the first sympodial node, number of total nodes per plant in both seasons and earliness% and fiber strength in the second season only. Foliar application of boron, zinc, manganese and iron in both seasons indicated marked improvement and produced a significant increase in plant height, no. of sympodial branches, no. of bolls/plant, boll weight, seed index, lint%, seed cotton yield, fiber strength and fiber fineness. However, position of the first sympodial node, no. of monopodial branches and fiber length insignificantly affected in both seasons and earliness% and length uniformity index in the first season only. The cotton cultivar Giza 90 was found to be the most promising cultivar which responded well to B and Zn foliar application compared to other cultivars. Also, the data revealed that, the application of boron at 1000 mgl^{-1}, zinc, iron at 200 mgl^{-1} recorded the maximum growth, yield and quality properties in the most examined treatments.

Key words: cotton, seed cotton yield, fiber properties, micronutrients, boron, manganese, iron, zinc, *Gossypium barbadense L.*

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CONTENTS

INTRODUCTION

Cotton (*Gossypium barbadense* L.) is considered the main fiber crop through industry in Egypt as well as in the world, belongs to the family Malvaceae. In Egypt, it was always and still the main cash crop for most growers. Total lint cotton production in Egypt was 435,000 bales (1.966 M kent.) from 130,000 ha. (312,000 fed.) in 2013 within an average 6.3 kent/fed..

Attainment of maximum yield of cotton from the unit area is greatly dependent upon appropriate environmental and cultural practices as well as the high yielding variety. Environmental stresses such as nutrition deficiency is one of the most important factors that limit growth and productivity. In cotton, flowering is a continuous process. However, all the flowers produced are not retained and harvested. About 40 to 50 % of the flowers and bolls are shed due to boll worm attack and/or nutritional stress. Hence, there is need to supplement the plant with proper micronutrients to produce more number of flowers and retain them on the plant to develop into bolls for final harvesting, so that yield can be increased considerably.

Essential micronutrients like boron, zinc, manganese and iron play an important role in physiology of cotton crop and these are being part of enzyme system or catalyst in enzymatic reactions. They are required for plant activities such as respiration, meristamatic development, chlorophyll formation, photosynthesis, energy system, protein and oil synthesis, gossypol, tannin and phenolic compounds development. Certain micronutrients may help to secure uniform

emergence, rapid seedling growth and healthy plant stand. Some beneficial effects on seed yield and quality as reflected in viability may be achieved by applying micronutrients. Boron is present in plant cell wall structures, being important for transport of sugars, cell wall synthesis, lignification process, carbohydrate metabolism, RNA, phenolic compounds, indol-acetic acid metabolism and for cell membrane and cell wall integrity (Marschner, 1995). Boron deficiency in cotton may cause small deformed bolls, shorter fruiting branches, deformed leaves, poor fruit retention and reduced lint yield. Zinc is involved in several enzyme-driven metabolic processes in plants, such as protein synthesis, membrane integrity, tryptophan biosynthesis, mobilization and NPK uptake and metabolism (Oosterhuis *et al*., 1991). Manganese acts as an enzyme activator for nitrogen assimilation. It is essential for the production of chlorophyll. Low plant manganese, therefore, reduces the chlorophyll content causing leaves to turn yellow (chlorosis). Manganese deficiency causes low pollen fertility and shortage of carbohydrates supply for fruit and seed development. Iron plays an important role in the synthesis of chlorophyll and also helps in the absorption of other nutrients. As a constituent of cytochrome, it regulates respiration, photosynthesis, reduction of nitrate and sulphate.

Boron, zinc, manganese and iron deficiency are common nutrient problems in crop production in arid and semi arid regions. Nutritional deficiency is serious abiotic stress in Egypt, where the soil is also generally low in plant available B, Zn, Mn and Fe concentration. In most cases, plant micronutrients deficiencies are not

due to the lack of boron, zinc, manganese and iron in the soil, but due to soil conditions that reduce their availability to plants, such as: high pH, high calcium carbonate ($CaCO_3$) content and high soil phosphorus levels. In many countries cotton is grown on calcareous soils or over limed reclaimed acid soils, sandy or soils rich in $CaCO_3$ (Silvertooth *et al*., 1999). In these soils, the availability of boron, zinc, manganese and iron is significantly reduced.

Foliar application of micronutrients plays an important role in changing growth and physiological characteristics of cotton. In optimizing fertilization strategies, inclusion of foliar application improves fertilizer use efficiency and reduces environmental pollution. Foliar application of micronutrient during flower and boll development stages have been shown to be effective in efficient utilization of nutrients by cotton and thereby reduce boll shedding and increase yield.

The present study aims to examine the effect of foliar application of micronutrients (boron, zinc, manganese and iron) on growth, yield and fiber quality of some Egyptian cotton varities.