Effect of nitrogen fertilization and some micronutrients on growth, yield and some technological properties of maize

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Two field experiments were conducted in the Research and Experiment Station of the Fac. of Agric., Moshtohor, Zagazig University in the two growing seasons of 1998 and 2000. The aim of this study was to investigate the effect of five nitrogen levels, (0,40,80,120 and 160 kg N/feddan), two micronutrients, (Zn and Cu) and three methods of micronutrients application, (grain soaking, foliar spraying and soaking combined spraying) on growth characters, tasseling and silking dates, grain yield and its components as well as chemical composition in the grain of maize cv. T.W.C. 310.The soil of the experimental plots was clay texture, with a pH value of 7.95,0.58 Ca Co3, 2.1 % organic matter content,114.71.tgg mg /kg available N and 3.14 tgg -I available Zn as well as 2.08 j.igg available Cu.A spilt-plot design with four replications was used, the main plots were devoted for nitrogen levels. Sub-plot for micronutrients and their methods of application. Sub-plot area was 14.7 m2 (1/286 feddan), planting was done on 23 And 18 June in 1998 and 2000 respectively. The preceding crop was wheat in both seasons.The results of the experiments could be summarized as follows:I- Growth characteristics A-Effect of N levels1- Application of 40,80,120 and 160 kg N/feddan significantly resulted in increasing the plant height, ear height, stemdiameter and number of green leaves / plant at 85 days from planting. The highest mean values of these traits were generally recorded at the highest N-level (160 kg /feddan).2-Leaf area of the topmost ear, leaf area index, dweight ofplant organs and crop growth rate (CGR) were ’ignificantly increased by increasing N-levels from 40 kg N/f ddan up to I 60kgN/feddan.3-The increases in nitrogen rates caused a significant decrease in the number of days from planting to mid tasseling and silking in the combined analysis. The earliest fl ering was recorded at the highest nitrogen level.B- Effect of Zn and Cu nutrient application methods1-Maize grain soaking in the micronutrients. (Z and Cu) resulted in significant increases in the plant eight, ear height and stem diameter compared with the other two methods of micronutrients application in the combined analysis of the two growing seasons, (1998 and 2000-seasons.).2-The highest mean values of leaf area of the topmst ear, leaf area index and number of leaves / plant were produced from soaking of maize grain in Cu nutrient.3-Crop growth rate in the first period, (55-70 days) was significantly affected.4-Crop growth rate in first period (55-70 days) and in the second period, (70-85 days) and the percent ge of dry weight of plant organs, (leaves, stem and ars) were significantly affected by methods of Zn and •u nutrientsapplication. The highest mean value was obtained by soaking maize grains combined foliar spraying with Zn nutrients and soaking maize grains with Cu nutrient.5-Number of days from planting to mid tasseling and mid silking were significantly decreased by received Zn as maize grain soaking in the combined analysis of 1998 and 2000 seasons.C- Interaction effect1-The interaction between N-levels and application methods of Zn and Cu nutrients had a significant effect on plant and ear heights and stem diameter. The highest plant height, ear height and stem diameter were produced from application 160 kg N / feddan with soaking of maize grains in Cu nutrient.2-Application 160 kg N / feddan with adding Zn nutrient as soaking maize grains combined with foliar spraying or adding Cu-nutrient as soaking method gave the greatest leaf area index.3-The highest mean values of green leaves / plant was obtained from adding 120 kg N / feddan with foliar

spraying of Cu nutrients. whereas no significant difference was obtained between the interaction of 160 kg N x Zn as soaking method and the interaction of 160 kg N x Cu as soaking method on the number of green leaves / plant.4-Crop growth rate at different period of growth was significantly increased by increasing N level up to 160 kg N / feddan with foliar spraying of Zn and Cu nutrients.5-The percentage of leaves, stem and ears per whole of plant were significantly affected by the interacti N-level with Zn and Cu nutrients at different method in the combined analysis.6-The earlier date of tasseling and silking were pro duced fromdry weight in between applicationadding 160 kg N / feddan with adding Zn nutrie spraying or soaking methods.II- Yield and yield componentst as foliarA- Effect of N-levels1-Ear length, ear diameter, number of rows / ear, kernels / row and ear weight were significantly i increasing nitrogen levels. The highest mean obtained by application the highest level fertilizer, (160 kg N/feddan.) in the combined an two growing seasons.2-Application of nitrogen levels significantly effe kernels weight, 100-kernel weight and shelling pe the combined analysis of the two growing se highest mean values of ear kernels weight and weight were obtained by application the highenumber of creased by alues were f nitrogen lysis of theted on ear rcentage in asons. The 100-kernel st nitrogenfertilizer level, (160kgN/feddan.). While, the highest average values of shelling percentage was obtained by using 80 or 120kgN/feddan .3-Grain, biological yields /feddan significantly inc eased with increasing nitrogen rates up to 160 kg /feddan. Application of 40,80,120 and 160 kg N /feddan resulted in increasing the grain yield over the check treatme t by, 19.13,...011010,35.14, 51.98 and 60.81% respectively in the 1998 season and by 16.37, 31.26, 46.18 and 50.56% respectively in the 2000 season, being, 17.67, 33.09, 48.91 and 55.38% respectively in the combined average. Nitrogen fertilizer application of 40,80,120 and 160 kg N/feddan increased the biological yield over the control treatment by, (15.20, 29.14, 45.78 and 45.54%), (14.12, 27.06, 42.49 and 51.42%) and (14.64, 28.06, 44.08 and 48.59%) respectively in the 1998, 2000 seasons and the combined analysis, respectively.4- The highest mean values of harvest index were, 33.4, 34.5 and 33.9% produced by application of 80 kg N/feddan in the 1998, 2000 seasons and in the combined analysis, respectively.B- Effect of application methods of Zn and Cu nutrients1-Grain yield components namely; ear length, ear diameter, number of rows/ear, number of kernels /row, ear weight and ear kernels weight, significantly increased by using maize grain soaking as a method of Zn and Cu-nutrients application when compared with the others methods in the combined analysis of the two growing seasons .2-Application methods of Zn and Cu nutrients had a significant affect on 100-kernel weight and shelling percentage in the combined analysis of the two seasons. Adding of Zn nutrient as soaking method gave the maximum weight of 100-grain, whereas the highest shelling percentage was obtained from application of Zn nutrient as foliar spraying method.3-Grain and biological yields / feddan significantly increased by Cu nutrient as maize grain soaking method. However, harvestindex significantly increased by application of C foliar spraying method, which gave the highest of this character in the first and second seasons the combined analysis of the two seasons.C- Interaction effect1-The effect of the interaction between N-level an methods of Zn and Cu nutrients had a signific ear characters, 100-kernels weight and shelling p2-The highest mean values of ear length was application of 160 kg N / feddan with adding Z soaking of maize grains combined with foli method.3-Application of 160 kg N / feddan with adding C soaking maize grains gave the maximum mean weight, ear kernels weight, 100-kernel weight percentage.4-The mean values of biological yield and grain yi as well as harvest index were significantly aff interaction between N-levels and application me and Cu nutrients.5-Increasing N level up to 160 kg N / feddan wit or Cu nutrient as maize grain soaking gave th yields of biological and grains per feddan.6-Application of 120 kg N / feddan with adding C maize grain soaking gave the highest percentag index.nutrient as can valuess well as inapplicationt effect on rcentage.btained by nutrient as r sprayingnutrient as alues of ear nd shellingId / feddan cted by the hods of Znapplied Zn maximumnutrient as of harvestSunintatyIII- Chemical composition A-Effect of N levels1-Application of nitrogen fertilizer levels caused significant increases in characters of chemical composition in maize grain, namely, N-percentage, Protein-% and protein yield / feddan. in the combined analysis of the two growing seasons, and the highest values were 1.86, 11.65% and 313.3 kg / feddan for N-percentage, protein % and protein in yield / feddan respectively, obtained by application of 160 kg

N / feddan. However, no significant difference was obtained between N-level on P and K percentage.2-The highest mean values of Zn and Cu - ppm in maize grain were 200 and 114.2 ppm respectively, obtained by application of160 kg N / feddan However, total carbohydrate percentage in maize grain significantly decreased by increasing N-levels up to 160 kg N/ feddan. The lowest average value of total carbohydrate was 74.52%, produced by adding 160 kg N / feddan in the combined analysis of the 1998 and 2000-seasons.B- Effect of application methods of Zn and Cu nutrients1- The chemical composition of maize grain, namely, N, total carbohydrate protein (%), and protein yield / feddan as well as Zn and Cu - contents (ppm) were significantly affected by application methods of Zn and Cu nutrient.The highest average values of these traits were, (1.84, 76.4, 11.3%, 278.6 kg / feddan, 156.4 and 87.7 ppm)zrespectively, obtained by adding Zn or Cu nutrients as grain soaking in the combined analysis of the 1998 and 2000- seasons.C- Interaction effect1-All characters of chemical composition were significantly affected by the interaction between N level and application methods of Zn and Cu nutrients except P and K percentage in the combined analysis of 19 8 and 1999 seasons.2-Application of 120 kg N / feddan with addi g Zn or Cu nutrients as grain soaking method gave the highest percentage of nitrogen in maize grains.3-The maximum mean values of Zn content (pp) in maize grains was produced from using method of g ain soaking in Zn nutrient with increasing N level up to 120 kg N / feddan.4-The interaction between Xu as soaking rnaiz grain with applied 160 kg N / feddan gave the highest can values of Cu ppm and protein content in maize grain as well as protein yield / feddan.5-On the other hand without nitrogen fertilizer with Cu nutrient as foliar spraying method produced the maximum percentage of carbohydrate in maize grains.